Can self-paced, online learning provide teachers with the competences needed to successfully implement learning technologies?

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Published in:
Conference Proceedings - The Online, Open and Flexible Higher Education Conference 2018

Publication date:
2018

Document version:
Final published version

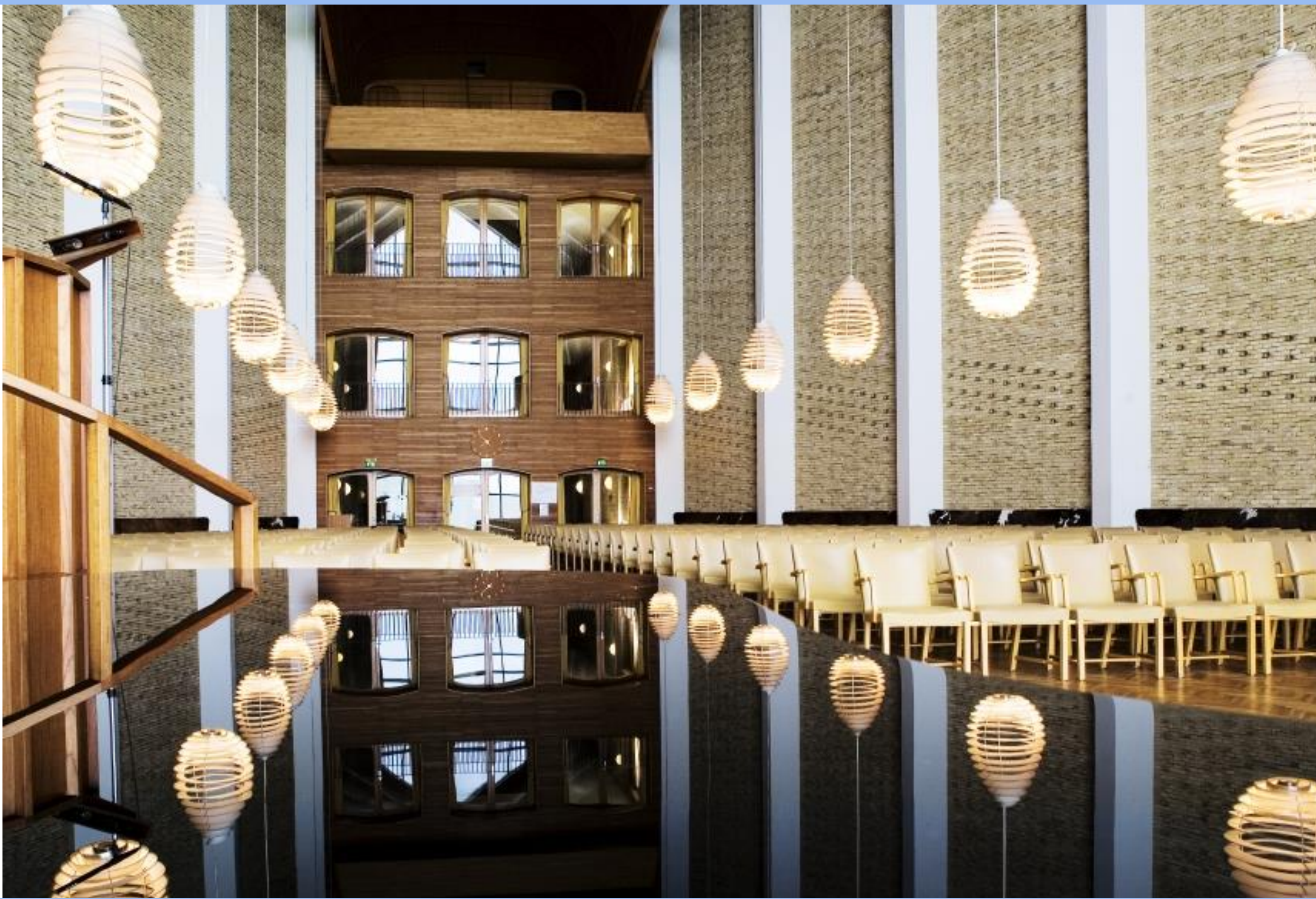
Citation for pulished version (APA):
Christensen, I.-M. F., Kjær, C., & Hansen, P. S. (2018). Can self-paced, online learning provide teachers with the competences needed to successfully implement learning technologies? In G. Ubachs, & F. Joosten-Adriaanse (Eds.), *Conference Proceedings - The Online, Open and Flexible Higher Education Conference 2018: Blended and Online Learning "Changing the Educational Landscape"* (pp. 44-58)

Conference Proceedings

The Online, Open and Flexible Higher Education Conference

Hosted by Aarhus University, Denmark

10-12 October 2018



Blended and Online Learning:

“Changing the Educational Landscape”

Blended and Online Learning

"Changing the Educational Landscape"

Overview of papers on Higher Education for the Future as presented during the Online, Open and Flexible Higher Education Conference in Aarhus, October 2018

Editors
George Ubachs | Managing director EADTU
Fenna Joosten-Adriaanse | Event Organiser EADTU

EADTU, October 2018

ISBN: 978-90-79730-35-3

Co-funded by the
Erasmus+ Programme
of the European Union

Foreword

Welcome to the OOFHEC2018 in Aarhus

Aarhus University in Denmark was the perfect academic setting for EADTU's Online, Open and Flexible Higher Education Conference 2018 (**OOFHEC2018**), bringing together key players in innovating education within the scope of this year's conference:

"Blended and online Learning: Changing the Educational Landscape"

Contributions in plenary and parallel sessions focussed on three emerging areas of provision in higher education: degree education, continuing education and continuous professional development and open education.

Blended and online systems are important to accelerate innovation and to keep pace with the needs of learners of all ages and of society. New modes of teaching and learning create new opportunities for enhancing the quality of the learning experience in on campus programmes, reaching out to new target groups off campus and offering freely accessible courses nationally or worldwide through the internet. They enhance the quality, visibility and reputation of the institution. The implementation of new modes of teaching and learning requires institutional strategies and frameworks. It cannot be successful without a strong motivation of a professional teaching staff and without a continuous commitment from the top management of a higher education institution.
University policies and strategies are needed to innovate and even transform higher education in the next years to:

- Blended degree education will raise the quality and efficiency of degree education, facing large numbers of students and it will offer new possibilities for communication and cooperation both inside the university (student-student and student-staff) and with stakeholders (student-stakeholder and teacher-stakeholder).
- Blended and online education will upscale the area of continuing education and continuous professional development (CPD) by offering flexible courses with a large outreach responding to the needs of learners at work, who face longer careers and career shifts.
- MOOCs are offered online only, providing massive and open learning opportunities for all, promoting engagement in the knowledge society.

University policies and strategies in this respect can be complementary to each other and to some extent interwoven. These were presented and explored during the 3-day OOFHEC2018 conference touching upon various supporting topics like:
- Accreditation of online education
- Quality Assurance in Blended and Online Education
- Short Learning Programmes
- Open education and MOOCs, European MOOC Consortium
- Inclusiveness
- Internationalisation by virtual mobility
- Networked curricula and Virtual Mobility
- New competences for teachers staff development and teacher training

The conference was well attended by representatives from more than a 100 universities from 30 different countries all over the world and with participation of higher education institutional policymakers, governmental bodies involved in innovating HE, deans and directors, educational innovators, university staff and umbrella organisations in higher education. All with a passion for research, improving teaching, learning, quality and support services by innovating education.

The Online, Open and Flexible Higher Education Conference 2018 - Proceedings will give you an overview of papers presented under the topics mentioned above.

EADTU and our host Aarhus University thank all contributors for making this event so interesting and inspiring. We thank all participants for their active involvement and hope to meet you all next year at the OOFHEC2019, hosted by UNED in Madrid, Spain.

With regards,

George Ubachs
Managing Director EADTU

Keynote speakers

We thank our keynote speakers for their inspiring contributions to the OOFHEC2018 Conference.

Liz Marr
President EADTU
Open University UK

Berit Eika
Vice Rector
Aarhus University, Denmark

Michael Gaebel
Director of the Higher Education Policy Unit
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Analysing emotions to personalise learning on EduOpen Moocs' platform

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Abstract

In this paper we analyse the emotional experience of students in 11 courses within EduOpen (www.eduopen.org), an international Moocs' platform. The main theoretical idea is that communities of inquiry (Garrison, Anderson, & Archer, 2000) are digital learning experiences characterized by an emotional dimension strongly impacting on learning (Cleveland-Innes, & Campbell., 2012). Our methodological approach refers to the field of qualitative learning analytics (ibidem; Loperfido, Dipace, Scarinci, in press), which connects the attention to the personalization of learning with the understanding of the students' experience from a microlevel point of view. Therefore, we connect the use of the general sentiment analysis, which looks at both negative and positive feelings, with Grounded theory approach, which looks at specific emotions. Through a bottom up process and Nvivo 11 Plus software, we analysed the forum dedicated to the students' self-presentation from all of the 11 courses. We defined a set of categories composed by a three-levels system. At a general level, we have the macrodimensions "Sentiment about EduOpen" and "Emotions toward topics". Each of these dimensions is composed by a number of "child" categories and subcategories. After defining the entire set of categories and categorizing all the texts (which was a circular process), we run some graphs on Nvivo showing the hierarchical structure of dimensions, the relations among dimensions and sources, and the clusters of dimensions by coding similarity. Results show how some courses are more composed by negative or positive sentiments and how the motivations dimension heavily characterizes the emotional dimension of students.

Keywords: emotional experience, moocs, learning analytics, grounded theory

1. Introduction

This contribution connects three different fields: the area of learning analytics, the area of education specifically interested in digital mediated learning processes, and the approaches focused on the emotional dimension in learning. Namely, learning analytics is the measurement, collection, analysis and reporting of data about students and the contexts they learn through. The aim of learning analytics is to understand, personalize and optimize learning and the environments in which it occurs. Learning analytics are mainly used in learning contexts mediated by the use of digital environments, since they can produce an amount of data about the traces each student or entire groups of learners leave online, successful activities, difficult experiences, and so on (Rienties & Rivers, 2014). In relation to the field of learning analytics, we stress the

[1] Anna Dipace wrote the section "Method of analysis and results"
Fedela Feldia Loperfido wrote the section "Introduction"
Alessia Scarinci wrote the sections "Aim", "Context and data", and Conclusions

emotional dimension of learning as well. Speaking about feelings and emotions from a general and classical perspective, we can think that human beings can feel universal emotions, such as anger, disgust, fear, happiness, sadness, and surprise (Ekman, 1999) or joy-sadness, anger-fear, trust-distrust and surprise-anticipation (Plutchik, 2013). However, we can refer to emotion and, specifically, to emotions and learning, after answering the question "How can we define and understand emotions at a more specific level?". According to Zembylas (2008), there is no agreement about what an emotion is and is characterized by. Indeed, emotions can be understood at least through three different perspectives: 1) Emotions as private and belonging to an intimate experience, as defined by psychodynamic approaches; 2) Emotions as sociocultural phenomena, as understood by social constructionist approaches; 3) Emotions as described by interactionist approaches, which transcend the dichotomies (e.g. mind/body, individual/social) established in the previous two and aims at bridging their differences. However, even if there is no a common definition of emotions, authors claim that they are not separated from the learning context (Lehman, 2006; Lipman, 1991). Coherently to this, for example, communities of inquiry (Garrison, Anderson, & Archer, 2000) are digital mediated learning experiences characterized by the cognitive presence, the social presence, the teaching presence and the emotional presence (Cleveland-Innes, & Campbell., 2012). This last is understood as the "emotional expression part of being socially present online" (ibidem, p. 272). If we still stay at this general layer, we can connect the interesting about the emotional dimension and the learning analytics by referring to Sentimental analysis, also known as Opinion mining looking for both negative and positive sentiments people have about the digital environment they use. However, this connection does not suggest how we can understand emotions at a more specific level. As for this point, Cleveland-Innes & Campbel (2012) approach the emotional experience of students through Grounded theory, that is by doing a content analysis of texts, looking for contents about emotions and defining a grid of categories through a bottom up process (from the text to the categories).

If we take for granted this premise, we can focus on the method of analysis we will use in this contribution. Very often, learning analytics are based on quantitative and statistic approaches (Greller & Drachsler, 2012; Papamitsiou & Economides, 2014), which are able to handle the huge quantity of data produced by online platforms. The so-called Big data, indeed, can give a paramount contribution in the analysis of individual and students' groups traces to support the learning personalization. However, when using quantitative analytics, researchers risk to lose the learners' micro perception about their own experience. We are not saying here that quantitative learning analytics are not useful, of course; rather, we try to stress the importance of considering the qualitative-micro experience of students which can go together with numbers and statistics (Macfadyen & Dawson, 2012). Therefore, in this paper, we connect both learning analytics and grounded theory to analyse the emotional experience of students in an online learning context made by eleven Mooc-based courses. So, we will present the analysis by showing the set of categories emerged from the students posts and how we use Nvivo software to sustain our qualitative view.

2. Aim

- To describe a qualitative method of analysis to explore the emotional processes experienced by students during the participation in MOOCs proposed by EduOpen (www.eduopen.org);

3. Context and data

This research is supported by Unifg Tutoring – UniTutor project and the context of analysis is EduOpen, an international Moodle platform lead by the University of Foggia (IT). At a general level, EduOpen is realized by 17 Italian Universities and several foreign partnerships. It started in 2014 and is an action-research project periodically rearranged thanks to evidence-based methods. Until now, it involved more than 70300 learners from all over the world and proposed 140 courses. Indeed, the activities of EduOpen are online courses loaded on the Moodle based platform www.eduopen.org. Each course, then, refers to a specific topic (e.g. math for beginners, animals, English, and so on), and is managed by a university teacher and an online tutor of the EduOpen team. Furthermore, at the end of a course, students receive a participation certification, an open badge or ECTS. More specifically, each course spends three-five weeks and is composed by:

- A self-presentation forum where students usually write down a post about themselves, the place they live, the wishes and expectations they have about the course, and so on;
- A number of MOOCs videotaped by the teacher and related to the topic of the course;
- Another forum where students can ask further explanations to the teacher;
- An evaluation section, where students fill in online tests during or at the end of the course.

All of the courses are categorized in different fields (such as, Literature, Science, and so on), in several pathways (an ensemble of courses connected each other by a main theme) and/or in the catalogue that a specific University partner proposes. In this paper, data are characterized by the self-presentation forums of all the courses managed by the University of Foggia (IT). These are 11 courses and have involved 43345 students in total (10277 of them completed the course they were unrolled in).

4. Method of analysis and results

Grounded Theory sustains that researchers have to operate inductively. As qualitative data are reviewed, repeated ideas and concepts appear and are tagged with codes (Strauss & Corbin, 1990;); Sentiment analysis aims at identifying and categorizing opinions expressed in a piece of text, especially to determine whether the writer's attitude towards a particular issue is negative or positive (Liu, 2010; Nasukawa, 2003). By combining these two views with each other, we:

1. Created a first general grid of analysis, composed by the two general dimensions "Positive sentiments" and "Negative sentiments" referred to the learning experience in the digital context;
2. Categorization of the texts through qualitative content analysis (Mayring, 1997), by using Nvivo 11 Plus;
3. Generation of further dimensions and their specific categories, emerging from the interaction between grounded approach and theoretical concepts;
4. Team discussion about the building of the grid and the categorization;
5. Checking of the categorization according the team discussion;
6. Analysis of the nodes (the categories to the software) by using Nvivo 11 Plus.

During the analysis, we realized that the first version of the grid needed to be much more enriched. Therefore, we created a double grid, able to grasp three levels of the students' emotional experience in the University of Foggia EduOpen courses. In other words, we defined two general dimensions: 1) "Sentiment about Eduopen", grasping what students felt about Eduopen, its services and the arrangement of the courses; 2) "Emotions toward topic", observing the feelings about the topic of the specific course students participated in. That is, the first dimension is about the feelings toward the digital environment, the concept of EduOpen, the arrangement of the environment. The second one refers to the feelings about the topic of the specific course. Furthermore, as Figure 1 and Figure 2 show, the category "Sentiment analysis" is composed by two more specific categories: "Negative sentiments" and "Positive sentiments". These, in turn, are composed by other two subcategories for each (moderately/very negative; moderately/very positive). To define these hierarchical relations between categories, we used the categorization proposed by Nvivo for default. The figure shows the hierarchical relation among "parents" categories and "child" ones too, as elaborated through the software.

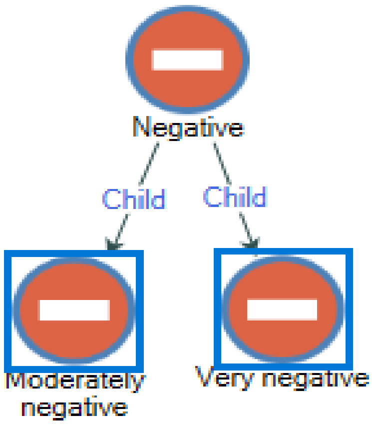

Figure 1. Negative sentiments to EduOpen child graph. Negative sentiments have the two children nodes "Moderately negative" and "Very negative"

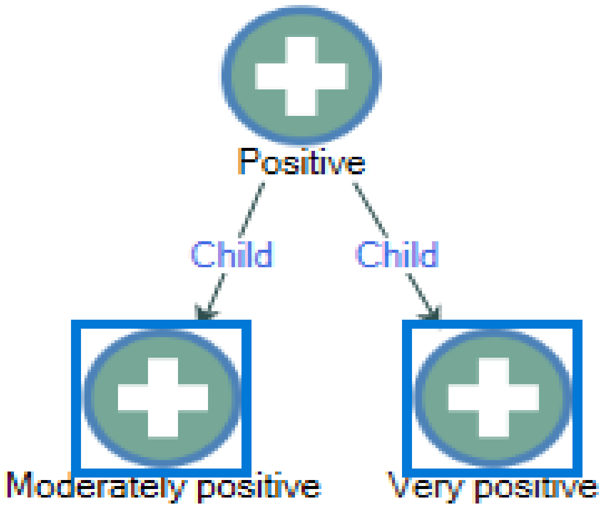

Figure 2. Positive sentiments to EduOpen child graph. Positive sentiments have the two children nodes "Moderately positive" and "Very positive"

Instead, the dimension "Emotions to topic" was at the end shaped by a complex structure of categories. At a middle level, we grasped the three categories "Motivations", "Negative sentiments" and "Positive sentiments (not to be confused with the two namesake categories "Positive" and "Negative sentiments" about the digital experience in EduOpen already described). "Motivations" refers to a category exploring a more cognitive dimension, even implying the students' expectations about the contents of the course and the reason why they are going to attend the course. Indeed, it is composed by seven specific or "child" categories. "Negative sentiments" is about the feelings students have against the content of the course and is composed by five specific or "child" categories. "Positive sentiments" is about the good feelings students have toward the content proposed by the course and is shaped by five specific or "child" categories. In Table 1, we describe all the categories composing "Emotions to topic".

Table 1. Emotions to the topic

Dimension	Category	Micro category (and eventual description)
Emotions to topic	Motivations	Deepen knowledge (to go in depth in the topic the course refers to)

		Home learning (participate because you can attend the course staying at home)
		Innovative methods (to be tried)
		Mind training
		Old knowledge renewal
		Practical effects (in daily job activities)
		Support to learning (of other contemporary learning experiences)
	Negative sentiments	Disorientation
		Fear
		Feeling in trouble
		Nostalgia (about past learning experiences on the same topic)
		Sense of unfinished
	Positive sentiments	Discovery and curiosity
		Enthusiasm
		Feel interest
		Hope (to better understand the contents in opposition to past experiences)
		Passion

After creating the final grid of analysis by making the categorization, we checked them (the grid and the first categorization) by a team discussion, until we reached a total agreement about both. At the end, we analysed the nodes and their relationships with the sources (the texts of the forum) by elaborating some graphs through Nvivo 11 Plus. The following graphs (Figure 3, 4, 5, 6) and their respective descriptions show the analysis we made. Figure 3 suggests that, in the general dimension "Sentiment to EduOpen", the category "Positive sentiments" is much more prominent than the which one about negative sentiments. Furthermore, the moderately positive sentiments are more present in the texts than the high positive ones. Figure 4, instead, shows what are the relations between nodes and sources. As it is visible, in eight forums referring to the respecting courses (Biochemical pills, Math for absolute beginners, Law history and philosophy, Animals, Knowing History, History of Italian literature, Course of general mathematics, Tourism marketing through digital media) students express both positive and negative sentiments about the structure of the course and/or EduOpen as a learning experience. Furthermore, in the document of "Pedagogy and education, basic concept" course there are just positive sentiments' references; whereas, in the course about Physics and Basic general pathology there are no sentiment expressions.

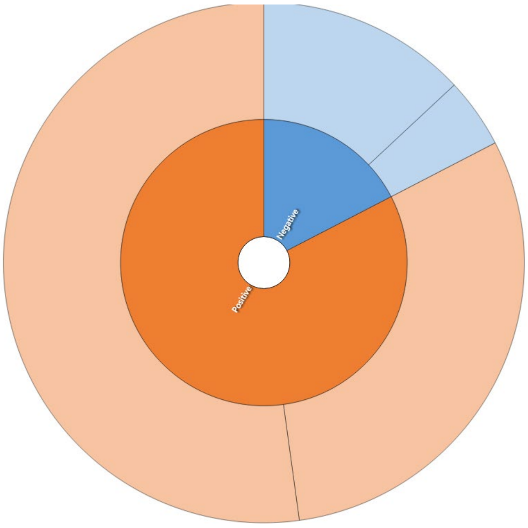

Figure 3. “Sentiment to EduOpen” hierarchical graph. Dark orange section represents Positive sentiments in total, whereas the dark blue one represents Negative sentiments. The smallest light orange section is about the highly positive sentiments; the smallest light blue sections is about the highly negative sentiments.

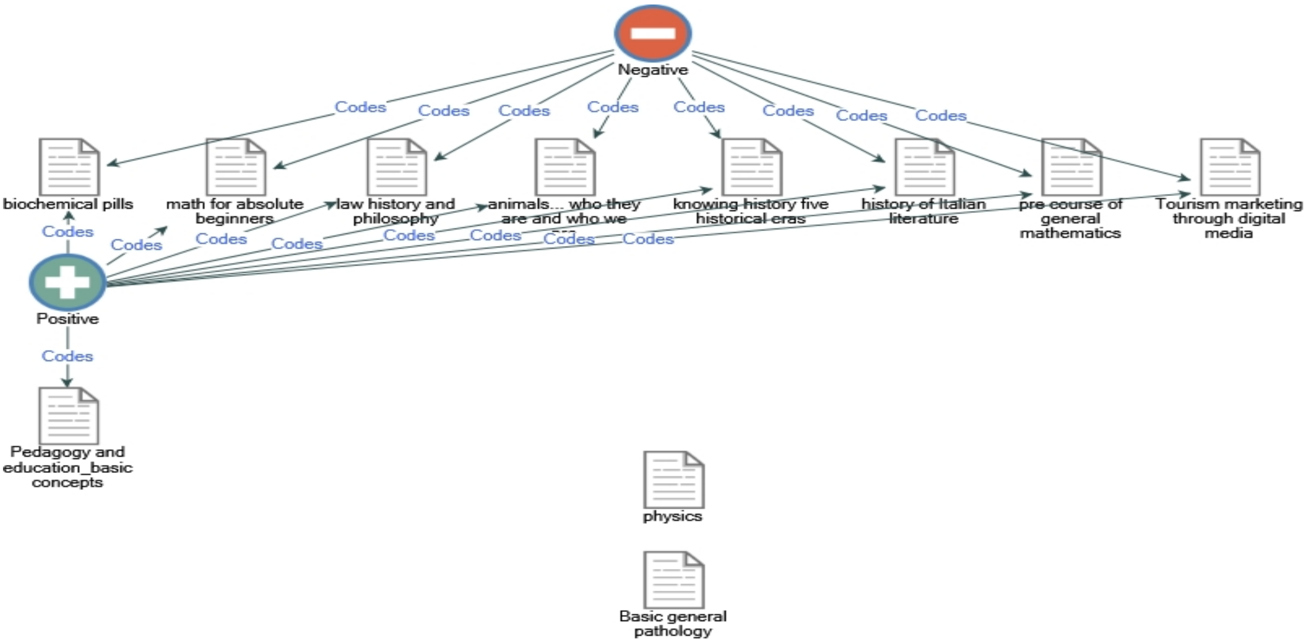

Figure 4. “Sentiment to EduOpen - sources” project map. The red circle represents Negative sentiments; the green circle represents Positive sentiments. Arrows show the relation between each dimension and the forum of the specific course, that is if there are coded units of the text by using the dimensions.

What about the macrodimension “Emotions to topic”? Figure 5 shows that the “Motivation” mesocategory is the richest one, followed by “Positive sentiments” and then by “Negative sentiments”, suggesting that the more cognitive aspects have a higher incidence in the texts.

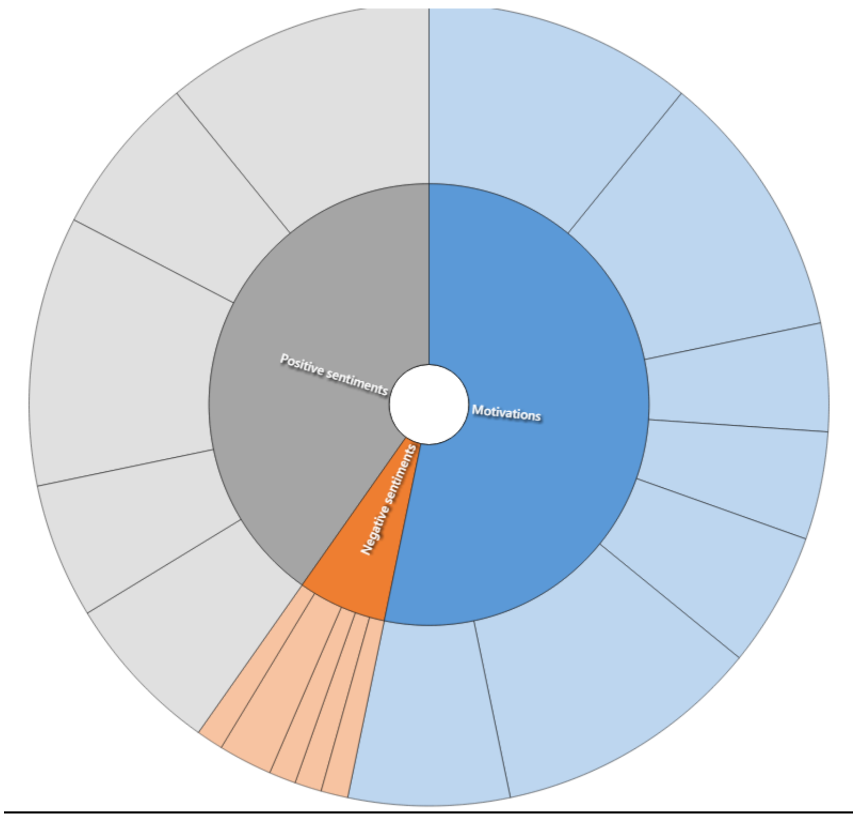

Figure 5. "Emotions to topic" hierarchical graph. The blue section is about Motivations, the grey section is about Positive sentiments and the orange section is about negative sentiments toward the topic.

Figure 6, instead, describes the connections between codes and sources. As it can be seen, the category "Motivation" is related to all of the sources, whereas the category "Positive sentiments" is used on all of the courses' texts except than in "Physics". Negative sentiments are involved in just three sources (Math for absolute beginners, Law History, Pedagogy and Education. Basic concepts).

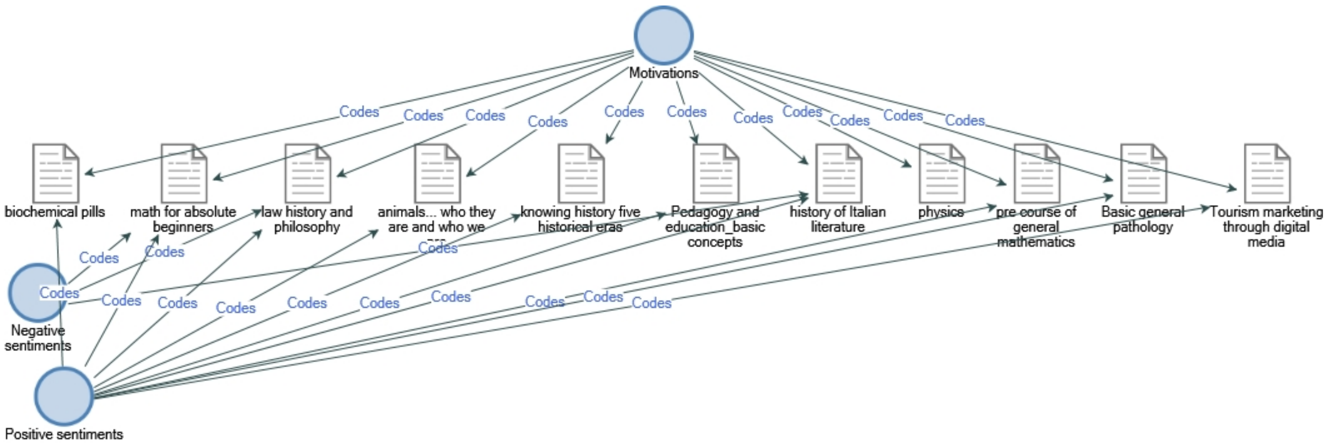

Figure 6. "Emotions to topic - sources" project map

With further analysis, the figures of them are not showed here because of the small space, we clusterized both sources and codes by coding similarity. As results, it emerged that "Motivation" and "Positive emotions" are more similar categories, and that "Physycs" and "Basic genetic pathology" are the most distant sources form the others. These further results obtained by the cluster analysis mainly confirm the previous ones.

5. Conclusions

In this contribution, we made a sentimental analysis in terms of both negative and positive opinions students have about the learning experience they are going to attend or just began on EduOpen. We also realized a more specific emotional analysis about the feelings learners have for the specific topic of the course they choose. We used a grounded theory approach to grasp the set of dimensions, categories and subcategories about emotions arising from the texts through a bottom up research process. The qualitative method we proposed allowed grasping the complexity of the students' emotional experience, since it recognized the sentiments toward both technology and topics. Furthermore, it allowed a hierarchical view on the students' experience, by building the knots of the discourse and the possible relations among them. However, the most important aspect, to us, is that, through this integrated method, we could grasp the microlevel of the students' perception on their experience. This, in turn, sustained a new planning of the online activities and an increased personalization of them. Do we think that this method is the best one to analyse the mediated learning phenomenon? Absolutely not. Rather, we do claim that a triangulation (Yesamin & Rahman, 2012) of methods can give both a general view on the learning process (through the analysis of Big data) and an analytic perspective on the micro aspects characterizing the learning experience (through Grounded theory integrated with Sentiment analysis).

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Building Course conceptualizations using Semantic Technologies to support the comparison of study programmes: advances and possible application scenarios

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Abstract

Machine-readable representations of a study programme, course or module are required to enable a multitude of applications of interest for a higher education institution. For example, in the context of Web-Based Educational Systems, they provide a means to foster adaptive learning and leverage the classification and retrieval of learning objects. From another side, these conceptualizations can encapsulate enough information to support the sharing of lessons or learning content. In this way, the level of detail and formality of these conceptualizations varies according to their application scenario.

This work explores the settings of study programme or course conceptualizations required to be able to be compared or contrasted to support the following application scenarios:

- Presentation of courses: the conceptualization provides structured information about the contents of a course, which can be used to guide students in their selection of new courses.
- Design of new study programmes or courses: the conceptualization captures the relevant concepts of a course at a level of detail that eases the identification of overlaps and gaps.
- Transfer credit assessment: the conceptualization captures the outcomes of a course in a way that it can be evaluated if one entails the other one.

Specifically, we will briefly list the recent advances in Semantic Technologies that can be used to build the mentioned conceptualizations from usual textual sources of programme and course description. A discussion will be provided about the adequateness of the conceptualizations facing the mentioned scenarios, which we believe to be of benefit in more generic contexts.

Keywords: Semantic Technologies, Course Conceptualization, Ontology, Terminology Extraction, e-Advising, Course Design, Networked Curricula

1. Scope and Outline of the Document

Universities keep track of their academic processes. Teaching and research activities, as well as resources offered and results obtained, are registered in every institution's own databases. All this information can be used to design intelligent agents that help improve institutional tasks, such as social projection, internal updating or collaboration with other institutions. The greater the precision in the labelling of this information, the better it will be exploited. However, there are levels of detail in this record of information that are filled by users in a flat textual manner, without using any type of controlled vocabulary. The main objective of this work is to show some case study of automatic analysis of this textual information, identifying some areas of interest in which the results obtained could be applied.

Narrowing the focus, study programmes and courses are described using pre-defined schemes or templates, where some relevant information is stored as free text fields in the database tables. Consequently, the information of the study programs and courses cannot be processed computationally in a direct and precise way as would be desired. For this reason, we tackle the task to (semi) automatically process the unstructured information contained in these descriptions to enable their further processing in different applications scenarios.

In particular, a task that is common to several processes in different context of the university is the comparison of programmes or courses. Hence, we motivate the (semi) automatic construction of machine-readable descriptions of courses as crucial step towards the development of supporting tools adding value in three main application scenarios targeted at:

- Students: students rely on publicly available information reflecting the academic opportunities offered by institutions, which is of special importance for potential students. Additionally, the information provided may also advise students to decide which courses to take. This information is usually publicly available and must be up-to-date and accessible (Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2015).
- Teachers, coordinators and quality assurance experts: internal coordinators need to design study programmes for their approval and redesign them through monitoring and review processes to ensure up-to-date content and meeting the requirements of society (Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2015).
- External academic institutions: external coordinators design and maintain study programmes in several ways of collaboration (exchange, networked and joint curricula) (Ubachs & Henderikx, 2018).

Following this idea, we encounter several works on the research literature showing the potential of semantic technologies to compute similarities between programmes and courses as a way to support their comparison in the mentioned application scenarios (Harispe, Ranwez, Janaqi, & Montmain, 2013; Nuntawong, Namahoot, & Brückner, 2015; Mandić, 2018; Yang & Heines, 2012). These works develop applications that take formal representations or conceptualisations of courses as input to compute similarities. In this way, the input representations, also known in a broad sense as ontologies, exhibit a structure and formal semantics that is not being currently exhibited by the descriptions of programmes and courses currently stored at university's centralised databases. The main problem arises because the information of great value in the mentioned applications scenarios (such as the knowledge items or learning outcomes) are described by fragments of text in natural language. Furthermore, the development of ontologies is time-consuming task and requires certain level of expertise to ensure the semantics are being correctly used.

For this reason, the present work focuses on methods from the field of Artificial Intelligence to (semi) automatically structure and formalise textual information in an attempt to bridge the gap between current descriptions and the kind of machine-readable inputs expected. Then, a selection of these methods is tested for the specific task of structuring the knowledge items of UNED's bachelor's degrees scrapped from the RUCT[1] (Spanish Registry of Universities, Centres and Degrees; *Registro de Universidades, Centros y Títulos*). We took the courses of Computer Engineering bachelor's degree as a complete example for the ontology building process.

To do so, the following section analyses and defines what we mean by a study programme or course as an information artefact and identify the lack of detail of these artefacts as they are currently being managed by the information systems of universities. Then, Section 3 provides examples of works in the literature aimed at the computation of semantic similarity between programmes and courses. They show how semantic similarity measures and metrics can be employed to support programme and course comparisons in the mentioned application scenarios. In addition, these works reflect the expected structure and semantics of the input conceptualisations.

In Section 4, we present several methods that can be adopted to bridge the gap between the current programme descriptions and the expected conceptualisations are presented. These methods belong to subfields of Artificial Intelligence such as Natural Language Processing, Information Retrieval and Knowledge Representation.

A subset of these methods is selected to test its usefulness facing the specific task of automatic conceptualisation of the knowledge body of Computer Engineering UNED's bachelor's degree compiled from the RUCT. The methods and results obtained are presented in Section 5, as well as proposals to alleviate the found shortcomings and enhance the performance of the system.

Finally, conclusions show the relevance of the tested method to enable a larger set of application scenarios fostering collaboration among universities and highlights the possible improvements of the method as well as the need for their formal validation or evaluation.

2. Study Programmes and Couse Descriptions as Information Artefacts

In order to understand what we mean by a study programme and identify its main content, we will refer to the concept of curricula. We can argue that the concept of "university curricula" in Higher Education has suffered from variations on the way it is understood or conceptualised.

(Annala, Linden, & Mäkinen, 2016) shows different ways in which we could understand the concept of curricula because of the influences by the distinct notions about knowledge and learning that have took place in Higher Education (especially with the implementation of the Bologna Process) between other aspects. What matters for this work are the historical notions about the concept, which can be understood as a syllabus, with "focus on the knowledge that is to be transmitted or acquired; as a product, or aggrupation of learning objectives and experiences alongside their organisation and evaluation; as a process, into which students and teachers set its aim and development according to their experiences; and as praxis, or the development of the process in response to societal needs.

As can be seen, different ways to understand what is referred by curricula may exist. In any case, we define the related concept of study programme as the information artefact that transmits the results of these different notions. In this way, there are several information items comprising the content of a study programme. We refer to the guidelines of ANECA (Spanish Quality Assurance Agency) when describing study programmes for the purposes of design and approval (which is in turn mapped to the European standards and

[1] https://www.educacion.gob.es/ruct/home

guidelines) to identify such items and how are they stored at the RUCT (Spanish National Registry of Universities, Centres and Degrees; *Registro de Universidades, Centros y Títulos*):

- Programme structure: programmes are structured in a set of modules or containers. Each module is then broken-down into subject matters that contain courses, the basic learning units of the study programme. Subject matters may gather courses according to different criteria. In any case, each subject matter is characterised by its distribution of ECTS according to different types of courses (basic, optional, etc.). Then, each course has its own ECTS associated, type of course and language. Even if it is not an obligation, it is recommended to use the module and subject matter levels of structure. All this kind of information is presented in the RUCT in a semi-structured or structured way.
- Body of knowledge: these are content for each subject matter. In practice, the contents of each subject matter are expressed in free text fields written in natural language, where the titles of the courses are used to differentiate their specific contents. The RUCT includes this information in a free text field embedded into html elements.
- Learning results: different types of competencies are associated at programme level and at subject matter level. In the case of the learning outcomes of the courses, they all are presented at subject matter level, but in this case the usual practice is not to differentiate the learning outcomes using the titles of courses. Competencies and learning outcomes are described by free text written in natural language. In the case of the competencies, the RUCT offers the structure to differentiate them from each other, whereas learning outcomes are embedded in html elements in a single text field.
- Methodology and assessment: text is also used to describe the type of learning methodology (distance, face to face, blended) as well as the permanency, enrolment and admission rules. The RUCT presents textual fields at the level of subject matter indicating the categories of the evaluation activities.

All this kind of information about UNED's official study programmes, which conform only a part of the global academic offer at UNED University, is stored mainly at the university's centralised database and at the mentioned registry. Subtle differences can be found between the official information requested by ANECA and the information shown at UNED's website describing the content of the courses for each programme in what is called the guide of the course. In the latter case, the guide is provided to describe a course understood as a learning experience. However, in the case of both descriptions of programmes (the one aimed at its approval and the one aimed to guide the learner), the most relevant information items describing these artefacts are provided in an unstructured way by using text written in natural language. A practice that makes sense when we target the artefacts to humans but prevents machines from understanding them.

Regarding this latter aspect, a lot of initiatives have arisen from educational and academic ambits regarding the adoption of Semantic Web technologies as underlying infrastructure that fosters the provision of accurate information services and enables the development of autonomous agents able to automatically collect information from heterogeneous sources for a wide range of objectives. In this way, there are notable efforts to build a web-based, linked and distributed knowledge base that comprises the description of several artefacts in other categories apart from study programmes or academic offer such as institutions (structure, personnel), research (publications, funding, workflows, datasets) or education (learning objects, learning experiences, pedagogical design, instructional design) (Pereira, Siqueira, Nunes, & Dietze, 2018).

Hence, the provision of study programmes and courses through detailed, structured and formal semantic representations is required to enable practices in the domains of educational and academic Semantic Web. For example, an immediate step would be the development of agents that automatically collect learning objects according to the body of knowledge or cognitive level specified by learning outcomes of a course or the provision of services able to respond to cross-information requests such as "the list of courses about topic1 taught by teachers with more than X publications about topic2". Note that in this kind of scenarios, it is paramount to have available a description of the domain of the course to understand the relationships between the different topics. Domain ontologies can be understood as the descriptions of the body of knowledge, are therefore of great importance because they enable a detailed description of topics on which a great variety of resources rely such as Learning Objects, Learning Experiences or Research Publications.

Our idea is that the semantic representations of study programmes also enable other possible applications while supporting the previously mentioned application, such is the case of programme and course comparison. We try to show this idea and the potential benefits of computer applications performing course comparison, which is a specialised task of the computational problem of semantic similarity.

3. Semantic Applications for Study Programme and Course comparison

The aspiration of Semantic Technologies is to make machines understand the information or data they manage in a closer way as humans do. Then, a set of models and algorithms have been developed to support the representation of semantics and to emulate in a simpler manner the way humans represent and process knowledge. In case of course comparison, we shall refer to the models and algorithms that tackle the more general problem of semantic similarity, which can be addressed from different perspectives (Harispe, Ranwez, Janaqi, & Montmain, 2013). Between all the possible approaches, we put emphasis on those methods that make use of representations in-line with the standards of the Semantic Web to keep in mind a wider range of objectives. Hence, we present some works that use ontologies and Knowledge Bases to compute semantic similarity in different application scenarios.

In first place, the application scenario could be targeted at students, as they compare the academic offer to choose which study programmes or courses to enrol according to their preferences or possible learning paths. They expect the information to be easily accessed, retrieved and to be up-to-date reflecting the actual content and skills to be acquired as learning experiences.

In second place, teachers, coordinators and quality assurance evaluators or experts, compare programmes considering several of their information items having the notions of process and praxis in mind. We refer to the processes of design, approval and the on-going monitoring and periodic review of programmes. Both (Nuntawong, Namahoot, & Brückner, 2015; Mandić, 2018) address curriculum alignment of courses against standard centralised national curricula to ensure consistencies or incompatibilities regarding the knowledge items of their courses. While the first work only focuses on lexicographical similarity between extracted terminology related to knowledge items against a reference ontology representing the centralised curricula (with hierarchical relations, previously developed by the authors), the second work also considers hierarchical representations of competences, built by experts in a collaborative environment.

Another work in line with this second application scenario is (Ramesh, Sasikumar, & Iyer, 2016), which presents a method to measure the alignment of evaluation questions and learning outcomes for a course about data structures. They developed a domain ontology representing several domain independent relationships between concepts such as "subclass_of", "has_parts" and "instance_of", and domain-dependent relationships such as "has_opperation" or "has_application". Then, relevant terminology and the cognitive level is extracted from textual learning outcomes. The same approach is applied on evaluation questions to map all the matching terms to the domain ontology and compute similarity using graph-based measures.

In addition, actors external to the university require descriptions of study programmes to support processes related to student mobility, academic recognition and the discovery of opportunities for the development of joint or networked programmes. For this latter aspect, the comparison is essential to find commonalities and gaps between study programmes and to decide which collaboration level can be reached. (Yang & Heines, 2012) propose a method to support transfer coordinators by "suggesting whether a course can be transferred from one institution to another" using graph-based similarity measures over the category structure of Wikipedia. To do so, they previously identify relevant terms from the knowledge items of courses that are linked to their corresponding articles in Wikipedia. They evaluate their approach against pre-defined tables of equivalences used by the institution. A similar application scenario is addressed by (Langan, Montgomery, & Garg, 2016), but only focused on Computer Science courses.

Summing up, we can distinguish different types of conceptualisations of study programmes used by the previous examples performing semantic similarity between courses, mainly oriented to exploit the body of knowledge and learning outcomes. These information items are required to be expressed in a structured format, which could be given by a set of concepts or ontologies were concepts and relationships are described according to several levels of detail and formality:

1. Concepts: the lowest level of detail requires the unique identification of concepts, for which several lexical forms (comprised by at least one word) may exist referring to the same concept. It is crucial to relate the different lexical forms related to the same concept to avoid duplications and introduction of noise facing the semantic similarity task. In this case, semantic similarity is computed using an external lexicographical or Knowledge Base sources, but also large textual corpora can be used for this purpose.
2. Lightweight ontologies: this corresponds to ontologies represented through is-a relationships. Concepts are uniquely identified and hierarchically related resulting in a taxonomy. Specific methods can be applied to compute semantic similarity traversing these kinds of relationships when the ontology is complete. Lightweight ontologies fall into the Semantic Web ontologies built using RDFS.
3. Heavyweight or formal ontologies: ontologies that uniquely identify concepts and their hierarchy, but also express distinctions between concepts and their instances, not being limited to these types of relationships. These ontologies are built according to the Semantic Web standard OWL, which is based on Description Logics formalism.

In this way, to support the summarised applications scenarios and not to overwhelm teachers in building their own ontologies themselves and avoid the need of experts, we need methods that automate the transforming of the textual descriptions of programmes and courses into one of these levels of detail, mainly their knowledge body and learning outcomes. In the case of learning outcomes, the first level of detail could be enough to identify their main components, while in the case of the knowledge body, depending on the domain being treated, more formal semantics are required.

4. Methods to (semi) automatically build Programme and Course conceptualisations

This section lists a set of methods to automatically or semi-automatically build conceptualisations of programmes from textual descriptions about the body of knowledge and learning outcomes of programme or course descriptions.

In the following subsections, in correspondence to the three levels previously identified, we distinguish methods to extract (1) terms from text and identify concepts, (2) hierarchical relationships between concepts and (3) instances of concepts or other relationships. The following figure depicts this idea:

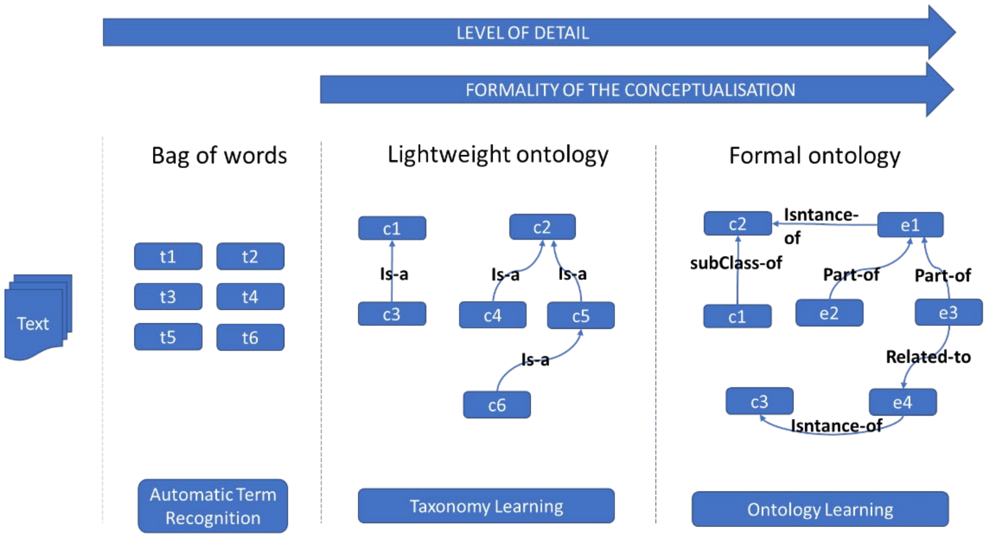

Figure 1. Automatic Methods to reach different levels of detail and formality from textual sources

As we can see, detail is achieved by structuring text and having a set of terms differentiated. Then, concepts can be hierarchically related, while formality is reached when we consider classes and entities of these classes, related in several ways. The following techniques come from studies on Natural Language Processing, Information Retrieval and Knowledge Representation. It is important to remark that these methods can be somehow applied in conjunction at different stages of a representation building process, forming a chain of processing steps that we denote as a processing pipeline. Therefore, the success of a complete pipeline is determined by intermediate results and the global evaluation.

4.1. Methods for Automatic Terminology Recognition

Terminology extraction or recognition focuses on the identification of relevant concepts that belong to the domain of a specific text corpus. In case of study programmes, the domains may be wider or narrower, probably according to the specialisation level of their courses (i.e. from a basic subject about physics to a more constrained domain of quantum physics). The identification of concepts requires the extracted terminology to be related to unique entities that represent the same concept and discard those terms that do not belong to the domain of the analysed text.

Hence, this initial step to build conceptualisations can be broken down into the sub-processes of candidate term extraction (collect a set of lexical forms that are likely to represent terms), term filtering (filter out those candidate terms that do not belong to the domain) and concept identification (associate one or several lexical forms of terms that refer to the same concept). The methods employed at each stage are based on the linguistic features (syntactic, semantic and pragmatic) that differentiate terms from the rest of words (Astrakhantsev, Fedorenko, & Turdakov, 2015).

For the stage of candidate term extraction, it is usual to exploit the syntactic characteristics of terms after a process of tokenization of words. Then, words are morphologically and grammatically analysed to associate them a part-of-speech and apply shallow parsing with pre-defined syntactic patterns that extract different forms of nouns and nominal groups. This kind of linguistic filter can also be performed directly using N-gram filtration (Astrakhantsev, Fedorenko, & Turdakov, 2015).

Once a set of candidate terms corresponding to one word or multi-word nouns or nominal groups is compiled, a hard task is to assess their relevance to the domain being analysed, a task that can be tackled following statistical methods or text mining methods. Between the statistical methods, TF-IDF is a common Information Retrieval feature or metric that assigns higher values to terms occurring only in a small set of documents. TF-IDF is said to be a termhood measure, while other measures analyse the unithood of terms. From this latter perspective, C-Value also considers how likely a word in a multi-word term is to occur enclosed by the rest of the words of the terms in the rest of documents, giving lower values to those terms that include words found in other contexts. This metric is employed to compute the NC-Value, which considers not only the context of words in terms, but also the frequencies of the context of terms themselves such adjectives, verbs or other nouns.

The methods based on Search Engines and Wikipedia can also be used to address the stage of concept identification. In addition, other linguistic sources and NLP techniques can be used to look for canonical forms of terms, synonyms and morphological derivations of nouns to try to reduce several lexical forms of terms to a single one. Another approach could be to consult Wikidata, which comprises different lexical forms of all the concepts of Wikipedia articles titles, and usually these items contemplate other lexical forms commonly used to refer to the concept in several languages.

Finally, latest advances focus on the use of Machine Learning or Data Mining techniques to extract any of the previously identified metrics as features that are considered as input to a system able to predict their relevance in the domain. While this process usually requires a set of tagged or manually extracted terms (supervised learning), there are some experiments to bootstrap and co-train the features used to train the prediction models. Refer to (Astrakhantsev, Fedorenko, & Turdakov, 2015) for a comprehensive survey on the previous methods for Automatic Terminology Recognition.

4.2. Methods for Taxonomy Learning

A require step to build semantically formal conceptualisations is to find relationships between concepts. In the case that we want to reach a hierarchical level of detail, possibly defined using RDFS. The task to find relationships between words has been mostly studied from the viewpoint of Relationship Extraction in Natural Language Processing, which does not explicitly require a set of identified concepts to be already identified.

The task of taxonomy learning can be understood as the extraction of is-a relationships (identification of hierarchical relationships) and the induction of taxonomy (build a complete hierarchy based on several is-a relationships) (Wang, He, & Zhou, 2017).

Pattern-based methods are commonly used for the identification of this is-a relationships, they are based on the idea of Hearst Patterns, that is, to search for occurrences of text of the type “[T1] such as [T2]”, where T1 and T2 are terms not necessarily already identified. Following this intuition, some variations have been proposed to improve the recall or the precision of these patterns. For example, more flexible or generalised patterns are built based on lexico-syntactic patterns, and dependency parsing could be a useful tool in conjunction to the use of lexical forms to enlarge the context of the pattern. Another idea is to perform hypernym inference, which is based on the idea that non is-a relationships occur between terms that share properties and are therefore likely to share the same hypernym.

Distributional methods address the identification of is-a relationships based on the prediction of relationships rather than their extraction from text. These methods use a set of features capturing the distribution of previously-extracted terms to predict hypernym relationships in a supervised or unsupervised setting. A very popular feature are word embeddings, which can be used to represent the context of terms through numerical vectors and feed a system with already labelled hypernyms to predict new ones based on other terms in a supervised setting (Wang, He, & Zhou, 2017).

Once a set of is-a relationships is identified, it could be the case that the relationships extracted do not reflect in detail each level of the hierarchy. To alleviate this problem, clustering methods can be applied to find common ancestors, while some graph-based methods exploiting the structure of the taxonomy are also proposed. We refer to (Wang, He, & Zhou, 2017) for an overview and references to all the mentioned methods for both tasks of taxonomy learning.

Finally, instead of extracting relationships from the text, we can rely on the Web of Data. Some possible Knowledge Bases to consult are Linked Open Datacloud, Wikidata or DBPedia.

4.3. Methods for Ontology Learning and Population

Variations of taxonomy learning can be applied to look for other types of relationships than is-a relationships. However, the identification of those relationships contemplated by the formalisms of Desciption Logics (OWL) are of special importance to support seamless reasoning and the use of other paradigms from Knowledge Engineering such as production rules on top of the entities of ontologies.

Ontology learning is still a big open research problem, which is based on traditional Relationship Extraction and Named Entity Recognition fields of Natural Language Processing. However, some more advanced methods are being studied that do not necessarily need an explicit textual relationship to predict instances and relationships and other methods used to find instances of the concepts of a given ontology (ontology population). We refer to for an overview of common methods for this purpose in (Buitelaar & Cimiano, 2008).

For our purpose, we base our method on the ontology already provided by Wikidata, which is controlled and structured by humans in a collaborative environment. Therefore, we try to assess its usefulness in a proof-of-concept described in the following section.

5. Building Study Programme and Course conceptualizations from the RUCT

In this section, we apply a specific processing pipeline to structure the body of knowledge of UNED's bachelor's degree programmes, restricting the whole pipeline (ontology building) to the courses of Computer Engineering bachelor's degree.

We decided to take course descriptions from the RUCT as it guarantees minimum homogeneity on the contents of each programme, and it has some information already structured regarding the structure of the programme. In any case, the major reason why we choose this source is the possibility to project all the official bachelor's and master's degrees approved by Spanish Higher Education System as Linked Data. Then, for our purpose, we developed a simple scrapping mechanism to build RDF representations of the relevant fields of the registry for each programme and course of UNED's bachelor's degrees. During the scrapping stage, we collect the knowledge branches, modules, subject matters and courses of all the UNED's mentioned degrees.

At the end of this stage, the body of knowledge of courses was expressed as textual information embedded in html elements that the registry gathers at the level of subject matter, so we did a segmentation of the pieces of texts referring to the specific courses. This pre-processing step was based on finding the titles of courses in the descriptions and storing the html patterns that lead to titles so as to infer the possible pieces of text corresponding to specific courses for those cases where string comparison wasn't so accurate using the Levensthein edit distance. In this process we have lost the assignment of 400 courses out of the 1500 scrapped courses along the 28 programmes.

5.1. Description of the method

Once we related pieces of texts about body of knowledge to their courses, we applied the pipeline in the following illustration:

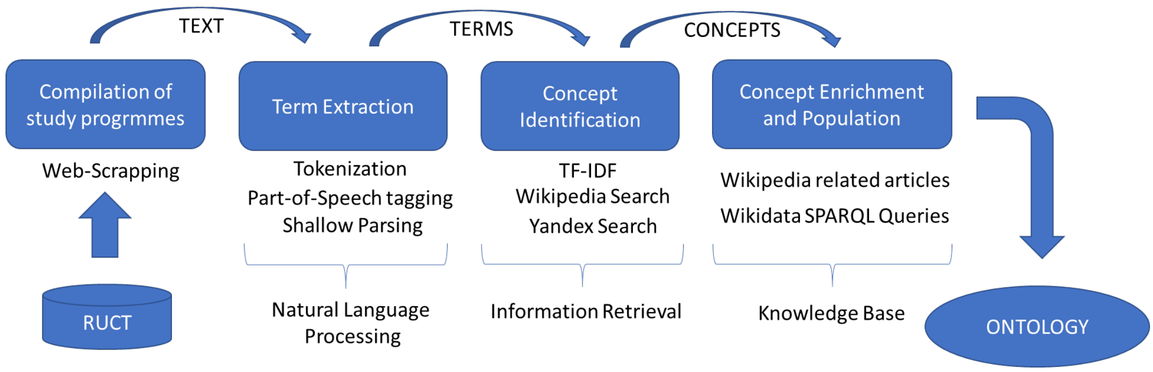

Figure 2. Pipeline employed to automatically generate domain ontology

In first place, the text is extracted from the html elements and tokenised, including the removal of special characters. Then, sentences are extracted from the tokenised text and a morphological analysis is performed to apply a HMM Part-of-speech tagger that assigns grammatical categories and characteristics to each token. All these parts of the process have been performed using Freeling 4.1 Python's API.

Then, we apply shallow parsing over the tokenised text for the extraction of candidate terms using the RegexParser class of NLTK Python library. We initially based our initial set of syntactic patterns on extracting nouns and nominal groups based on (Barrón-Cedeño, Sierra, Drouin, & Ananiadou, 2009). The most relevant of patterns and examples of associated extracted terms are shown in the following table:

Table 1. Examples of syntactic patterns and extracted terms using shallow parsing

<table>
<tr><td rowspan="3">Pattern 1</td><td>Pattern</td><td>{ <N.*> }</td></tr>
<tr><td>Example term</td><td>[('Radiactividad', 'NP00000')]</td></tr>
<tr><td>Translation</td><td>Radioactivity</td></tr>
<tr><td rowspan="3">Pattern 2</td><td>Pattern</td><td>{ <N.*>(<A.*>|<VMP.*>|<N.*>)+ }</td></tr>
<tr><td>Example terms</td><td>[('autómatas', 'NCMP000'), ('celulares', 'AQ0CP00')] and [('Procesadores', 'NP00000'), ('segmentados', 'VMP00PM')]</td></tr>
<tr><td>Translation</td><td>Cellular automata, pipelined processor</td></tr>
<tr><td rowspan="3">Pattern 3</td><td>Pattern</td><td>{ <N.*><SP>(<D.*>)+<N.*> }</td></tr>
<tr><td>Example terms</td><td>[('Sintaxis', 'NCFN000'), ('de', 'SP'), ('las', 'DA0FP0'), ('oraciones', 'NCFP000')], [('Trastornos', 'NP00000'), ('de', 'SP'), ('el', 'DA0MS0'), ('sueño', 'NCMS000')]</td></tr>
<tr><td>Translation</td><td>Phrase syntax, sleep disorder</td></tr>
<tr><td rowspan="3">Pattern 4</td><td>Pattern</td><td>{ <N.*>(<A.*>)<SP>(<D.*>)+<N.*>(<A.*>|<N.*>|<VMP.*>)+ }</td></tr>
<tr><td>Example term</td><td>[('paisaje', 'NCMS000'), ('rural', 'AQ0CS00'), ('en', 'SP'), ('la', 'DA0FS0'), ('Grecia', 'NP00000'), ('antigua', 'AQ0FS00')]</td></tr>
<tr><td>Translation</td><td>Rural landscape of Ancient Greece</td></tr>
</table>

At this stage, each course is assigned with a set of candidate terms. So in order to discard those that are not relevant for each course's domain, we compute the TF-IDF measure of each term, considering the lemmatised one-word terms. We discarded the 5% of the terms with lowest TF-IDF value, but only the first 25 with lowest score are shown in the next figure:

['sociedad', 'organización', 'ámbito', 'formación', 'estudiante', 'contexto', 'objetivo', 'marco', 'concepto', 'tipo', 'forma', 'desarrollo', 'análisis', 'campo', 'grupo', 'factor', 'contenido', 'introducción', 'característica', 'sistema', 'torno', 'persona', 'disciplina', 'vida', 'siglo']

['society', 'organization', 'ambit', 'formation', 'student', 'context', 'objective', 'framework', 'concept', 'type', 'form', 'development', 'analysis', 'field', 'group', 'factor', 'content', 'introduction', 'characteristic', 'system', 'around', 'person', 'discipline', 'life', 'century']

Figure 3. 25 candidate terms with lowest TF-IDF value

As we can see, TF-IDF measure tends to assign lower values to those terms that are common in all the processed courses.

Then, the following stages of the method were focused on the automatic building of an ontology for the courses of Computer Engineering degree. To validate the extracted terms and identify the related concepts, we used the search engine of Wikipedia, accessible through pywikibot Python library, to look for results according to the different lexical forms, including one-word and multi-word terms. We validated the terms as concepts if the Levenshtein edit distance between the stemmed lexical form of the candidate term and the one representing the concept in Wikipedia (page title) was lower than a pre-defined value.

In case that similarity between strings is not close enough to validate the term using Wikipedia, the term is searched using Yandex Search engine using requests Python library with parameters of language and domain set to Spanish and ".es" respectively. We considered the term to be validated if a Wikipedia page was suggested between the 5 first retrieved results. After this step, it was straightforward to represent each of the concepts by their WIkidata URI, departing from the article's page using pywikibot library. We collected a set of labels of the concepts of the courses of Computer Engineering in several languages, resulting in a great bunch of alternative lexical forms for the same concept.

Then, we enriched the validated concepts of Computer Engineering courses taking the main Wikipedia article for each of the concept's categories and the concepts described by the article's output links. A second enrichment process was performed by making simple SPARQL queries to Wikidata for the extraction of direct subclass, direct superclass, "part_of" and "is_part_of" relationships, instances and "said_to_be_the_same_as" relationships between others. Therefore, the concepts and relationships extracted, including the multilingual labels, are represented in a graph using Wikidata relationships. This graph is linked to each of the courses collected at the first stage, resulting on a final graph on which courses are represented as a collection of Wikidata concepts, probably related between them.

5.2. Results obtained

We provide a simple and informal analysis of the results obtained after the application of the method to automatically build the semantic representation of the courses of Computer Engineering from textual descriptions of their body of knowledge scrapped from the RUCT.

On first place, we scrapped a total of 28 study programmes corresponding to all the official bachelor's degree offered at UNED's university. Resulting in an RDF graph that compiles text fields such as competencies, learning outcomes and body of knowledge of 381 subject matters, for a total of 1484 courses. We assigned pieces of texts of the descriptions of the body of knowledge to a total of 1092 courses.

The Automatic Term Recognition stage resulted in a total of 29,992 extracted terms, from which 900 terms were considered as not relevant at the domain of each course. As a result of the filtering by TF-IDF values, we got a total of 29092 distinct terms. Taking a look at the filtered terms, we note most of them were one-word terms, while the terms with lowest score seemed to be irrelevant, a great number of apparently relevant terms was discarded in the process.

Then, we proceed to build an ontology for 37 courses of the Computer Engineering study programme. The method accepted a total of 527 concepts and the enrichment process included another 7003 concepts, from which only 864 were linked to previously accepted concepts by any of the properties used during enrichment. Some metrics to assess the quantity of relationship taken from Wikidata are shown in the following table:

Table 2. Simple metrics showing the usefulness of Wikidata

Number of accepted terms	527
Number of enriched terms linking to any of the accepted terms	864
Number of accepted concepts that are instances of any enriched concept	68
Number of enriched concepts that are instance of any of the accepted terms	275
Number of accepted terms that are subclass of any of the enriched concepts	145
Number of accepted terms that are superclass of any of the enriched concepts	464
Number of accepted concepts that are part of any of the enriched concepts	43
Number of enriched concepts that are part of any of the accepted concepts	102
Number of accepted concepts with at least one label in French	441
Number of accepted concepts with at least one label in Italian	420
Number of accepted concepts with at least one label in English	474
Number of accepted concepts with at least one label in German	439

The previous table indicates that most of the accepted terms are considered classes rather than entities. These classes seemed not to be very specific, as we found them to be superclasses rather than subclasses and are generally more prone to be decomposed than acting as a component. Furthermore, we can note the usefulness of Wikidata to retrieve the labels of concepts in other languages of the European Union.

Hence, the resulting graph now includes a set of terms for each course, and it is ready to be applied to perform course comparison but there are some shortcomings that need to be addressed for these methods to perform as expected. However, when consulting the graph, we have a much more accurate and complete capability to search for courses related to a given term. This is mainly due to the enrichment process, that gives the possibility to return results of accepted concepts based on the relationships with other concepts, or the different aliases and languages of the accepted concepts.

5.3. Problems found and alternatives

Several shortcomings arose during the development of the method, while some problems regarding the fitness of the methods have been identified. One of the main problems was to generate the Python API for Freeling 4.1, as the open software is developed in C++. Another problem was the long-time taken by the stages of concept acceptance and enrichment, so we decided to limit the number of Wikidata output links to analyse to 25.

Regarding the performance of the chosen method, a little effort was spent on pre-processing the textual descriptions embedded in the scrapped html of the courses, so we got a lot of cases where parsing the html and getting the text generated wrong tokens made by the concatenation of several words. To alleviate this problem, we can better analyse the html elements on which the text is embedded or use statistical information about words to automatically identify those tokens including the concatenation of words. In addition, there is also the possibility to consider the structure of the html as semantic information regarding the found terms.

In what regards the task of term candidate selection, we applied each of the syntactic patterns without considering the rest of patterns, which generated a lot of irrelevant single-word nouns, that are probably extracted later on using a more complex pattern. Therefore, we should employ a unique grammar of syntactic patterns ordered by preference or used N-gram filtration to perform this task.

From other side, we found false positives and false negatives during the task of term filtering according to the domain, which indicates that TF-IDF is not the best possible approach for our corpus, probably because of the little statistical relevancy of the words in such little pieces of texts. For this purpose, we could have relied on a reference or external corpus such as the texts of the Wikipedia articles to perform TF-IDF, but this is a very time-consuming task. Other possibility is to build a Language Model from a pre-build reference corpus to capture the frequencies of nouns and nominal groups for each course and then assess the likelihood of a new term to be generated by any of the Language Models.

The acceptance of the terms and identification of the concepts is very limited as it is based on string edit distance comparison and simple searches using Yandex that anyways rely on Wikipedia articles. For this purpose, more advanced methods need to be applied to accept also terms that do not correspond directly to the titles of Wikipedia articles, but are present in a number of those. Another option could be to employ Hearst patterns over text to consider the acceptance of terms if a relationship is found between an already accepted term.

While the enrichment of terms for a course using Wikipedia generated a great number of output articles, not all the accepted concepts (represented as articles) had an associated Wikipedia Category. Furthermore, we observed that the Wikipedia Categories are not always structured in a more general or more specific hierarchy. Therefore, we suggest the use of Wikidata hierarchical properties for this purpose, while the structure of Wikipedia categories may be best fitted to identify the domain relevance of terms by generating a category graph from manually selected categories as explained in (Yang & Heines, 2012).

5.4. Contributions and future work

We provided a method to automatically generate semantic descriptions about the body of knowledge of programmes and course descriptions from textual sources. In this way, the mechanism can be applied to generate domain ontologies that can be further used in a variety of application scenarios such as enabling the comparison of courses and programmes. Their detail and formality enable graph-based and ontology-based methods for computing semantic similarity between the built conceptualisations, while being compliant with the Semantic Web standards and hence opening new practices in the educational and academic domains.

Our main contribution from the automatic generation of ontologies from text is the use of Wikidata as an external Knowledge Base. Its main benefit is that it has been edited and reviewed by humans (in contraposition to DBPedia). Other benefit comes from the fact that is part of the WikiCommons project, so it is immediate to relate the concepts to other WikiCommons resources, having a multilingual support. In this case, the resulting graph could be used to support multilingual search of terms in course catalogues, possibly by potential foreign students in a Virtual Mobility setting in the line of other platforms such as the NetCu catalogue[2].

[2] www.networkedcurricula.eu

We identified some shortcomings that need to be alleviated as proposed. Once the performance of the system increase, we will plan a method to perform a formal evaluation or validation of the ontologies. A task that requires a coherent, practical and simple interface to do this task.

Nevertheless, we open new possibilities regarding the comparison of programme and course descriptions at national level. The projection of RDF data from the RUCT gives space for possible collaborations between universities to look for commonalities, inconsistencies and gaps between curricula to support a wide range of application scenarios such as the creation of joined curricula, alignment of curricula or identification of new perspectives and practices.

6. Conclusions

The comparison of courses is a task that is present in several contexts of the activity of the university and requires great effort to discover and manage different information artefacts. To alleviate this issue, we presented some works focusing on the computation of semantic similarity between course descriptions.

Current Information Systems does not manage the information of study programmes at level of detail and formality required by the mentioned works as they are mainly described by text in natural language. To overcome this issue and avoid the need for expertise and effort in building these models, we proposed methods to automatically build machine-readable and formal conceptualisations (domain ontologies) of study programmes. A method that supports other educational or academic applications under a Semantic Web setting.

We chose a specific method and perform a proof-of-concept to address the task of building a formal ontology for courses of UNED's Computer Engineering bachelor's degree, mainly by taken the texts about the body of knowledge of courses from the RUCT (Spanish Registry of Universities, Centres and Degrees). Results shown the usefulness of the method, but there is still work to do to enhance the filtering of terms that belong to the domain of the course, and to enrich the found concepts ensuring also their domain relevancy. We proposed some enhancements before being in the position to plan a formal validation or evaluation of the resulting conceptualisations.

In any case, the followed approach can be performed to automatically build conceptualisations of any of the courses present in the registry on which similarity measures can be employed to perform course comparisons. This work opens new ways of collaboration between universities in different context and improves the accuracy of university's information systems.

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Building quality assurance frameworks for accessibility in education through ICT

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Abstract
The 2030 Agenda for Sustainable Development "United Nations Sustainable Development 17 Goals" defines in Goal 4 "Ensure inclusive and quality education for all and promote lifelong learning" a specific target: by 2030 [...] ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations". A key challenge is represented by the need, for HEIs, to be both "universal" and "need-specific" while dealing with students and specific learning needs. This paper aims to present the work conducted in different projects funded by Erasmus+ programme to define state of the art analysis, institutional assessment checklists and other tools for institutions and educators at different levels for implementing accessible approaches. This paper is presented as part of the ACAI-LA (Adopciòn de enfoques de calidad, accesibilidad e innovaciòn en la educaciòn superior de Latinoamerica) project activities, a Capacity building (Erasmus+) project, aiming at improving openness, flexibility and accessibility in HEIs in Latin America, and at the creation and updating of online services to support teaching, to ensure the access and permanence at University of disadvantaged groups and to develop professional qualifications to enhance employability of graduates by establishing links with companies.

Keywords: Accessibility, Higher Education, professionalization, capacity building, quality frameworks for accessibility

1. Introduction

Inclusive education is a global goal, pursued by International Organization such as UNESCO, UN and, at European Institution level since years.

In 1994, the Salamanca Statement on Special Needs Education underlined how educational policies should take full account of individual differences and situations; focus was set not only on children, but also on youth and adult education, both at secondary and higher education level, as well as in training programmes. The key-phrase of the document was clearly education for all. A specific chapter is devoted to the preparation for adult life: "Young people with special educational needs should be helped to make an effective transition from school to adult working life". At strategy definition level, the 2030 Agenda for Sustainable Development: United Nations Sustainable Development 17 Goals defines in Goal 4 "Ensure inclusive and quality education for all and promote lifelong learning" a specific target: by 2030 [...] ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.

Through the Incheon Declaration, UNESCO - as the UN specialized agency for education - was entrusted to lead and coordinate the Education 2030 Agenda. The Education 2030 Framework for Action sets as one of the objective equity, inclusion and gender equality in education, stressing the role of lifelong learning as one of the pillars of the abovementioned Sustainable Development - Strategic Goal 4.

Inclusive education of persons with disabilities is often framed in terms of human rights or justice. Notwithstanding, the economic argument for educating persons with disabilities is also very strong. Lack of adequate education remains the key risk factor for poverty and exclusion of any person, whether they are disabled or nondisabled.

One of the key Europe 2020 targets is to have *'at least 20 million fewer people in or at risk of poverty and social exclusion*'. This shows the great importance social inclusion has at European level and thus for the Member States and at the same time, it demonstrates the strong need for trans-national cooperation and an integrated approach and measures for promoting and supporting social inclusion Europe wide. The number of people at risk of poverty or social exclusion in the EU amounts to nearly one-fourth of the total population. Current levels of poverty and social exclusion jeopardise the achievement of the EU 2020 headline target (Social policy reforms for growth and cohesion: Review of recent structural reforms 2013, European Commission).

Moreover, another Europe 2020 target is: *'at least 40% of 30-34-year-olds completing third level education'*. It indicates the need for a highly skilled labour force at European level and at the same time, it is based on a limited level of tertiary education among 30-34 year-old European citizens (in 2013 the European average was 36,8% with only 29,2% in Portugal and 22,4% in Italy).

These practical very specific targets are in line with the UN Convention on the Rights of Persons with Disabilities which states that *'States Parties recognize the right of persons with disabilities to education. With a view to realizing this right without discrimination and on the basis of equal opportunity, States Parties shall ensure an inclusive education system at all levels and lifelong learning*'.

One in six people in the European Union (EU) has a disability[1] that ranges from mild to severe making around 80 million who are often prevented from taking part fully in society and the economy because of environmental and attitudinal barriers. For people with disabilities the rate of poverty is 70 % higher than the average[2] partly due to limited access to employment. Furthermore, these numbers are set to rise as the EU's population ages.

2. Opening the access to Higher Education

Currently, one of the great challenges for higher education is moving towards a university model based on the principles of inclusive education (Lopez-Gavira et al., 2016). Participation in Higher Education is wider, due to the progressive incorporation of groups that traditionally were outside of higher education (Thomas, 2016). Being accessible and inclusive cannot be limited to support enrollment; it is also appropriate to have practical mechanisms that guarantee that these students continue their study path. This fact is extremely important when the dropout rate is highest among these students (Moriña et al., 2015).

Nowadays, a significant number of countries have implemented measures to make universities more accessible to people with disabilities, becoming progressively more committed to the processes of inclusion (Jacklin, Robinson, O'Meara, & Harris, 2007).
Focusing on online/digital enhanced Higher Education Institutions, the Digital Education Action Plan (COM(2018)) from the European Commission defines the future strategy for ICT / digital technologies

[1] EU Labour Force Survey ad hoc module on employment of disabled people (LFS AHM), 2002.
[2] EU Statistics on Income and Living Conditions (EU-SILC), 2004.

integration in education at all levels; one of the fundamentale statement is that "Digital technology enriches learning in a variety of ways and offers learning opportunities, which must be accessible to all".

2.1 Web accessibility

Being the Internet the main mean of course delivery/course attendance for online programs, Web accessibility is usually the dimension used to design and evaluate the effectiveness and of learning programs for students with perceptive impairments or specific learning needs.

The main standard used is WCAG – Web Content Accessibility Guidelines[3], in their 2.0 version. WCAG are a set of guidelines to be used for designing and delivering Web pages with any purpose, and a set of indicators with 3 level of conformance to each statement, useful for assessing or self-assessing the level of Web content accessibility of the Web application of an institution/organization. This set of principles and guidelines is useful mainly for Course (Web) content design and production. The first, and probably most important, principle stated by WCAG regards providing multiple options for perception: specifically, non-textual contents must be provided with a text-equivalent alternative. Guideline 1.1 from WCAG 2.0 states "Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language". Audio and video contents are useful and effective in learning, but not usable by all learners.

All the WCAG 2.0 guidelines relate with contents and should be applied to course contents design; the following is the list of all the WCAG 2.0 principles and guidelines[4]:

1. Perceivable
   1.1 Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.
   1.2 Provide alternatives for time-based media.
   1.3 Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
   1.4 Make it easier for users to see and hear content including separating foreground from background.

2. Operable
   2.1 Make all functionality available from a keyboard.
   2.2 Provide users enough time to read and use content.
   2.3 Do not design content in a way that is known to cause seizures.
   2.4 Provide ways to help users navigate, find content, and determine where they are.

3. Understandable
   3.1 Make text content readable and understandable.
   3.2 Make Web pages appear and operate in predictable ways.
   3.3 Help users avoid and correct mistakes.

4. Robust

[3] https://www.w3.org/TR/WCAG20/
[4] https://www.w3.org/TR/WCAG20/#guidelines

4.1 Maximize compatibility with current and future user agents, including assistive technologies.

As already said, WCAG 2.0 Guidelines are structured in success criteria with different level of compliance (A, AA, AAA). Moreover, WCAG 2.0 provides also a “Techniques” page in which are listed a series of tips and implementation examples for providing specific file-type in an accessible way. Current techniques provided cover:

A. General Techniques;
B. HTML and XHTML Techniques;
C. CSS Techniques;
D. Client-side Scripting Techniques;
E. Server-side Scripting Techniques;
F. SMIL Techniques;
G. Plain Text Techniques;
H. ARIA Techniques;
I. Flash Techniques;
J. Silverlight Techniques;
K. PDF Techniques;
L. Common Failures.

2.2 Universal Design for Learning

Compliance to WCAG 2.0 cannot prove that an Higher Education Institution is fully accessible for all categories of students, mainly because WCAG 2.0 are strictly focused on Web content technology. They can provide a guidance and a check-tool for course contents, but the overall learning experience is not just a matter of “accessing to contents”, as it involves interaction and activities, assessment methodologies, examination.

A more complete set of guidelines are provided by Universal Design for Learning – UDL Guidelines. UDL has been elaborated by CAST in Teaching Every Student in the Digital Age by Rose & Meyer (ASCD, 2002), The Universally Designed Classroom (Rose, Meyer, & Hitchcock, Eds.; Harvard Education Press, 2005), and A Practical Reader in Universal Design for Learning (Rose & Meyer; Harvard Education Press, 2006). UDL framework is a a set of principles for curriculum development, addressing four interrelated components:

- **Goals:** focus is not on specific sets of skills or competences, but on developing “expert learners”;
- **Methods:** instructional approaches, techniques, decisions that teachers us to foster learning in students; in UDL framework, focus is on facilitating differentiations of method based on learner variability;
- **Materials:** media used to present learning contents and used by learners to demonstrate their knowledge. Focus is on differentiation and variability of materials both for conveying theoretical contents and for strategic learning and for learning engagement.
- **Assessment:** UDL assessments reduce or remove barriers to accurate measurements of learner knowledge, skills and engagement, improving accuracy and timeliness of assessments.

Three primary principles, which are based on neuroscience research, guide UDL and provide the underlying framework for the Guidelines[5]:

1. Provide multiple means of representation;
2. Provide multiple means of action and expression;
3. Provide multiple means of engagement.

The three principles address the "what", the "how" and the "why" of learning, affecting three different brain networks: the Engagement; the Representation; the Action and Expression.

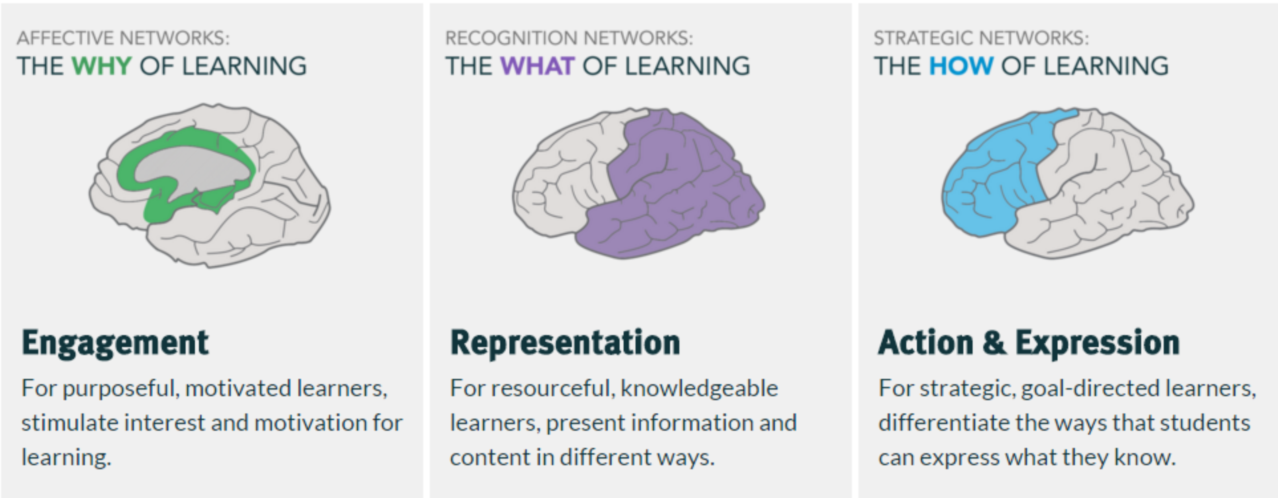

Figure 1 – Three brain networks according to UDL.
Source: http://www.cast.org/our-work/about-udl.html#.VqQqufnhCM8

UDL Guidelines – version 2.0 – are available for download in English and several other languages (Arabic, Catalan, Chinese, French, Greek, Italian, Japanese, Korean, Portuguese, Spanish) at http://www.udlcenter.org/aboutudl/udlguidelines/downloads.

Each Guideline is structured in Checkpoints, providing further specifications and Implementation Examples for each of the Checkpoints. The following is the list of Principles, Guidelines and Checkpoints of UDL Guidelines[6]:

Principle I. Provide Multiple Means of Representation

Guideline 1: Provide Options for Perception

Offer ways of customizing the display of information
Offer alternatives for auditory information
Offer alternatives for visual information

Guideline 2: Provide Options for Language, Mathematical Expressions, and Symbols

Clarify vocabulary and symbols
Clarify syntax and structure

[5] http://www.udlcenter.org/aboutudl/whatisudl/3principles
[6] http://www.udlcenter.org/aboutudl/udlguidelines/downloads

Support decoding of text, mathematical notation, and symbols
Promote understanding across languages
Illustrate through multiple media

Guideline 3: Provide Options for Comprehension

Activate or supply background knowledge
Highlight patterns, critical features, big ideas, and relationships
Guide information processing, visualization, and manipulation
Maximize transfer and generalization

Principle II. Provide Multiple Means of Action and Expression

Guideline 4: Provide Options for Physical Action

Vary the methods for response and navigation
Optimize access to tools and assistive technologies

Guideline 5: Provide Options for Expression and Communication

Use multiple media for communication
Use multiple tools for construction and composition
Build fluencies with graduated levels of support for practice and performance

Guideline 6: Provide Options for Executive Functions

Guide appropriate goal-setting
Support planning and strategy development
Facilitate managing information and resources
Enhance capacity for monitoring progress

Principle III. Provide Multiple Means of Engagement

Guideline 7: Provide Options for Recruiting Interest

Optimize individual choice and autonomy
Optimize relevance, value, and authenticity
Minimize threats and distractions

Guideline 8: Provide Options for Sustaining Effort and Persistence

Heighten salience of goals and objectives
Vary demands and resources to optimize challenge
Foster collaboration and community
Increase mastery-oriented feedback

Guideline 9: Provide Options for Self-Regulation

Promote expectations and beliefs that optimize motivation
Facilitate personal coping skills and strategies
Develop self-assessment and reflection

3. A self-assesment tool for Higher Education Institutions accessibility

While UDL Guidelines embraces a wider perspective in analysing the accessibility of a learning program, they still miss a focus on the institutional commitment to the accessibility and to the continuous improvement process put in practice by the institution.

ISOLearn was a strategic partnership project, coordinated by Universidade Aberta de Portugal with partners from Portugal, Sweden, Italy and Slovenia, aiming at supporting the accessibility to the HEI innovative learning offer, specifically addressed to hearing-impaired and visually-impaired individuals. Beyond developing a Needs and Gaps Analysis European report, and an handful Handbook on accessibility in Higher Education Institution, one of the key activities within the project was to develop and pilot an "accessibility checklist" as a self-assessment tool for Higher Education Institutions.

The methodology used involved:

- Literature review, analysing other accessibility evaluation tools;
- Meetings and focus groups with relevant stakeholders, both visually and hearing impaired students, associations, and Higher Education Institutions;
- Local workshops and seminars presenting the checklist at an early stage for acquiring feedbacks in several rounds (as in Delphi method).

The objective was to develop something like an Accessibility Maturity Model aimed at trigger discussions within the different actors dealing with students at different levels (enrolment phase, course design, course delivery, evaluation, QA), and to provide an effective decision tool for institutions manager and leaders in general.

In its final version, the checklist lists 5 groups of indicators:

- Indicators about the Policy/Strategy of the Institution regarding Inclusion (weight in total: 20%)
- Indicators regarding Course Conception (weight: 20%)
- Indicators regarding the Delivery of the Course (weight: 25%)
- Indicators for Learners' Evaluation/Assessment (20%)
- Indicators for the Evaluation of the Course (15%)

The weight of each indicator is reflected on the "final overall score" of an institution.

Each group lists several (from 15 to 25) indicators, split in two categories: "Strategic Planning", with a weight of 40% on the indicator, and "Daily Management and Operations", with a weight of 60% on the indicator score.

For each of the item, who is filling in the checklist has to determine a level of compliance, ranging from "not executed" to "planned, systematically executed and evaluated" on a 5-step scale:

- Not executed
- Not planned but occasionally executed
- Partially planned and executed

- Planned and systematically executed
- Planned, systematically executed and evaluated

Indicators about the Policy/Strategy of the Institution regarding Inclusion (weight in total: 20%)

Strategic Planning (40%)	Not executed	Not planned but occasionally executed	Partially planned and executed	Planned and systematically executed	Planned, systematically executed and evaluated
1.1. At the level of the strategy or policy guiding documents of the HEI, is it clearly stated the need to support the inclusion of these students?					
1.2. Does the total budget of the HEI dedicate a percentage to promote the inclusion of these students, by guaranteeing the access to the necessary resources to achieve it (e.g. special equipment; psychological support; training, etc.)?					
1.3. Is the participation of representatives of these students promoted, at the decision making level?					
1.4. Does the HEI promote partnerships with associations/organisations representing these students disabilities aiming at:					
a. Ensuring quality staff training?					
b. Acquiring knowledge of technological advances?					
c. Assessing the quality of the support services provided?					
1.5. Is the teaching staff advised on how to create an inclusive environment?					
1.6. Are positive attitudes among colleagues and the teaching and non-teaching staff promoted?					
1.7. Is the student union involved in the inclusion of these students?					
1.8. Are KPIs that clearly monitor and control the different levels of services and teaching offered to these students promoted?					
Daily Management of Operations (60%)					
1.a) Is there an office dedicated to the support of students with special educational needs?					
1.b) Is there trained staff to provide all the support that these students might needed?					
1.c) The academic community is regularly trained on the needs of these students in order to develop higher educational good practices?					
1.d) The teaching staff is advised on the needs of these students and on the adjustments to teaching strategies and materials?					
1.e) Is there a professional who provides individualized educational support?					
1.f) Are the different levels of services and teaching offered to these students regularly monitored, through KPIs dedicated to this issue?					

Figure 2 – Indicators about the Policy/Strategy of the Institution regarding Inclusion in the ISOLearn accessibility checklist

These 5 “levels of compliance” for each indicator are then converted in a numerical score, from 0 to 8 in step-2. Some of those groups of indicators where further sub-divided in categories focusing on the two types of perception impairments (visually and hearing impaired students were the target group of the project) in order to have a more in-depth view of the institutions’ level of accessibility for the main target group.

3.1 Piloting the tool

During the project, UNINETTUNO and Universidade Aberta coordinated the piloting activities of the checklist, involving several HEIs from Italy, Sweden and Portugal. All of them reported the usefulness of the tool in term of something able to trigger discussion and confrontation within their institution, putting together people from different departments that had a completely different view on the same topic (for example, an enrolment officer and a course manager with a totally different perception about institutional policies on accessibility).

Project consortium provided a feedback to all the participating institutions, both in testual form and in form of elaborated Spider Graph, representing the 5 main dimensions (as to say, the 5 indicator groups) the checklist was focused on:

1. Policy/Strategy of the institution about inclusion;
2. Course Conception;
3. Course Delivery;
4. Learners’ Evaluation/Assessment;
5. Evaluation of the course.

In the example provided below (about my institution, as we do not have the rigth to publish information about other institutions participating in the pilot), we can see the “Accessibility Graph” with a numerical and graphical representation of the score obtained by Uninettuno on the 5 analyzed dimensions about accessibility:

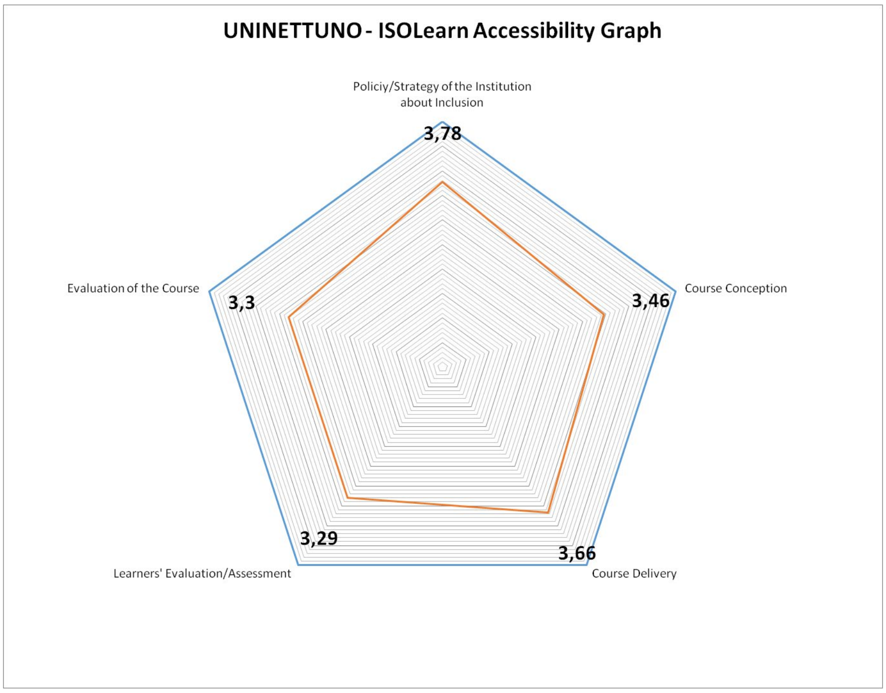

Figure 3 – ISOLearn Accessibility Graph about UNINETTUNO

Furthermore, the results of the analysis were provided also with a specific detail of accessibility addressing the two target groups: visually and hearing impaired students.

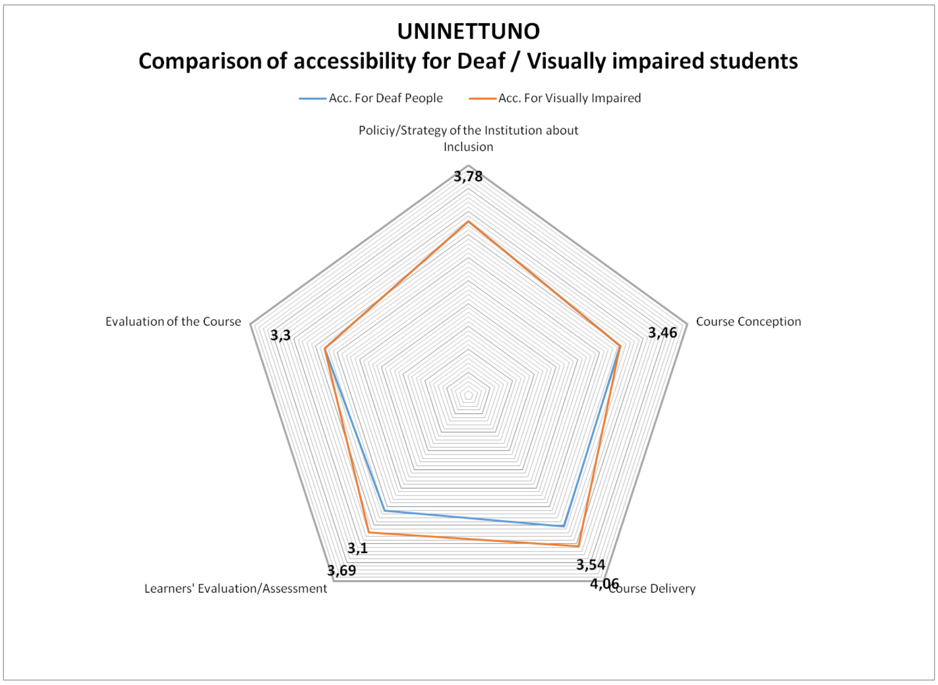

Figure 4 – ISOLearn Accessibility Graph about UNINETTUNO for Deaf and Visually impaired students

It is clear that, while the first graph provides an overall score of the institutional accessibility, the second one provides a clearer view on the effectiveness of institutional policies and processes for specific target groups. In this example, UNINETTUNO appears to be at a good level of accessibility for visually impaired students, while approaches and practices for deaf students should be revised especially for Course Delivery and Learners assessment dimensions.

4. Conclusions

As stated above, usually, in the context of online universities, accessibility is managed in the sense of Web Content Accessibility; this is a good first step for promoting an accessibility vision in a Higher Education Institution, but the learners' experience goes beyond access to digital learning contents.

Universal Design for Learning proposes a wider approach on inclusion and access to learning programs, but it still misses some dimension more related to management and institutional leaders.

The approach proposed with ISOLearn pilots was designed with the idea of overcoming course design and content accessibility, aiming at promoting an accessibility culture in all the node-departments of an institution. For this purpose, as nowadays we are talking about "Learning experience design", probably we will have to move from a "course accessibility" culture to a "Learning experience usability" vision, taking into consideration the "classic" dimensions of usability:

1. effectiveness, as the capacity of an artefact to reach the scope it is designed for;
2. efficiency, in terms of resources needed to the user (learner) for reaching his/her scope using the artefact;
3. and finally the satisfaction, the overall comfort perceived by the user/learner while interacting with the artefact.

These should be put in relation with the needs of the different target groups (as different learning needs require different design and delivery solutions) and be managed as a relevant process in Higher Education Institutions, if the goal will be to really involve everyone in Higher Education and Continuous Learning.

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Can self-paced, online learning provide teachers with the competences needed to successfully implement learning technologies?

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Abstract

University managements, governments and industry are advocating the implementation of learning technologies in HE as the answer to cost cuttings, student employability, internationalisation etc. Often the overall goal seems to be to simply implement learning technologies to digitise teaching and learning. However, teachers need new competences if learning technologies are to be successfully implemented in higher education and if the potentials are to be realised. But HE teachers must fulfil many roles and have little time to attend courses or workshops to upgrade their competences. Self-paced, online courses may be the answer to this challenge; however, attendance and completion rates in such courses are often low, so it's important to consider how to engage learners in active participation.

Studies stress that teachers must be guided in the application of new learning technologies and in the development of their own teaching practice for staff development to be successful. A further challenge is therefore, how to design self-paced, online learning that can achieve this.

In May 2017, the SDU Centre for Teaching and Learning launched the self-paced, online course, "Setting up your course in Blackboard", aimed at teachers at the university. The course aims to support teachers in acquiring the knowledge, skills and competences needed to set up user-friendly course sites on the university's e-learning platform, communicate effectively with students online and design engaging online activities for students.

This paper will explain the theoretical foundation of the learning design and report on the effect together with the participating teachers' evaluation and experiences.

Keywords: self-paced, online learning, staff development, competences, learning technologies

1. Introduction

Professional development within the field of educational technology is needed to bridge the gap between the enthusiasm at management, government and industry level and the actual use of educational technology in higher education (HE). Often the potentials are not realised; existing materials and activities are merely delivered and supported by new technology (Englund, Olofsson, & Price, 2016; Price & Kirkwood, 2013; Selwyn, 2007, 2016). The professional development of teachers is a prerequisite for the successful implementation;

however, teachers in HE have many roles and time for professional development is often scarce (Christensen, Kjær, Lüders, Apollo, & Hansen, 2016). It is difficult to set aside a full day or more for development activities. Online, self-paced courses are a possible solution providing the flexibility needed to fit development activities into a busy schedule. However, attendance and completion rates are often low, so the question is how to motivate and engage learners (Schlusmans, van den Munckhof, & Nielissen, 2016). A further challenge is how to move beyond mere dissemination of knowledge in self-paced, online learning (Williams, 2002). Studies emphasise the importance of teachers being guided in the application of new teaching methods and learning technologies and in the development of their own practice as part of successful professional development (Postareff, Lindblom-Ylänne, & Nevgi, 2007; Rienties, Brouwer, & Lygo-Baker, 2013; Teräs, 2016).

In May 2017, the Centre for Teaching and Learning (CTL) at the University of Southern Denmark (SDU) launched a self-paced, online course titled "Setting up your course in Blackboard" aimed at teachers at the university. The purpose of the course is to support teachers in acquiring the knowledge, skills and competences to set up user-friendly course sites on the e-learning platform Blackboard, communicate effectively with students online and design engaging online activities for students. The course builds on the following principles in the attempt to support teachers' in achieving not only the knowledge goals but also the skills and competence goals: adult learning (Illeris, 2003), work-based learning (Boud, Solomon, & Symes, 2001; Evans, Guile, & Harris, 2010), e-tivities (Salmon, 2011, 2013; Wright, 2014), training practical skills (Dohn, 2013; Dohn & Kjaer, 2009), and badges (Ahn, Pellicone, & Butler, 2014; Grant, 2014; Hurst, 2015).

In May 2018, 93 individuals, representing all five faculties and the central administration, were enrolled in the course, and 23 of these had completed it successfully. Both qualitative and quantitative data have been collected to evaluate the effectiveness of the learning design.

This paper presents the components of the learning design of "Setting up your course in Blackboard" and the theoretical underpinnings of these components. Following this, the data collection methods are described, and the findings are presented and discussed. Finally, conclusions are drawn as to the strengths and weaknesses of the individual components of the learning design and recommendations regarding how to design successful self-paced, online faculty development are presented.

2. Why a self-paced, online course?

One of the main tasks of the CTL at SDU is to support faculty development via formal courses within the field of university pedagogics and online learning. According to our unit's annual report from 2017, 56 courses were held that year with an average enrolment of 9 participants and a dispersion between 3-20 participants. Based on informal feedback from our teachers and standard course evaluations, the following challenges can be identified; the fixed times and dates do not always suit our teachers who are busy teaching and researching; traveling from one of our five campuses to the main campus in Odense to attend a course is time consuming; and the timing of the course might be wrong considering the date when the teacher needs the new competences for his or her own teaching. These results correspond to similar findings by Rizzuto (2017) and have forced the CTL to conduct several courses with a low number of participants, which in the long run demands too many resources, but is difficult to avoid when teachers ask for specific courses to be able to develop and conduct their teaching in a satisfactory manner.

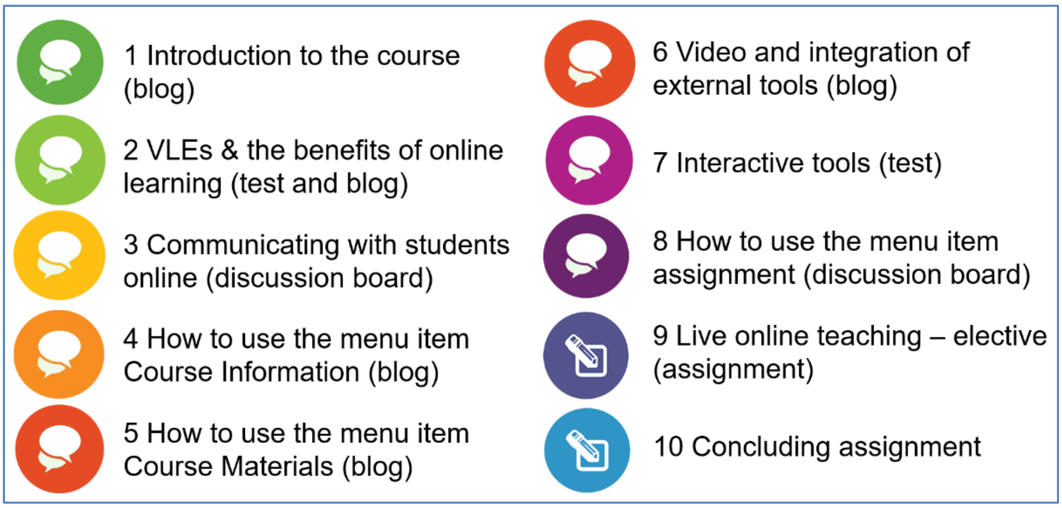
From this perspective, the idea of developing a self-paced, online course in Blackboard emerged. However, research shows that "… making courses entirely self-paced after enrolment leads to lower retention and completion rates" (Daniel, 2016). Further, Daniels argues that older learners who have jobs and families "need a mechanism that motivates them to give some priority to their studies. This usually takes the form of assignment deadlines and a fixed date for the end of the course while giving them flexibility to schedule their work within this framework. Another approach is to break the course into several shorter courses so the student can complete each one more quickly and, if desired, take a break before tackling the next one” (Daniel, 2016). From a more practical perspective, Bates (2015) highlights the difficulties with the use of online discussions and collaboration when learners are at different points in the course. Nevertheless, Bates also stresses that self-paced courses can make a lot of sense and be an important offer among other types of courses.

On the basis of the above-mentioned aspects, it was decided to design a self-paced, online course with the purpose of allowing teachers to enrol in and do the course anytime and anywhere, thus also attracting more participants; and preferably demanding fewer resources from the CTL, but still supporting teachers in obtaining not only knowledge, but also skills and competences.

3. The learning design

The course was set up in SDU’s learning management system Blackboard and exemplarily designed so learners could get first-hand experience with the learning design while working with the different assignments. The course consists of 10 short modules, see figure 1 below, each taking approximately 1 to 2 hours to complete. Since the course is about learning fundamentals in Blackboard, a strong teaching structure was found necessary. The completion of all the activities in one module will automatically release the next module and so on. Some modules will require learners to produce information, materials or activities intended for their own students. In this way, learners will be able to use the information, materials or activities they have produced directly in their own teaching.

Figure 1: The 10 course modules.



Despite the above-mentioned challenges concerning collaboration in self-paced courses, interaction and feedback activities are built into the course via blog and discussion forum exercises, but in ways that allow learners to be at different points in the course. The value of this will be explored in the analysis section.

3.1 A framework for active and participative online learning

An essential key to designing meaningful and motivating online learning activities is to “design for interaction, participation and feedback” (Salmon, 2011, p. 24). It is essential to let the learners interact with the course content as well as with the teacher and fellow learners and receive feedback on their contributions to motivate them to engage in online learning (Williams, 2002; Salmon, 2011, 2013). A high level of interaction and collaborative learning can be a challenge in a self-paced course when the learning design also has to support flexibility and individual learning paths (Bates, 2015).

The design of the learning activities in "Setting up your course in Blackboard" is inspired by Gilly Salmon's e-tivity concept and 5-stage model, which are founded in social constructivism and the assumption that learners construct knowledge with and through others (Salmon, 2013). E-tivities are "frameworks for enabling active and participative online learning by individuals and groups" (Salmon, 2013, p. 5). The e-tivities scaffold learners' learning online via structured learning paths with clear instruction, interaction in the shape of feedback activities, and frequent deadlines. The 5-stage model consists of five stages: 1 Access and motivation, 2 Online socialisation, 3 Information exchange, 4 Knowledge construction, and 5 Development. The model emphasises the need for a gradual progression in interactivity, where the focus in the initial stages is on scaffolding co-operative learning activities to secure individual access to the online learning environment and to make learners comfortable with contributing to learning-oriented information exchanges. Stages 1-3 create a foundation for moving on to more demanding, collaborative learning activities with a higher level of interactivity and joint knowledge construction (Salmon, 2011).

The learning design of "Setting up your course in Blackboard" attempts to find a balance between the learners benefiting from working together with fellow learners and their needs for flexibility and working with learning activities at their own pace and time, therefore deadlines were not included in the e-tivities.

There is an e-tivity for each module that invites learners to engage actively via clear instructions on the purpose and required interactions: interaction between learner and course materials, interaction between the e-moderators and the learners, and interaction between learners. There is an estimated workload for each task to help learners plan and find time for each e-tivity which is important in online learning (Christensen, Kjær, Lüders, Apollo, & Hansen, 2016; Salmon, 2013). In the introductory e-tivity of the course, the learners study the course description and the introductory video to become familiar with the course content, activities and assessments as well as the course site in Blackboard. In order to create a sense of community and give the learners the possibility to benefit from the experiences of fellow learners, they also have to share and match expectations towards the course via a blog and study and comment on the blog posts of fellow learners. These tasks cover stages 1 and 2 of the 5-stage model by welcoming the learners and helping them get ready to learn and socialise online and get confident using Blackboard as a virtual learning environment.

The other e-tivities in the course include more demanding tasks covering stages 3 and 4 in Salmon's 5-stage model, where the learners gain new knowledge, analyse their exiting practices and plan new learning activities, which they share and get feedback on from the e-moderator and fellow learners. Module 10, the final module of the course, covers stage 5 in that it asks teachers to reflect on their own learning during the course and describe what they would like to learn more about. Furthermore, Module 10 requires learners to plan and record a video welcoming their students to the course site they have built up themselves as a result of their engagement with the individual course modules, thus bringing it all together.

Each Monday, the e-moderator from the CTL sends out an announcement reminding learners that they are doing the course and encouraging them to move on and complete another module.

3.2 Badges

The use of digital badges in "Setting up your course in Blackboard" builds on the latest research that suggests that badges can engage and motivate learners to participate actively in both formal and informal learning settings (Ahn, Pellicone & Butler, 2014; Abramovich, 2016; Hurst, 2015; Grant, 2014).

The digital badges, which are online, visual representations of achieved learning outcomes, have strong ties to analogue badges issued by scout organisations to acknowledge practical skill building, and the use of scores, levels, and points as incentives in a game context. Gamification defines scenarios, where game components are employed as motivators for behaviour in non-game contexts. The use of badges as a method of gamification is just one way that the digital badges have entered HE. Digital badges also serve as a pedagogic tool to guide or scaffold learners through a process by helping them visualise the learning path and emphasising what knowledge and skills are valued. In addition, badges are used for credentialing and for signalling the acquistion of finer-grained skills since well-designed badges can show what skills each learner has acquired in a more nuanced way than a diploma (Ahn, Pellicone & Butler, 2014).

In “Setting up your course in Blackboard”, the digital badges are used to motivate and engage the teachers to keep up their continuous learning and complete the course. The badges act as a pass mark, and they are connected to the main course activities to signpost the main learning path of the course and point out the potential achievements. There is a badge for each module to help the learners keep track of each module they complete. Once a module is completed, the learners will receive a badge, and the next module will be released. When the learners have earned a badge, they also get access to a more detailed certificate that explains what the badge is issued for and which learning objectives have been achieved. When the final module is completed, one of the e-moderators will give feedback and release the module badge together with the Course Completion badge and a course diploma. Badge assignments with personal feedback and feed forward from e-moderators can provide a clear learning pathway and create a room for reflection. This approach has been shown to have great potential as an effective gamification element and a pedagogical tool in a blended learning context, especially if the digital badges are not used exclusively as a reward for completing a task (Christensen, Kjær, Lüders, Apollo, & Hansen, 2016).

4. Theoretical underpinnings

Above, we described how our learning design enables self-paced, active and interactive learning online and how we guide learners through the course modules and attempt to motivate them to complete the course by using badges. Below we present the theoretical underpinnings of the actual learning activities and explain how we try to make these meaningful for our particular target group; teachers. Furthermore, we explain how we support learners in not only reaching knowledge goals, but also skills and competence goals in our online course.

4.1 Adult learning and work-based learning

One of the challenges with respects to supporting and facilitating teachers’ continued professional development, i.e. adult learning, is how to make the development activities meaningful and motivate teachers to participate actively. According to the Danish educational and learning researcher Knud Illeris,

> “the generally most decisive factor for significant learning in adults is the requirement for motivation rooted in direct interest, something they feel like doing and are committed to, or a realized necessity, something they have understood and accepted to be beneficial to learn in relation to something they want to achieve.”
> (Illeris, 2000 quoted from Illeris, 2004, p. 162)

Thus, generic development activities do not hold much appeal for teachers. The key is to design learning activities that are open and provide teachers with the opportunity to use what they have learnt during a course or workshop as a point of departure for developing their own practice. The learning activities of “Setting up your course in Blackboard" were designed with inspiration from Illeris' (2004) instructional principles of participant direction and problem orientation to enhance learners' motivation and sense of meaningfulness.

Embedded in the instructional principle of participant direction is the idea "… that the participants themselves have the possibility for and are maintained as directing their learning to the highest possible degree within the given framework" (Illeris, 2004, p. 173). In "Setting up your course in Blackboard", learning activities are designed to support learners in gaining knowledge on the principles and best practice regarding the use of Blackboard, in analysing their existing use of the e-learning platform, in exploring new, potentially useful tools and ways of communicating and learning online and in reflecting on their future use of the platform. Thus, the learning activities are intertwined with learners' specific teaching practices and their individual intentions to develop new knowledge, skills and competences relating to their use of the e-learning platform.

The course tasks are based on the idea that teachers formulate specific strategies for their future use of Blackboard and develop specific designs for course sites in Blackboard that they will use for their upcoming courses. The teacher must thus develop his/her own practice to successfully complete the professional development activities. The fact that teachers must use their own courses as a point of departure, identify areas for improvement and reflect on future use makes the development activities more problem oriented which is exactly the intention as the instructional principle of problem orientation states that

> "[it] is first and foremost when one works with finding out where the important problems lie, when one tries to formulate problems with precision and to develop patterns of understanding and proposals for solutions that the full learning challenge is established."
> (Illeris, 2004, p. 177)

For the learners, problem orientation lies in the challenges that appear when they attempt to develop new strategies and specific designs for their future use of the e-learning platform.

In addition, the use of the instructional principles participant direction and problem orientation provides teachers with optimal conditions for the integration of work and learning, a design component that also has the potential to enhance teachers' motivation for engaging in professional development. The idea of integrating work and learning derives from the research field work-based learning (Boud, Solomon & Symes, 2001). The key point is that the learning activities should be based on the actual needs of the learner and the workplace instead of "being controlled or framed by the disciplinary or professional curriculum: work is the curriculum" (Boud, Solomon & Symes, 2001, p. 5).

Although the learners are provided with an introduction to the principles and guidelines governing the use of Blackboard at SDU as well as an introduction to the e-learning tools and functions of the platform, it is still the individual teacher's challenges and specific teaching context which are the point of departure for the learning activities as mentioned above. The introductions are resources for the teachers and showcase possible solutions that they can implement in their own practice. When engaging in the learning activities of "Setting up your course in Blackboard", the teachers complete tasks which they would need to do anyway to get ready for their upcoming courses. In addition, learners receive feedback when completing a task and they can use this feedback to inform their future use of the e-learning platform and tools. Another important purpose of this close integration between work and learning is to reduce the teachers' workload. Teachers doing the course do not have to spend time on theoretical course work or fictitious cases, but will be engaging in learning activities that are actual and authentic work tasks at the same time. In module 3, e.g., learners learn about online communication with students and are asked to write a welcome announcement for own of their own classes and submit this to complete the module.

4.2 Training practical skills

Teachers in HE often lack both the knowledge and the skills to implement e-learning platforms and tools in their teaching which creates insecurity and a lack of confidence (Christensen, Kjær & Nielsen, 2016). Professional development initiatives that aim to give teachers the knowledge, skills and competences to successfully use e-learning platforms and tools for the design and delivery of online learning activities must address this challenge. The learning activities of "Setting up your course in Blackboard" are based on the concept of 'knowledge in practice' (Dohn og Kjær, 2009; Dohn, 2013) in an attempt to do this. Knowledge in practice contains "three interdependent, but analytically distinguishable, aspects: linguistically expressible knowledge ('know that'), practical knowledge ('know how'/skill), and personal experience ('know' of)" (Dohn og Kjær, 2009, p. 147).

Knowledge in practice rejects the idea of knowledge as something you possess and can transfer from one context to another (Dohn, 2013). Context and action become key elements; knowledge in practice can only be obtained through application. Traditional development activities such as presentations, lectures and dialogue therefore lack an important component, namely the possibility for learners to train new skills. The integration of practical skills training "will give the learners the possibility to acquire a readiness to act in future situations in which the same e-learning platform and/or tool is used" (Christensen, Kjær & Nielsen, 2016, p. 124).

In "Setting up your course in Blackboard", the participating teachers will be cast in the role of online learners in Blackboard and get valuable experiences from this perspective. With the purpose of supporting the teachers in obtaining the necessary competences to implement the e-learning platform and tools successfully in their own courses, "Setting up your course in Blackboard" includes the elements listed below that are to give learners the possibility to obtain knowledge in practice from a teacher perspective and enable the creation of re-situation experiences that can support them in applying the acquired knowledge to their own practice (Dohn, 2013).

- Knowledge on the benefits and rise of online learning, virtual learning environments, the e-learning platform Blackboard and recommended e-learning tools and functions, the principles and guidelines for using Blackboard at SDU. Online resources, such as texts, short video lectures and guides are available on these topics (know that).
- Practical knowledge by trying out and training relevant skills as a learner in the course site on Blackboard dedicated to "Setting up your course in Blackboard" and as a teacher using a sandbox course in Blackboard or a course site to be prepared for an upcoming course (know how).
- Personal experience via reflections/debriefings on the experiences connected to the trying out and training of relevant skills (know of).

The practical skills that are deemed necessary in this context are, among others,

- Setting up user-friendly course sites that are easy to navigate.
- Distributing information and uploading course materials in appropriate ways.
- Communicating with students online in an appropriate way using relevant and efficient tools.
- Designing active online, learning activities.
- Producing video resources for students.

See Module 5, Module 6 and Module 8 for examples.

The learning design of “Setting up your course in Blackboard” attempts to enable cognitive apprenticeship; a method which tries to “enculturate students into authentic practices through activity and social interaction in a way similar to that evident – and evidently successful – in craft apprenticeship” (Brown, Collins & Duguid, 1989, p. 37). The course aims to embed learning in meaningful activity to enhance the motivation and engagement of learners and to support them in integrating the e-learning platform and relevant tools into their own teaching practice. “Learning methods that are embedded in authentic situations are not merely useful; they are essential” (Brown, Collins & Duguid, 1989, p. 37).

4.3 Contextualisation and exemplarity

Contextualisation is a valuable design component with respects to supporting learners’ authentic learning and application of new knowledge and skills to their own practice (Gregory & Salmon, 2013). Contextualisation involves ensuring “that the terminology, structure, technologies, and examples [in development initiatives are appropriate in the specific context and provide] staff with a relevant framework for application to their own teaching and learning practice” (Gregory & Salmon, 2013, p. 268). This is achieved in “Setting up your course in Blackboard” by using Blackboard as a platform for all course activities, by being exemplary with respects to online communication with learners, upload of course materials and with respects to the presentation and facilitation of and feedback on online learning activities. An overall aim of the course, as it is presented in Blackboard, is to showcase recommended tools and the appropriate usage of these as well as to provide ideas with regard to user-friendly and visually appealing designs for courses in Blackboard.

Contextualisation and the training of practical skills or ‘developing technical capacity’ (Gregory & Salmon, 2013) are important design principles that can help teachers overcome insecurities and build confidence with respects to the application of an e-learning platform and its tools. It gives “staff the chance to see how the LMS work[s] from a student perspective, and to explore and experiment with the system in a safe and supportive environment” (Gregory & Salmon, 2013, p. 268).

In the evaluation section below, we will look at the degree to which we succeeded in making the learning activities meaningful and in motivating the teachers to participate actively by using e-tivities and badges and by moulding the learning design on the principles of adult and work-based learning, training practical skills, contextualisation and exemplarity. In addition, we will evaluate the effect of this self-paced online course.

5. Evaluation of the learning design and learner experiences

To determine the effectiveness of the learning design, data on the participating teachers' experiences were collected in a number of different ways. A questionnaire survey was conducted. Questionnaires were sent out to all teachers who had completed the course. At the point of data collection, 22 learners had completed the course and 19 of these completed the questionnaire which equals a response rate of 86 %. Furthermore, we conducted in-depth, semi-structured interviews with 5 of the teachers who had completed the course to obtain more nuanced responses. In addition, questionnaires were sent out to enrolled teachers who had not started the course or had not engaged with the course for a month. The questionnaire was sent out to 47 teachers of which 15 responded and 1 gave some answers. Finally, data have been compiled from the virtual learning environment on e.g. time consumption.

The main question that we set out to answer in our survey was: Can self-paced, online learning provide teachers with the competences needed to successfully implement learning technologies? And subsequently, we wanted to investigate how you engage learners in active participation in self-paced online courses, and how you design self-paced, online learning that guide teachers in the application of new learning technologies and in the development of their own teaching practice. Below we present our findings.

5.1 Learners' experiences regarding the self-paced, online format of the course

In our survey, learners reported that they did indeed benefit from the self-paced, online format of the course. Some emphasised the convenience of being able to do course activities at their own pace thus having the possibility to fit it in around other obligations in a busy schedule and taking the time needed to complete the different course activities. This gave a sense of freedom. Also, learners enjoyed the accessibility connected to the online format, which meant that they could complete the course without having to travel to the main campus. More than 50 % of the respondents in our questionnaire survey said that they would like more self-paced, online courses to be offered, see figure 2 below. On the down-side, some learners reported that the course was more time consuming and challenging than expected. Some technical skills were required to successfully engage with some course activities. Some also reported to lack peer feedback and F2F interaction. As for the time consumption, the course was estimated to ½ ECTS, i.e. a work load of 13.5 hours. As is apparent in table 1 below, the average number of hours spent on the course was 12.3 hours. However, some learners spent more than 32 hours doing the course and others spent below 5 hours. Furthermore, some learners completed the course in one week, others took months and a single teacher took a full year to complete all 9 compulsory modules.

Figure 2. Would you like to see more of our courses offered as online, self-paced courses?

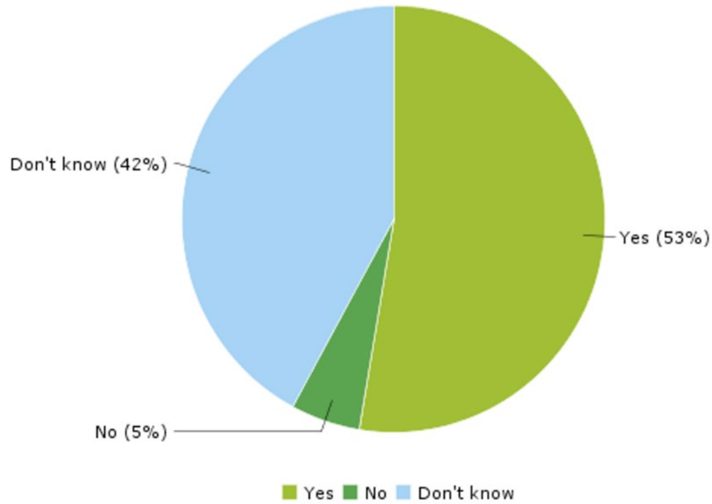


Table 1. Number of hours spent on the course

Time spent in the course site in Blackboard	
Minimum	4.44 hours
Maximum	32.28 hours
Average	12.3 hours
Estimated workload	13.5 hours

5.2 A framework for active and participative online learning

The interviews with the teachers clearly showed how they experienced the e-tivities. One teacher found that "the course material and instructions were very clear, concise, and easy to follow, as well as being a 'meta' example of the course content". In the questionnaire survey, a teacher said that "the e-tivities made it very easy to follow the course, especially when (as often happened) I had to stop the module, do something else, and come back to it later". These quotes give evidence that the e-tivities have provided the flexibility needed for the teachers to catch up on course activities and fit them into a busy schedule.

Even though the teachers appreciated that they could follow the learning paths individually, they also valued the interaction with fellow learners. In the survey, 68% of the teachers responded that seeing and commenting on the posts of other learners had supported their learning to a certain or great extent. A teacher liked the idea of having "the opportunity to see the other people's posts", but also "saw commenting on their posts quite unnecessary and time-consuming so, quite superfluous". The teachers were inspired by their colleagues, and they mostly liked to share knowledge although they were at different points in the course. However, the last quote also indicates that it is important to make interactions with fellow learners meaningful. 79% of the teachers responded that other learners' comments had supported their learning to a lesser extent or not at all. A teacher also stated in the interview that "only a few comments were really helpful", but the same person also found "the comments requirement" interesting and a great way to make sure to get inspiration from others.

The use of the 5-stage model to build in progression across the course modules appears to have succeeded as well, as is evident in the excerpt below from a learner's concluding assignment;

> "I tried to incorporate in this final assignment most of what I learnt about the use of the BB along the course (see screencast). Generally, I found the course very interesting, useful and gave me the chance to reflect on how to incorporate on-line teaching in my usual practices as well as how to do that in practice. In the next semester I will have (likely) a course on my own in which I will apply the knowledge I got in this course. In particular, I would like to implement the e-tivity object of module 8 as preparation for the final/assessment. Thank you and hope to have feedback from you soon."

5.3 Use of digital badges

Most teachers that we interviewed felt that the use of digital badges in the learning design motivated and engaged them to keep up their continuous learning and complete the course. One teacher stated that "the badges system is pretty good to keep up continuous learning" and another teacher felt that "it was quite motivating, made you feel that you were achieving something as you went through, that was nice". A teacher liked the idea of the badges acting as a reward and a pass mark: "Nice that you got a little reward, a badge at the end of the section. Nice to see where you were going". This quote also indicates that the digital badges in the learning design acted as signposts and helped the teachers visualise the learning path and keep track of each module they completed. One teacher emphasized the feeling of advancing from one stage to another: "feeling ok I have completed something. I have rewards, makes me feel confident. I passed, this is what I learnt. I therefore go to the next step".

The approach with ongoing badge assignments with personal feedback and feed forward from e-moderators has shown great potential in self-paced, online courses. As one teacher we interviewed stated;

> "I was receiving very quickly a badge after completing every module. This in particular brought a certain level of confidence. I have done something and somebody has seen what I am doing. When it is an online course, I'm not sure what I have been submitting will be checked, if I do something wrong will somebody correct me? The badge, somebody is really paying attention to what I am doing, the badge is an indication that I probably passed the module and I can move on".

This quote indicates that it is highly valued when digital badges as a gamification element and as a pedagogic tool are combined with personal feedback from the e-moderator.

5.4 Adult learning – motivation for a self-paced course

The use of the instructional principles of participant direction and problem orientation to enhance learners' motivation and sense of meaningfulness, seems to have had a positive effect on some of the interviewed learners. One learner stated that she enrolled in the couse because she "had to get prepared for my first course I had to teach at SDU. It would be me who had to set up the course on the Bb site and I would like to find out how to do that before doing it for real" and "I could choose how to do these modules. Showing up for the class would have been more difficult" (From interview).

The quote indicates that the learner had a strong motivation for taking the course because she needed to set up a course in Blackboard at the start of the semester. In addition, the learner liked the openness in the modules which allowed her to work with the modules in meaningful ways. The motivation for taking a self-paced course was also highlighted by two other learners that we have interviewed who emphasised the self-paced nature of the course. The first learner indicated that the course, "… was really good. Could fit it around other things, if I had a little time spare, whenever, I had time for it". The other learner emphasised the possibility of matching the course to your lifestyle; "I like to be kind of free, making choices so that sounded good to me. Less pressure if you have the option to self-pace you can do it faster or slower according to your lifestyle work nights or early morning".

5.5 Work-based learning - Did you work on an actual course when doing the module activities?

Regarding work-based learning as a design principle, the idea was that the learning activities could be applied directly to the learners' own course on Blackboard to prevent an additional workload. Regarding this, one informant said;

> "Yeah, I did. Yeah, I did it all for one course. Used everything I did for an actual course. The video I made at the end, I put that on my Bb course, the welcome announcement I wrote for one of the assignments, I used that pretty much as it was" (From interview).

Learners clearly found it meaningful to complete work tasks when engaging with the learning activities in the course. In his final assignment, a learner writes;

> "Regarding the use of BB, I'd like to start by pointing out that I found this course very valuable because it got me introduced to the main BB functions and let me apply them directly within the context of a course I have to design anyhow while also getting useful feedback from the moderators (so great, thanks!)".

5.6 Training practical skills, contextualisation and exemplarity

In the learning design, our focus was to support learners in obtaining not only knowledge, but also skills and competences. Learners' responses on our questionnaire survey lead us to believe that we have succeeded. Learners reported to be more confident when using Blackboard.

> "When I have a course of my own, I will be in charge of the design, I intend to incorporate what I learnt in this course to make my teaching more interactive than it was. Mainly, I would like to use more e-tivities and audio-visual stuff. And now, thanks to this course I know how to do it!" (From survey).

In addition, the course has also caused learners to reflect on their own teaching and present use of the e-learning platform and has helped them formulate ideas and specific plans for the future;

> “The course went well beyond my expectations. Not only I learnt about how to use the BB but also I have the opportunity to self-reflect about my actual teaching practices and explore new possibilities. For instance, how to incorporate external audio-visual elements in my courses or how to make my teaching increasingly participative and interactive (using the BB tools).”

The latter part of the quote above is especially interesting, since the exemplarity of the learning design becomes a starting point for learning in itself by showcasing the possibility of designing for participative and interactive learning using Blackboard.

Learners seemed to be intrigued by the possibility for learning in a self-paced, online course – “It gave me more competences than I had expected”, wrote one learner. Another reported that “I gained knowledge about Blackboard and skills in designing online learning activities”. The sandbox was seen as essential for the training of practical skills;

> “The provision of a sandbox course was vital because I could use it to practice with, not only for the activities specified by the course but also other things that might work for my own course later. It worked best of all with the activities where we had to make content that could be useful for our own courses, like setting up discussion forums or making the screencasts” (From survey).

One of the teachers we interviewed summed up her learning outcome by saying “I think I learnt in a more general sense how to use Bb in an integrated way not just as a repository but in interactive engaging ways”.

6. Discussion and conclusions

The main question that we set out to answer in our survey was: Can self-paced, online learning provide teachers with the competences needed to successfully implement learning technologies?

The findings from our survey, interviews and data collection from Blackboard clearly shows that yes, teachers can obtain the competences needed to successfully implement learning technologies via self-paced, online learning. In fact, it seems that self-paced, online learning can lead by example and is an efficient way of showcasing ways of implementing learning technology to enhance students’ learning. However, there are a number of design considerations you have to make in order for self-paced, online learning to be successful. Firstly, it is important to consider how you engage learners in active participation in self-paced online courses. The e-tivity concept has proven useful with respects to scaffolding learners’ active and to some extent interactive learning online. The e-tivities provide clear instructions and learners can complete the module assignments unaided. Only a couple of learners have contacted the e-moderators for clarification. Furthermore, the use of the 5-stage model helps learners get started on the course and gradually develop their knowledge, skills and competences, bringing their accumulated learning together in the concluding assignment.

Our ideal is online collaboration in which learners interact online and co-construct knowledge. However, it has proven difficult to achieve true collaboration in this self-paced, online course since learners move through the course at very different paces. In practice, almost 2/3 of learners benefit from studying the assignments posted by previous learners and use these for inspiration or for confirmation regarding the actual demands of the task. Few learners go back and review any comments they might have received. Our conclusion is that it is important that learners can see each other’s’ assignments, but it does not make sense to make comments mandatory.

Badges are also effective with respects to encouraging learners to complete the course in that they visualise the learning path and help learners keep track of their progress. However, a badge must be accompanied by e-moderator feedback and feed forward to be truly effective in self-paced, online learning.

The design principles of adult and work-based learning appear to work as intended. Learners experience freedom and flexibility that allow them to work with the course activities when it fits into their busy calendar. Furthermore, they find it meaningful that the course activities are combined with actual tasks they need to do when preparing their own courses. The openness of the course activities also appeals to learners because they are able to work with the issues that they find interesting and useful in their specific context.

Secondly, you must consider how to design self-paced, online learning that guide teachers in the application of new learning technologies and in the development of their own teaching practice. In our learning design, we investigated the effect of a hands-on approach to enable learners' practical skills training. Furthermore, we put much effort into creating an exemplary course to showcase the possibilities. The findings clearly show that these design components did indeed guide teachers in the application of new learning technologies and helped them become confident users of Blackboard. In addition, teachers were inspired and gained the courage to go from using Blackboard much as a repository to integrating more participative and interactive approaches. Our conclusion is that it is possible to obtain not only knowledge goals, but also skills and competence goals via self-paced, online learning.

One downside is that timing is of the utmost importance. If a teacher embarks on the course without having a course of his/her own to plan and use as a case, the learning activities will not seem meaningful but only contrived. We have observed that some teachers in this situation perceive the course as a resource and are prepared to obtain new knowledge, but do not engage fully with respects to training practical skills. This is exactly the challenge when using the principle of work-based learning. According to our findings, for work-based learning to prove its worth, the timing must be perfect. Learners must have a course of their own that they can prepare as they move through our course in order to perceive it as meaningful and be motivated to complete it.

The completion rate is app. 25 % and some learners take a long time completing the course. We are interested in learners completing the entire learning journey within a couple of weeks to secure the best learning outcome. Therefore, we contemplate introducing an overall deadline and ask learners to finish the course within half a year.

It is very time consuming to design and moderate self-paced, online learning and a lot of e-moderator hours go into providing learners with feedback and feed forward. The tendency is that many learners are active at the same time, typically just before a new semester starts. Therefore, time must be allocated to this task.

So, is it worthwhile spending time designing and moderating a self-paced, online course? The answer is a resounding "yes". Teachers' learning outcomes are enhanced compared to the F2F version of the course because the online course works by contextualisation and exemplarity and allows learners to spend the time needed on the individual modules. Not only do the course activities help learners train practical skills but they are also inspired and ready to develop their own teaching as a result of doing the course. In addition, we save time in that we do not have to conduct courses with only a few learners, and we have facilitated wider participation in terms of enrolment numbers and faculties and departments covered. We are convinced that self-paced, online learning is a good solution in our particular context where the goal is to train practical skills and get inspiration with respects to developing one's teaching, and we are in the process of transforming other courses to self-paced, online learning using the learning design described in this paper.

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Challenges and opportunities for RPL in Open and Distance Learning: Lessons learnt from the Open University UK

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Abstract
Since the development of the UK National Credit Framework for Higher Education (HE) in 2008, recognition of prior learning (RPL) has become a more established mechanism for promoting student mobility within UK HE**.** Not only can it promote lifelong learning and widen participation, it also has the potential to create a more inclusive system for academic study, bringing together different avenues into and through HE. The perceived difference between HE delivered in traditional university settings and that delivered within alternative providers, further education colleges and professional organisations could be eradicated as RPL creates a more holistic education system that meets the needs of a wider audience.

A growth in the development of informal learning opportunities and short learning programmes (SLPs) does however call for the implementation of RPL on a National and International level to be reviewed, focusing attention on the potential to recognise a broader range of learning opportunities. The benefits of such an approach would be a more inclusive HE system that is responsive to the needs of students, employers and the wider communities.

This paper will provide a critical review of the key challenges and opportunities for RPL within Open and Distance Education and will draw on the experience of the Open University (OUUK) as the leader of credit transfer in the UK. The paper will draw on themes of inclusiveness, lifelong learning, quality assurance and recognition and will discuss how changes in the regulation of Higher Education in England will further promote and facilitate student mobility through credit transfer.

Keywords: recognition of prior learning (rpl), short learning programmes (slps), higher education (he)

1. Introduction

RPL is a well-known concept in the UK, but the lack of national and institutional monitoring makes it difficult to identify the scale at which RPL is utilised, and the different RPL activities that take place (Atlay and Turnbull, 2017). According to Atlay and Turbull (2017), 42% of institutions responding to the UK Credit Forum survey (2017) had no awareness of the level of RPL activity within their own institution, raising concerns about the degree to which RPL activity is reported at institutional level. The devolved nature of HE in the UK and lack of a unified system for the implementation, monitoring and reporting of RPL also means that higher education institution's (HEIs) cannot be held accountable for their contribution to student mobility.

RPL is not a new concept and has been practiced in the UK for several decades (Harris, Wihak and Kleef, 2014). Despite this however, the term RPL is interpreted in different ways resulting in inconsistent definitions of the term across the UK (Atlay and Turnbull, 2017). In light of this, RPL is here defined in accordance with the quality assurance agency for HE in the UK (QAA). According to the QAA in their glossary of terms (2018, p.31) RPL is a process for "assessing previous learning that has occurred in any of a range of contexts including school, college and university, and/or through life and work experiences". Prior learning can then be used to "gain credit or exemption for qualifications and/or personal and career development" (QAA, 2018, P.31). RPL can therefore be viewed as an umbrella term encompassing different mechanisms for recognising an individual's prior learning, including the recognition of prior certificated learning (RPCL) and the recognition of prior experiential learning (RPEL). RPCL reflects two streams of certificated learning. Firstly, if prior learning has been assessed, certificated and awarded academic credit at a HEI, it can be accepted, quantified and included within a programme of study at a different HEI through a process of credit transfer (Pollard et al, 2017). Alternatively, if prior learning has taken place at HE level but does not bear academic credit i.e. professional development or employment-based awards, it can be recognised through a process of credit assessment that will evaluate the credit value of the qualification. RPEL on the other hand is a mechanism for recognising and awarding academic credit for informal learning, that has taken place at work, during voluntary activity and throughout key life experiences. RPL therefore providies an avenue for individuals to engage with HE study "who might otherwise be excluded by a lack of formal qualifications" (Garnett and Caveye, 2015, p. 29) and has consequently "been recognised as playing an important role in addressing issues relating to lifelong learning, employment and social inclusion" (CEDEFOP, 2010 cited by Garnett and and Cavaye, 2015, p. 29). As a result it could widen access to HE, but this cannot be achieved if inconsistencies remain with how RPL is used and interpreted.

The use of RPL has many benefits, not only to students but also to HEIs and employers and provides a mechanism for individuals to enter HE without following the formal entry routes. For students it gives them an opportunity to return to education after a break and enables them to top up sub qualifications to a full honours degree. In addition to this it reduces the length and cost of study, increases their choice and flexibility and can accelerate their progression to employment. With RPEL more specifically the process of reflection makes learning more meaningful and context specific, which could serve to enhance an individuals motivation to engage. For the institution, the provision of greater RPL opportunities will not only make them more responsive to the student market, and increase retention and completion rates, it will also facilitate the development of partnerships between different institutions, employers and the wider communities. This in return bridges the gap between vocational and formal HE qualifications and acknowledges that higher level learning also takes place in contexts other than traditional universities and HEIs (Marr and Bravenboer, 2017). RPL can also be favourable to employers particularly in light of the development of new Degree Apprenticeships in the UK where the recognition of prior certificated or experiential learning can reduce the completion time. As a direct consequence, employers will have a more qualified workforce in a shorter space of time.

It is clear that the benefits of RPL are potentially significiant but institutions within the UK are far from offering a consistent process for its implementation. The increased presence of open and distance learning opportunities also strengthens the need to develop consistency in the operationalisation of RPL to ensure learning opportunities are available to all.

2. Opportunities for RPL in Open and Distance Learning

Open and distance learning was once viewed as a separate mode of educational study which was relevant only to groups of students who were unable to access HE through mainstream routes (Gaskell, 2007). With more provision now available, this mode of delivery can be viewed as a mechanism for delivering a more flexible and personalised educational experience that helps "individuals to take responsibility for their own learning" (Lewis, 1995, p. 52). The autonomy it provides students with regards to "time, place and pace makes it readily adaptable to the consumer" (European Commission, 1991 cited by Lewis, 1995, p. 52) and easy for students to "to dip in and out of higher education as their circumstances permit" (Lewis, 1995, p. 52) thus providing a suitable platform to promote RPL. Not only does this promote lifelong learning but it can also make open and distance learning opportunities more inclusive.

2.1. **Inclusivity**

Open and distance learning is perhaps the most inclusive form of HE in that it does not constrain students to the pattern of study that takes place in traditional face to face settings, providing a flexible avenue for students to continue learning. This might be particularly beneficial for learners in work, those that have caring responsibilities or disabled individuals where face to face delivery could be less accessible for them. It therefore enables students to continue to study in a unique and personalised manner and at a time that is right for them. This is particularly crucial for students whose circumstances may have prevented them from completing an earlier course or even from entering HE in the first place.

RPL has the potential to increase inclusivity but this can only be achieved if institutions extend their 'open' ethos to the range of prior learning that can be recognised. This would require institutions to be open to the recognition that higher level study takes place in a variety of settings, including further education colleges, alternative providers, and employment and community settings and to have processes in place that enables equitable recognition. The development of the national credit framework for HE in 2008 provided a "consistent way to recognise, measure, value and compare achievement" (Qualifications and Curriculum Authority, 2004, p. 4). By providing "clarity about the ..... level of diverse HE and professional development qualifications" (QAA, 2008, p. 8) all certificated courses that sit at the appropriate level on the Framework or equivalent should be regarded as equitable. Unless this happens, even the most 'open' of universities can be seen to be 'exclusive' despite the provision of unique distance learning opportunities. The development of more formal articulation agreements with further education colleges, alternative providers and professional bodies as well as traditional HEIs both nationally and internationally would enable open and distance learning providers to be inclusive to a wider range of prior learning achievements.

2.2. **Lifelong learning**

The very essence of open and distance education promotes lifelong learning. It recognises that knowledge is acquired across the life span, and embraces the need to provode learning oppportunities to individuals who did not have them within the early stages of life (Field, 2006 cited by Miguel, Ornelas and Maroco, 2016). As Butcher and Rose-Adams (2015) argue if open learning is to emphasise this 'social justice mission' and continue to promote freedom of education for all, the need for greater openness and flexibility is more important than ever. RPL is by definition an important foundation for lifelong learning (Giddens, 1991 cited by Harris, Wihak, & Kleef, 2014) and can help institutions achieve this mission. RPL can provide demand-led learning opportunities (Harris, 2014) that can arise at any point within a person's lifespan and can enable individuals to achieve with the investment of less time and cost. To achieve this mission however open and distance learning providers need to develop diverse ways to use RPL to facilitate self-directed lifelong learning (Harris et al, 2014) and ensure that they offer RPL to its fullest extent. RPCL and RPEL must therefore be viewed on equal playing fields removing the perception that formal learning is worth more than informal learning by some stakeholders (McCready, 2017). This does not however come without challenges. The mechanism for recognising certificated learning positioned on the Framework for Higher Education Qualifcations (FHEQ) or equivalent framework is well established, with instutions in the UK recognising qualfiications across Europe and internationally. However the mechanism for recognising informal or experiential learning on an open and distance learning platform is far from straightforward. The process developed needs to be achievable for the ‘mass’ given the scale of distance education without placing unrealistic demands on staff to assess this learning. It is however an essential endeavour to further promote lifelong learning.

3. Challenges to RPL in open and distance learning

Through RPL, individuals can engage with study at different points in their life at a pace that aligns with their personal needs and goals (Pollard et al, 2017). For open and distance learning providers, RPL enables them to widen participation and promote lifelong learning but there are some challenges with regards to quality assurance and recognition.

3.1. **Quality assurance**

The devolved nature of HE in the UK, means that HEIs are responsible for ensuring the quality and standards of their own provision. Despite providing institutional autonomy, deemed as a strength of the UK HE system, this does present challenges when it comes to RPL. To fully embed this concept within open and distance education, mutual trust must exist between different institutions with regards to the quality assurance processes in place and assessment decisions being made. The presence of the QAA and UK Quality Code, a tool used to ensure HEIs are meeting the expected outcomes, only goes so far in instilling this trust. To make further steps, the sector must tackle the perception of institutional perfectionism which presents itself as a barrier to the implementation of RPL and more specifically credit transfer (Pollard et al, 2017). According to Pollard et al (2017) in their review of credit transfer in HE, some institutions were reluctant to grant direct entry on admission. This seems obscure considering that all HE qualifications are positioned on the same or equivalent framework. Such reluctance is puzzling and can only stem from an inbuilt mistrust of other HEIs or a lack of confidence to view qualifications awarded at another HEI as having parity with their own. This mistrust is perhaps heightened when comparing qualifications delivered at a distance with the more traditional face-to-face mode which is surprising given that both modes are expected to meet the same outcomes set out by the UK Quality Code.

This perceived mistrust further escalates when considering vocational qualifications such as Higher National Diplomas (HNDs) in the UK, which do not always receive parity when it comes to RPL. Thus the “historical divide between vocational and academic education” (Pollard et al, 2016, p. 16) continues to be emphasised.

As the Observatory on Borderless Education (2007) (cited by Gaskell, 2007) point out, operating across borders can also present challenges in terms of quality assurance. UK NARIC, “the designated United Kingdom national agency for the recognition and comparison of international qualifications and skills” (UK NARIC, 2018), goes some way to develop institutional trust in quality assurance processes by providing advice and guidance on international qualifications. The Standards and Guidelines for Quality Assurance in The European Higher Education Area (ESG) also support this by ensuring a shared understanding of quality assurance exists across borders (ESG, 2015). The presence of the European Quality Assurance Register (ENQA) and its role in “promoting European co-operation in the field of quality assurance in HE” (ENQA, 2013), also makes steps to ensure greater student mobility. These can however only go so far to promote this until variations in the method and precision in which RPL processes are completed across institutions (Atlay and Turnbull, 2017), become far less common.

Ultimately, open and distance learning providers need to ensure they take a student-centred approach when it comes to RPL. Although organisations do exist to instil trust in the quality of HE provision, they can only go so far to enhance RPL opportunities with the absence of consistent quality assurance processes at an institutional level. McCready (2017) highlights the way that these inconsistencies between and within institutions make it challenging for stakeholders to engage with RPL. Greater parity of decisions and quality assurance processes, is therefore essential across faculties, to ensure students have an equal opportunity to enter a more flexible learning environment, and prior learning is given the amount of credit it deserves regardless of the field of study.

3.2 **Recognition**

According to Duvekot (2014, p. 65) "RPL provides a process-oriented approach for recognising and valuing what people have learned in their lives", which could facilitate personalised lifelong learning and enable learners to play an active role in their education. Despite becoming more integrated within educational policies and practices (Feutrie, 2014 cited by Miguel et al 2016), 'recognition' of prior learning in its very essence poses challenges within open and distance learning which can ultimately make an 'open' learning environment appear more closed. RPL will be at the heart of such institutions to widen access to HE but it is not clear whether all students are given equal recognition for their prior learning. Indeed it might be argued that the amount of recognition that is awarded is dependent not only on the level and credit value of the prior qualification, but also **where** it was completed **and** if it is 'perceived' to be at HE level. According to Blackman (2017) about 130,000 students use RPL as a path into HE each year through qualifications such as HNCs/HNDs and Foundation Degrees. The presence of RPEL has also "pushed the boundary of what higher education actually is" (Blackman, 2017, p. 7). Participation in HE has therefore moved from being for the elite to the mass (Blackman, 2017) with RPL being one factor that has contributed to the change. Despite this however, Blackman (2017) suggests that the amount of credit HEIs award for prior learning is often viewed as 'stingy' by further education providers, with Universities pointing out the dangers of RPL students not being prepared for degree study. This is surprising, given that a Higher National Certificate (HNC) is positioned at the same level as the first year of a degree (level 4) on the FHEQ and a HND or Foundation Degree is equivalent to the completion of the first two years (Level 5) on the FHEQ. Within open and distance learning one must therefore argue that such courses have parity with degree level study and the only difference is the mode in which it is delivered and the body that accredits it. With this in mind institutions should therefore not award less credit for 'equivalent' level study but instead explore how they can support these learners in their transition from face-to-face to online and distance learning. Students should not be penalised because of misplaced fear that giving full recognition might lead to reduced retention and completion rates and therefore institutions should instead facilitate a better support mechanism for such learners.

The challenge to recognition also stems from the autonomous nature of HE in the UK which allows instututions to design courses with very little regard for RPL thus making awarding credit for prior learning difficult, particularly when a close match in learning outcomes and content is required. The credit size of modules can also make this difficult with some institutions delivering modules as small as 10 credits and others as big as 60 credits making it difficult to assess the equivalence of two qualifications for the purpose of RPL. The development and recognition of Short Learning Programmes (SLPs) that are more responsive to learner and employer needs are therefore essential alongside traditional degree level qualifications. In January 2018, EADTU with 14 partner universities started the European Short Learning Programmes (ESLP) project for lifelong learning and continuous professional development (EADTU, 2018) which might lead the way in encouraging HEIs to develop courses in smaller chunks. This could then facilitate greater opportunity for students to learn on a need to know basis and engage as the needs arise (Yorke, 2004). In doing so it might facilitate greater attention being paid to the success of students per study module rather than on whole programmes (Yorkes, 2004) which might be more manageble for any learner but particularly those that choose to study at a distance.

4. RPL at the Open University UK: Lessons learnt

The Open University UK (OUUK) is a market leader in open and distance learning and one of the biggest Universities in the UK for Undergraduate study. Not only does it follow an open access admissions policy, it also leads the way with the recognition of prior certificated learning and specifically credit transfer. RPL supports the OU in achieving its mission to "be open to people, places, methods and ideas" and developing its "core values of inclusion and responsiveness" (OU, 2018).

Based on HESA data (2016), the OU has a 17% share of the market for students entering with FHEQ Level 4 qualifications and 8% share of the market for students entering with FHEQ Level 5 qualifications. To facilitate this the University has a long standing credit transfer centre which operationalises the Open Universities recognition of prior learning policy. In the academic year 2017-2018, 5,940 students received an award of credit transfer through recognition of their prior certificated learning, with incomplete degrees being the most prevalent prior study followed by HNCs/HNDs. The credit transfer centre therefore operates at scale requiring very streamlined processes for the administration and recognition of credit. One mechanism for its success in the recognition of prior certificated learning is the centralised area for processing such claims which for some institutions is far from the case. By having a centralised as opposed to localised process, the OU can monitor the consistency of RPL decisions.

A unique offering at the Open University is the provision of its Open Degree which allows students to design their qualification to meet their interests as well as their personal and professional needs (OU, 2018). It gives students flexibility to engage in a wide range of subjects and recognises up to 240 credits of prior study. When making an award of credit transfer the credit transfer team will automatically include the Open Degree as an option for the students, which in some cases gives a more generous allowance of credit.

Despite having a clear process for the RPCL, the RPEL is far less well developed at the OUUK which poses challenges when seeking to meet the RPL needs of degree level Apprenticeships. This is however something that requires serious consideration and planning to ensure the processes are innovative and can cater for large volumes. Traditional methods of assessing portfolios would therefore potentially be unrealistic for any large scale open and distance learning provider. Although not RPEL in its full sense, the Open University has however developed a mechanism to recognise learning completed through Open Educational Resources (OERs) through the development of a 30 credit, FHEQ Level 4 module, Making your Learning Count. This innovative offer allows students to use previous study on OERs or Massive Open Online Courses (MOOCs) towards the BA/BSc (Honours) Open degree. Students explore what they have learnt when studying OERs and at the same time develop the skills required to be a successful student (OU, 2018).

The implementation of RPL at the OU is however currently under review in order to recognise a broader range of learning opportunities and facilitate direct entry as an entry point to HE study. This will enable students to continue or build on studies completed elsewhere and is fundamental to the OUs mission.

5. Conclusion

RPL and more specifically credit transfer has been an area of debate for many years (Dent et al, 2017). Not only does it widen access to HE but it also facilitates student mobility and provides a mechanism for them to move between institutions if their circumstances require them to do so. Although processes exist to facilitate student transfer, the extent to which it is promoted within institutions is unknown.

The development of the Higher Education and Research Act 2017 and appointment of the Office for Students (OfS) as the new regulatory body for HE in England will however make institutions more accountable for their provision of credit transfer. One of the duties of the OfS will be to monitor the extent to which credit transfer opportunities are utilised by students and to promote awareness of such provisions (Dent, 2017). What impact this will have across borders is unknown but what is clear is that in response, HEIs in England will need to ensure they have appropriate mechanisms in places and do not 'discriminate' between institutions leading to a more equitable HE arena.

It is evident through discussion, that RPL has an important role to play in open and distance learning and facilitating a more inclusive environment for lifelong learning. However, one must not address its benefits without understanding the challenges that present through operation, of which are not posed by RPL but by the systems in which it sits. Quality assurance and recognition should therefore not prevent implementation of RPL processes but instead should be scrutinised to ensure RPL serves its function within HE.

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Challenges of ensuring the viability and sustainability of a South African institutional Short Courses Division within an ever-changing educational landscape

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Abstract

Positioned as an international tertiary education leader on the Africa continent, Stellenbosch University (SU) recognises that the offering of short learning programmes (SLP) provides the institution with an avenue for societal, vocational and educational engagement while generating an additional income stream for the institution.
There has been a shift from the traditional research, and applied learning focus of tertiary education providers to include the 'third mission' responsibility and South African (SA) institutions are becoming more involved in SLPs, exploitation of third-stream income, technology transfer and the stimulation of innovation and entrepreneurship.
Having made fundamental changes to principles, processes and structures of its SLP environment over the past eight years, SU has to now ensure the continued viability and sustainability of its Short Courses Division (SCD). To do this, SU has to ensure that the SLPs that it offers, meets the market demands of mobility and flexibility in learning by expanding technology platforms for delivery of these programmes, provides interactive learning opportunities and adds vocational and educational value to the professional development of its participants. All this while still aligned to the strategic objectives of the institution and to the established best practices in the SLP environment and while also exercising firm internal governance and control. The latter to maintain SU's high standard of academic quality assurance, to manage reputational risks and to address the challenges of providing dynamic and effective flexibility in learning in an emerging country.

Keywords: short learning programmes, sustainability, flexibility, technology platforms, societal engagement, market demands and trends.

1. Introduction

Stellenbosch University (SU) is amongst South Africa's(SA) leading tertiary institutions and is recognised internationally as an academic institution of excellence. In cementing itself as a world-class institution, SU is not only ranked 405th of the top universities in the world (Times Higher Education World University Rankings: 2018), but is also among the top 50 universities in the BRICS countries (BRICS referring to the countries of Brazil, Russia, India, China and South Africa) and is ranked 3rd in Africa (QS World University Rankings: 2018).
Universities do have academic and institutional differences, but most universities, locally and globally, are finding themselves in a similar situation of having to transform and reposition themselves to enable them to respond and address the challenges of providing technology-assisted learning opportunities and experiences to both students and staff. In SA, the higher education environment has in recent years been exposed to political instability, economic sustainability issues with institutional subsidies

diminishing, and then still increasing demands for technology-enhanced learning which all clearly have a major impact on already-constrained institutional budgets.

Over the past 11 years, SU has been responding to institutional needs and societal demands by establishing and refining its Short Courses Division thereby expanding its short learning programme (SLP) offerings which provide opportunities for and access to career-oriented learning and specialised personal skills development. The priority areas in which SU has pinpointed it could potentially explore new knowledge markets in online education, in combination with existing face-to-face and blended learning facilitation, included SLPs. SU's SCD has had to obviously explore how to expand the mode of delivery for its SLPs, to not only add vocational and educational value to the professional and skills development of its SLP candidates but to also foster institutional economic growth and ensure the viability and sustainability of its SLP environment.

2. Background

SU has formulated and adopted a new *Vision 2040 and Strategic Framework 2019–2024* document, launched mid-2018, and which builds on the previous institutional strategic documents. This new document guides and directs SU's future positioning by unpacking six core strategic themes namely "a transformative student experience, networked and collaborative teaching and learning, research for impact, purposeful partnerships and inclusive networks, employer of choice, and a thriving SU". This *Strategic Framework* document highlights the fact that SU has acknowledged the need to expand its current knowledge base to include more student markets and has recognised the agility, adaptability and responsiveness requirements needed within a shifting education paradigm.

At SU, SLPs are seen as a learning opportunity that do not form part of the official, approved and subsidised qualification and programme profile of the University. Although the presentation of short courses, as a teaching and learning activity, takes place in the name of the University, short courses presented by most higher education institutions in South Africa are not a whole qualification nor part qualification and will not lead to the achievement of a full qualification but may in certain cases be considered for Recognition of Prior Learning (RPL) access to or recognition of learning for an academic programme.

Market demands are now showing an expectation by students of having the flexibility to choose when and where they want or need to study while balancing their educational needs with other responsibilities they may have such as careers, family and possibly financial restrictions (Méndez-Vilas *Ed:* 2011). This trend has necessitated that academic institutions have to closely examine their SLP offering and determine how to facilitate online learning effectively and efficiently in a competitive educational landscape and at a time when South African universities are facing financial sustainability challenges.

Traditionally, SU is known as a residential campus with an active residential life, but since the residence demand generally exceeds supply, and in line with new learning needs, SU recognised the need to serve students not only through its full-time residential model, but also through a collaborative and interactive online teaching and learning model which will include the delivery mode of its SLPs.

In the past, SU's short learning programme activities have mostly been presented as contact (face-to-face) sessions on-campus or off-campus (for example, in another SA region or African country). SLP statistics for SU show that although the total number of registered SLPs (face-to-face and blended and/or online) had increased by 7,3% for the three year period from 2015-2017, blended and/or fully online SLPs were still only forming just a little under 10% of the total number of SU's SLP presentations for 2017. See Figure 1 below:

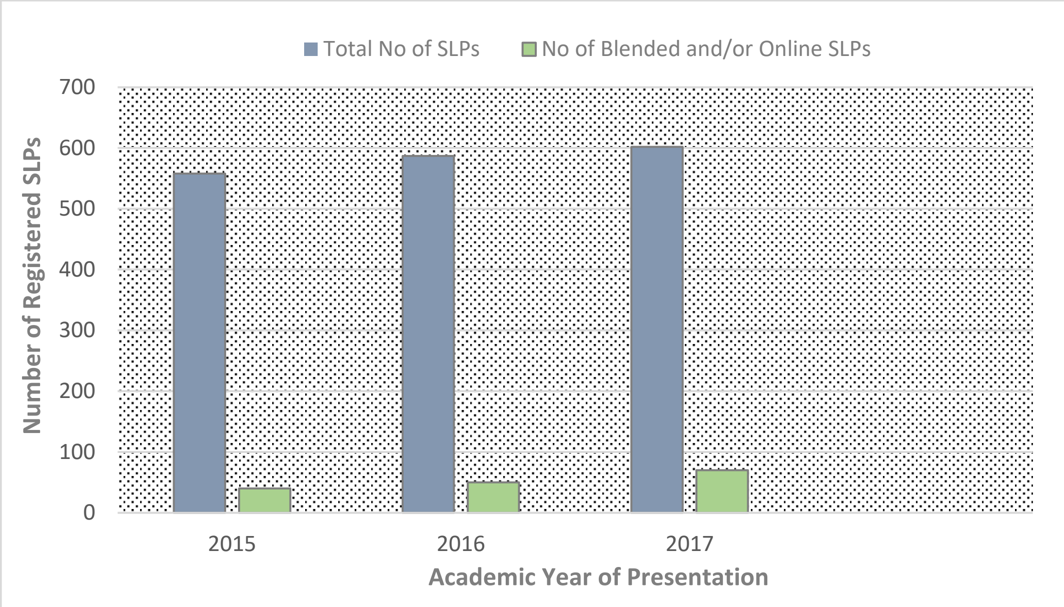

Figure 1: Gradual increase shown in total number of SLPs from 2015-2017, with an indication of the number of blended and/or fully online SLPs in relation to the total number of SLPs.

Based on these statistics, the SCD is working on the hypothesis that the percentage of SLPs for blended and/or online presentations is low potentially due to the high cost and challenges of using external hosting platforms, possible under-utilisation of the visual and interactive technology tools available on the institutional Moodle-based learning management system (LMS) or resistance from academic environments due to the extra time and effort required from the environment to plan, design, develop, present and provide support for online SLPs.
Accordingly, SU statistics also indicate that, for this same three year period from 2015-2017, the total number of students enrolled for SLPs (face-to-face and blended and/or online) had increased by 36,6 %, but the number of blended and/or online enrollments were still only forming just on 8% of the total number of SU's SLP enrollments for 2017. See Figure 2 below:

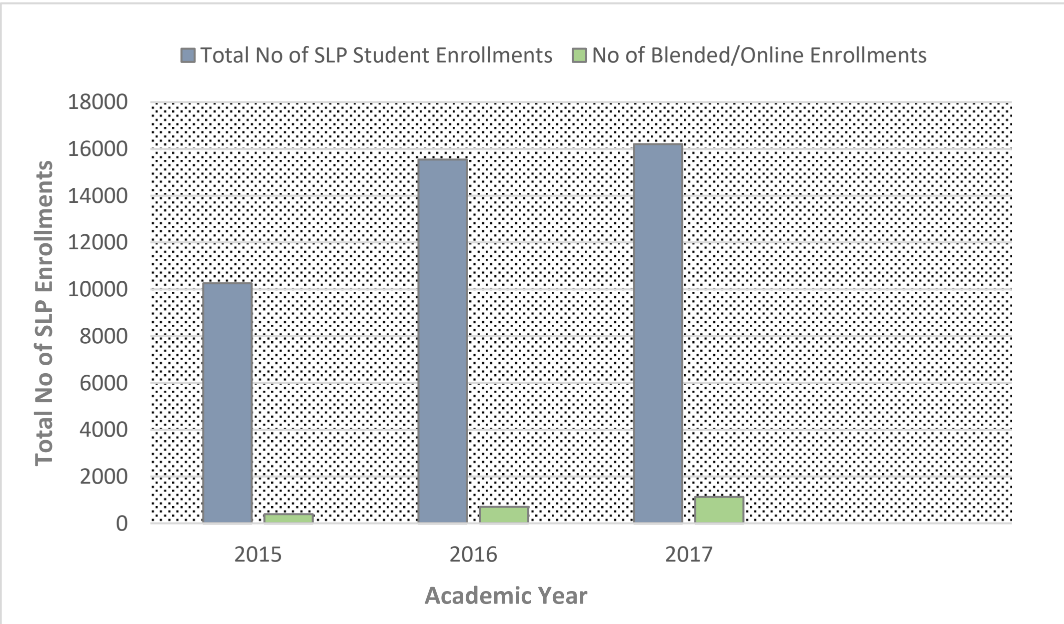

Figure 2: An increase reflected in total number of SLP enrollments from 2015-2017, with an indication of the number of blended and/or fully online SLP enrollments in relation to the total number of SLP enrollments.

From these statistics, the SCD is assuming that the percentage of enrollments for blended and/or online SLPs from 2015 -2017 is indicative that society's expectations of education delivery modes is shifting. However, the ratio of blended and/or fully online student enrollments to the total number of student enrollments for 2017 is low possibly due to the existing SLP student application and registration process inhibiting seamless self-registration and access.

To respond to the educational demand and to SU's new *Strategic Framework* themes, SU now needed to increase its offering of online SLPs through a collaborative and interactive online teaching and learning model which would comply with the applicable regulatory and university policies and academic quality assurance regulations. This would also increase SU's geographic SLP distribution beyond its current boundaries and expand new student markets.

3. Scope and Objectives

SU's *Vision 2040* focus is on enhancement of competencies and skills and a need to impart a knowledge base to students to equip them for their futures. From a professional perspective, UNESCO raised the point that "Digital Literacy improves one's employability because it is considered a 'gate' skill required by employers. It is a catalyst for individuals to acquire other valued outcomes."(Chetty et al:2017).

In SA, the ongoing challenge is to improve digital literacy and educational equity where literacy in the digital age not only means gaining experience using web-based tools and technologies but includes the ability to understand and apply the information made available electronically. As stated in the *NMC Horizon* Report: *2017 Higher Education Edition, "*Fluency in the digital realm is more than just understanding how to use technology. Training must go beyond gaining isolated technology skills toward generating a deep understanding of digital environments, enabling intuitive adaptation to new contexts and co-creation of content with others".

General assumptions of the potential benefits of providing a technology-based learning opportunity include:

- Creation of self-regulated learners – encourages self-discipline and responsibility;
- Self-paced studying – with flexible schedules and learning environment thereby enabling working individuals to further develop and enhance industry-specific skills in their own time;
- Facilitation of team and student interaction via online forums and chat rooms – collaboration with mixed peer groups to exchange knowledge and learning experiences;
- Improvement in students' technical skills – encourages development of new digital skills by navigating different LMSs;
- Fewer geographic barriers – students could access SLPs which may not be offered where they live or work; and
- Broader institutional exposure with potential to target new student markets.

SU's current educational online programmes include a few MOOCs (massive open online courses) which are facilitated via an external MOOC platform provider. Although the number of MOOC presentations are showing a general increase worldwide, it is estimated that in 2015 only roughly 8% of higher education institutions were offering MOOCs (Lapovsky: 2015). Initially, MOOCs were free online courses and did not generate income for an institution (but with high development and facilitation costs to the institution), they were usually not accredited by the institution and certificates of learning were not issued on successful completion of the MOOC. Some MOOC platforms are now including fees for students who require assessment and certification of successful completion of the course and also noteworthy is that it generally appears as if MOOC participants are mostly university or college-educated, having already obtained some form of qualification. Therefore it is debatable whether MOOCs are really expanding an institution's student market or rather "it appears that MOOCs are mostly educating the educated and are therefore increasing the divide between those who have access to education and those who do not" (Hollands: 2015). Institutions offering MOOCs have cited their main objectives as including heightening the institution's visibility, increasing student markets and wanting to provide flexible learning opportunities.

To address both the societal and business need in South Africa, SU's SCD together with the University's Centre for Learning Technologies (CLT) and Information Technology (IT) Department, initiated discussions regarding a SLP online project proposal within the institution during 2017 to address the strategic direction of optimising its SLP offering and expanding its student market.

SU already provides specific operational, administrative and support services with regards to its SLPs and takes full responsibility for the academic quality assurance of its SLPs and other functions delegated to it by SA's Council on Higher Education (CHE), but to make online-based accredited short learning programmes available, these services would need to be expanded, enhanced and enforced with stricter control measures put in place. The institution would also need to ensure that the online offering would be a positive online learning experience and would also not dilute the profile of the current contact and blended SLP offerings.

It became increasingly apparent that making SLPs available as online short courses was not simply a case of repackaging existing face-to-face or contact accredited short courses and then placing them online - accredited online short learning programmes not only need to be delivered in compliance with applicable regulatory and university policies and academic quality assurance regulations but also need to have a user-friendly, effective, visually-appealing and interactive course design with seamless connectivity and easy accessibility.

It was also obvious that in developing country like SA, connectivity and accessibility could be a complication with regards to seamless connectivity. World Wide Worx released an internet access study in SA in 2017 and estimated that our country's internet penetration will reach close to 40% with the potential of digital growth of 7% by 2018. Notable is that Statistics SA cited in their Statistical Release P0318 General Household Survey (released in May 2018) that internet access at home "remains relatively low, with only 9,5% of the population having a connection in their household" where the percentage household connectivity in the metropolitan and urban areas in SA is obviously higher than the 2% indicated as household connectivity in rural areas. Further analysis also reflected that internet cafes, educational facilities and workplaces were used by many South Africans for electronic access.

The strategy adopted included initial meetings with external online service providers so that SU could familiarise itself with the different approaches of these service providers and ascertain complex issues that potentially arise when considering such partnerships *viz* academic quality assurance, accreditation, certification, brand management and intellectual property aspects.

It was subsequently decided that institutionally the SCD, CLT and IT together had the potential to initiate and provide an in-house online platform and support service for SU environments to enhance its SLP offerings. By optimising the use of these existing short course and SUNLearn systems, it would be a cost-effective measure for the institution given the high development costs and hosting fees that external online service providers charge, and which also usually includes unfavourable profit-sharing. An added advantage would be that by using SU developers that were already familiar with the current SLP and SUNLearn systems, it would be easier to maintain continuity of the 'internal' IT knowledge which was an important consideration for maintenance and system sustainability purposes.

SCD, CLT and IT would pilot the project by providing the core in-house services themselves and then consideration would only be given to possibly partnering with external platform developers/providers for supplementary services should SU not be able to provide a fully user-friendly, interactive online platform for its SLPs. At the same time all three divisions realised that to create an institutional platform that would be sufficiently agile and adaptable to respond to the dynamic nature of online learning could potentially be a daunting task, and that the divisions would undoubtedly encounter obstacles and various technological limitations along the way.

Obviously, with this alternative mode of SLP delivery consideration would need to be given to specific challenges and associated risks. The typical challenges associated with this type of technology expansion and development and that would need to be addressed, included:

- Funding – for development costs and additional staff salaries required for an effective online support structure. “Efficient and effective use of technology in an online environment requires administrative support at all levels of the institution” (Meyer & Barefield: 2010);
- Capacity - including time investment by staff and Human Resources Division recognising the need for flexi-time staff appointments necessary to be able to implement an online support service;
- Developing and maintaining support infrastructure for online processes - including IT helpdesk, administrative, technological and academic support. If the support infrastructure is not suitably developed, equipped and trained, it places additional demands on other institutional environments;
- Technology limitations – would possibly need additional hardware, software and other technological applications;
- Connectivity – the speed and availability of the internet connections in remote areas of SA could be a limiting factor to access online content and submitting assignments;
- Academic quality assurance concerns;
- Ownership of intellectual property including copyright issues in third party content; and
- Institutional culture and perceptions would need to change to recognise the value of technology-assisted learning and teaching modes.

4. Development and Deliverables

Mid 2017, SCD, CLT and IT subsequently initiated the project proposal for online SLPs within the institution. To ensure seamless integration, streamlining of the students’ registration process and access to SU’s systems/SUNLearn platform, SU has had to revisit specific SLP and LMS processes and determine the scale of the changes that would be required where:

- SCD currently provides centralised electronic databases, which include short course registration, financial administration, student application and registration, invoicing, course and facilitator evaluation and certification;
- CLT provides a professional online learning design and support service to the SU environments; and
- SUNLearn is SU’s online learning management system (LMS).

These changes affected would need to fulfil and accommodate the requirements of all SU’s SLPs: face-to-face, blended and fully online. See Figure 3 below:

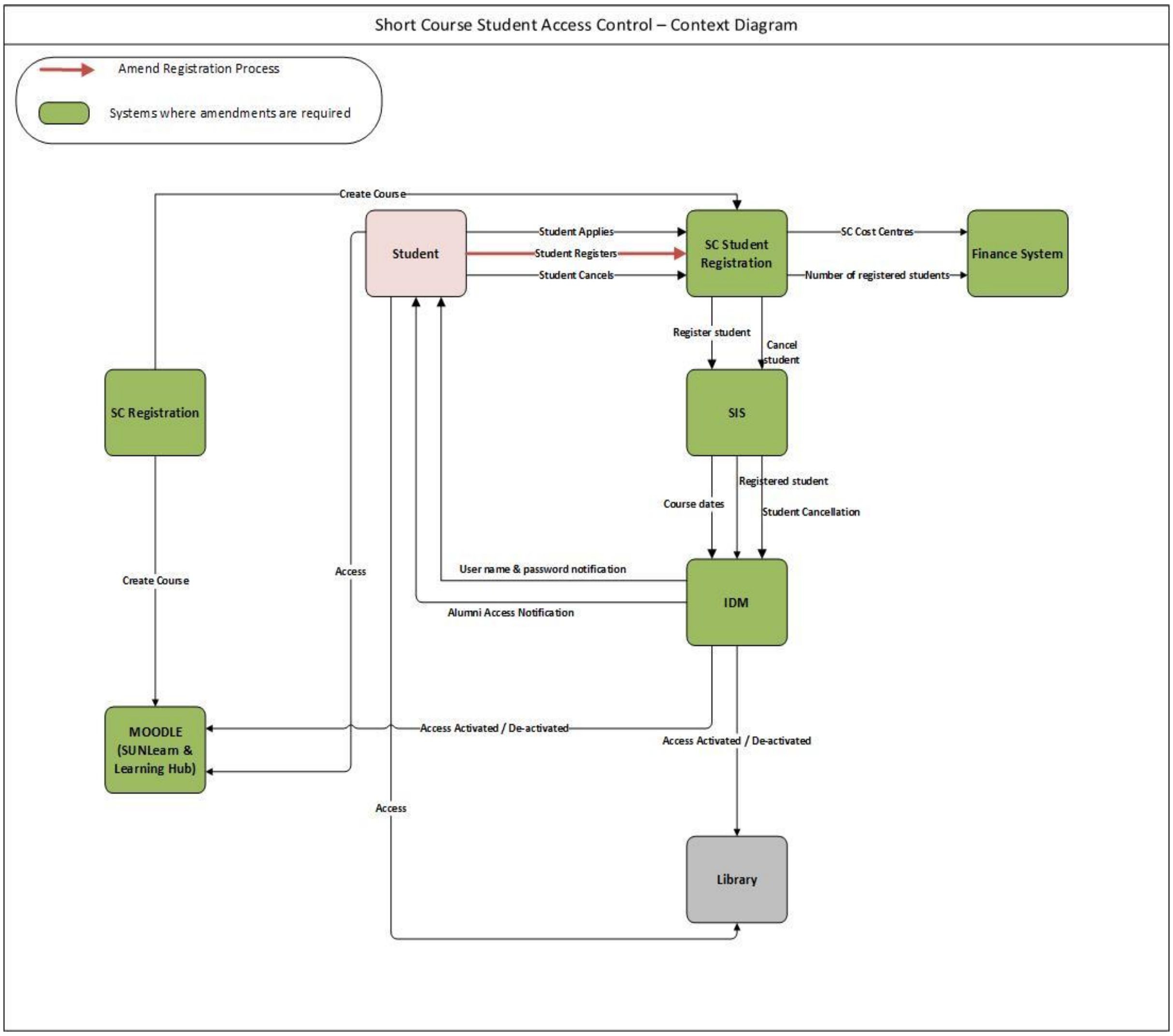

Figure 3: Schematic representation reflecting where system changes would be required to faciltate seamless integration between SCD, CLT, SUNLearn and other SU environments.

SU also has had to take a number of factors with into consideration, firstly establishing the business requirements and then determining the high-level proposed changes within the technology environment to achieve the deliverables of the project. After careful review, the main business requirements were established and which included:

- Meeting the requirements of SU's previous *Institutional Intent and Strategy 2013 - 2108* and more recently SU's *Vision 2040 and Strategic Framework 2019–2024;*
- Addressing the stated institutional strategic direction of facilitating the Mode 2 project where Mode 2 is the proposed institutional model for delivery of interactive online academic offerings*;*
- Providing an agile and responsive in-house online SLP platform as cost-effectively as possible to SU; and

- Addressing market demands and trends where online SLPs could potentially increase SU's 5th stream income as well provide additional income to CLT to ensure the sustainability of SU's internal online design and support service.

Following this, the proposed high-level changes were identified and the expected deliverables were established. It was necessary to determine which existing technological system components would have to be adapted to enable the realisation of the end result of this online SLP project, with the focus being on minimising the impact on the existing SU systems but maximising the desired results and benefits to SU.
Specific observations of the required changes and expected outcomes are set out in Table 1 below:

Table 1: Proposed high-level technology changes for achievement of the expected deliverables of the online SLP project

High-level proposed system changes for technology environment	Deliverables
1. Short Course Registration System 1.1 The existing electronic *short course registration system* would have to include the requirement of indicating access to the LMS (*SUNLearn*) and e-Library for SLP students. Currently the registration system only makes provision for contact courses and will need to include type of and access to online SLP delivery modes. 1.2 The existing *Identity Management processes* (IDM) would have to include the electronic provisioning of access to the LMS (*SUNLearn*) and *e-Library* for SLP students, a process that is currently a manual process.	○ SLP must be identified according to the type of delivery mode – contact, blended or fully online. ○ Adjustment to fields within *short course registration* system for type of SLP (blended/online) and type of access required. ○ Automatic access for a student granted for the specified SLP with notification processes to facilitate the activation of their access to the *SUNLearn* platform and *e-Library* where applicable. ○ Access to *SUNLearn* platform and *e-Library* for the specific enrolled SLP will automatically be de-activated when SLP is completed or enrollment is cancelled.
2. Standard SLP Budget 2.1 A full cost approach is applied to all SLP activities at SU, with all direct and indirect expenditure related to a SLP being recovered from the income from the SLP. The *standard SLP budget* completed during the registration process of a SLP would need to make provision for technology and user support fees as part of the full cost approach budgeting process.	○ *Standard budget form* within the short course registration system must be amended to include LMS and e-Library access fees as a line item. ○ Provide integration with SU's financial systems to facilitate the transfer of these access fees to IT's cost centre.
3. SUNLearn (LMS) 3.1 Access for students to blended and/or fully online SLPs, hosted on SU's platform, is currently manually created in *SUNLearn*. This should be automated to reduce errors and ensure	○ The Web Services Engine will need to be extended to facilitate SLPs in SUNLearn and must be an automated process once a SLP is

High-level proposed system changes for technology environment	Deliverables
consistency across SCD's registration systems, Student Information System and *SUNLearn*. 3.2 *Technical structure adjustment in SUNLearn* to develop a distinctively designed theme/category within the existing *SUNLearn* platform specifically for online SLPs, with an identifiable and unique 'look and feel' to enhance the students online learning experience.	approved on the short course registration system. ○ Create and design a visually-appealing and user-friendly theme/category within *SUNLearn* integrated with the current 'look and feel' of the SCD to establish the identity and clear branding of SU's online SLPs.
4. Student Registration System 4.1 According to the business regulations of SU's SLPs, course fees are payable before SLPs commence. SLP students indicate on application via the *student registration system* who is responsible for payment of their SLP attendance. Organisations often have formal agreements with SU and payment for these candidates is not always facilitated before the start date of the SLP. To automate the process of student registration and access provisioning, an indicator is required to automate the registration specifically for these students where retrospective payment is applicable. 4.2 The existing short course *student registration process* (for face-to-face and blended SLPs) requires a student to be registered on first day of contact on the start date of the SLP. This inhibits seamless registration and needs to be modified to provide for automated self-registration for online SLPs.	○ Additional field must be created and be editable in the *student registration system* on the enrolment entity under the Payment Section to indicate that student is permitted to register before payment has been received (to accommodate formal agreements with organisations). ○ Delegated role to SCD co-ordinator to manually set payment indicator for enrollments where the student's organisation is responsible for payment of the SLP's fees. ○ Detail specifications for self-registration option for online SLP students. ○ The student must receive an email with self-registration and login instructions with the electronic identity of the student already created with a system-generated password. ○ The student must have the opportunity to reset his/her own password (as per instructions communicated via email).
5. Evaluation System Students need to rate the SLP and the performance of its facilitator(s). The existing SLP process of course and facilitator *evaluation* is paper-based and currently only applies to students participating in contact or blended short courses. Paper-based evaluation is neither practical nor achievable in an online environment. With fully online SLPs this process will need to be an	○ Provide a web-based online *evaluation system* solution for students. ○ Automatic processing and delivery of the evaluation reports to relevant SLP facilitators. ○ Web-based solution must be stable and scalable across different devices (desktop/laptops, tablets and mobile devices). ○ Anonymous identity is a prerequisite (student confidentiality on completing the evaluation and feedback).

High-level proposed system changes for technology environment	Deliverables
electronic process applicable to all SLP students.	
6. Certification All candidates who participate in contact or blended SLPs receive either an attendance or competence certificate if they successfully achieve the outcomes of the SLP. For fully online SLPs, provision will need *to* be made for electronic verification as to the outcomes of students' participation.	○ An automated email will be sent to the candidate after completion of the SLP indicating that the SLP has ended and electronic verification from SU will be sent thereafter as to the outcomes of his/her participation. ○ On application, students will need to indicate whether a printed certificate is required - especially for international students in terms of courier/dispatching costs which will need to be included in the course fee.

As with most projects, theoretically the proposed technology changes and deliverables shown above seemed comparatively attainable but only once the development of the project was initiated, did the main principles which determine the success of this type of project, manifest themselves. An article available at www.theconversation.com indicated in January 2018 that "online education is a disruptive challenge for which colleges are ill-prepared" and this seems to ring true for most institutions needing to create a platform for online delivery of it teaching and learning programmes.
Table 2 below indicates the issues SU encountered in the development process and how they have been or are being addressed:

Table 2: Challenges and issues encountered and addressed in the development of a institutional SLP online platform.

Issues encountered	Issues addressed or in process of being addressed
1. **Institutional culture and perceptions** This would need to change to recognise that the traditional learning and teaching modes could be enhanced and reinforced by online delivery of content.	○ Predictions of potential resistance from SU staff will be addressed by advocating the value of institutional online SLPs to the academic environments. ○ SU will need to recognise the 'adaptability' challenge and that online SLPs have a different presentation medium which must be structured in a way to promote the innovative qualities of the presentation.
2. Staff Capacity SU wishes to utilise an agile approach for online delivery. This has a potential impact	○ Consideration will need to be given to provide additional support staff and the

Issues encountered	Issues addressed or in process of being addressed
on staff capacity for SCD, CLT, IT, *SUNLearn* and SU academic environments to be able to ensure comprehensive online, administrative and academic support.	additional and current staff will then need to trained and coached in support practices.
3. Technology and Access Fees Escalating development costs and the need to include technology and access fees for infrastructure, user and administrative support and systems' licensing.	○ The standard short course budget form within the short course registration system will be amended to include access and technological fees as a line item and a part of the full cost approach for SLPs.
4. Technology Limitations The need for the development of additional hardware, software and expansion of current technological applications to achieve.	○ Major software development is required and the institutional IT skills in the domain of software development related to SU's preferred technologies (Oracle SOA Middleware and Java EE) will be used, since the SU developers are already familiar with current SU, SLP and SUNLearn technologies.
5. Connectivity With generally high demands on flexibility in the mode of delivery of the programme content across different devices and the quality of the connectivity.	○ With SA being a developing country, reliable and affordable high speed internet connection with sufficient bandwidth, students with limited technological knowledge and a consistent electricity supply remain a challenge. ○ Software solution will be installed to accommodate user-access from different devices.
6. Academic Quality Assurance Since online SLPs are often criticised for apparent lack of quality control, SU will need to ensure that academic quality assurance concerns are addressed including delivering content that is adaptable and appropriate for all cultures and beliefs.	○ Online SLPs will be subjected to the same academic quality assurance requirements as the contact or blended SLPs currently are. Thereby ensuring well-designed and executed online SLPs to provide an interactive and resource-rich learning experience.
7. Intellectual Property and Academic Honesty Ownership of intellectual property and academic honesty.	○ Lecturers have clear parameters as to what third party content may be distributed online

Issues encountered	Issues addressed or in process of being addressed
	and must discern when copyright permission is required to avoid potential copyright infringement risks to the institution. ○ SU has a blanket licence agreement with SA's Collecting Rights Organisation and it only makes provision for use and distribution of third party content on an internal institutional electronic platform (*SUNLearn*). ○ SU is already proactive in advocating implementation of the provisions of its copyright blanket licence agreement, and this will be extended to include further awareness amongst its staff regarding online SLPs. ○ Third party content that is specifically licensed to SU for use by SU students and staff (*eg* electronic journals), has to be in strict accordance with the T & Cs of such licencing agreements concluded by SU. ○ The easy availability of information electronically and which students can potentially present as their own, creates opportunities for academic dishonesty – SU will continue instilling academic honesty and integrity in its SLP students with a plagiarism-detection tool also available for students to utilise.

5. Conclusion

The *NMC Horizon* Report: *2017 Higher Education Edition* states "Institutions are charged with developing students' digital citizenship, ensuring mastery of responsible and appropriate technology use, including online communication etiquette and digital rights and responsibilities in blended and online learning settings and beyond," and traditional institutions have to now shift their focus to include blended models for teaching and learning and seize opportunities to experience the potential benefits that the modern technologies and transformational practices in online teaching and learning can offer. Furthermore, institutions globally are needing to make online learning attractive, accessible and cost effective whilst still providing high-quality academic content that remains relevant as technology and web-based services evolve.

SU's SCD has embarked on ensuring the successful achievement of the objectives and priorities of SU's 21st century institutional strategy, *Vision 2040*, by aligning with three of its six core strategies:

1. Where fully online accredited SLP facilitation will create opportunities for work-integrated learning, add vocational and educational value to the professional development of candidates, have positive societal impact and expand new student markets;
2. Where the fully online SLP experience will serve candidates through a collaborative and interactive online teaching and learning model in compliance with applicable regulatory and university policies and academic quality assurance regulations; and
3. Where SLPs can change the size, shape and mix of SU's student population to mirror the strategic direction of SU's vision and create an opportunity for entrepreneurial activities for lecturers that advances institutional innovation.

Initially, the time and effort required by SCD, CLT, IT and *SUNLearn* to plan, develop and implement this SLP online project, seemed daunting, especially with the high-level technology changes that needed to be made and which have been highlighted in this narrative. The potential to increase the scope and reach of SU's accredited SLPs, to decrease the cost by hosting these online programmes on an internal platform and to increase students' capabilities of using web-based tools and technologies through online learning have been instrumental in driving this project thus far.

SU did investigate the possibility of acquiring the use of an external IT and applications service provider to assist in expanding SU's existing platform into a high-quality integrated technological platform within a fixed and short turnaround time. This would have had major cost implications at almost three times the cost of using the expertise of SU's IT developers and upgrading and developing software for which additional funding would have had to be made available by the institution. For cost effectiveness and continuity of internal system maintenance and sustainability, it was decided not to make use of an external service provider for this online SLP expansion and only the business analysis aspect was outsourced to an external consultant.

More than a year after initiating this project, it has progressed to the stage that the development will be completed by mid-December 2018 and will be launched in the 'test environment' thereafter. If all goes according to plan, the project will be in the 'production environment' by February 2019. By the end of 2019, SU will be able to fully measure the success of this SLP online project against the current projected critical performance measurements indicated below:

Critical Performance Measurements
1. At least 80-90% improvement in seamless SLP registration and access processes
2. At least 30% improvement in the number of SU accredited online SLPs
3. At least 50% improvement in the number of student registrations for SU accredited online SLPs
4. Increase in the total income generated by SU's SLPs
5. Improvement in the sustainability of the online design and support service (CLT) within one year
6. Improvement in the viability and sustainability of SU's SCD

Where universities and higher education institutions are forging partnerships with other universities (nationally and internationally) to host online SLPs or outsourcing their online SLPs to be hosted on external platforms, SU's SCD made the decision that its online SLPs could be hosted internally as a cost-effective measure thereby not only being responsive to delivering a transformative SLP experience, but also optimising the potential to ensure the sustainability and viability of the institution's Short Courses Division.

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Computational Fluid Dynamics as a Driver for Teaching Millennials

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Abstract
It could be observed that students' learning progress for similar facts, e.g. in the field of physics, can be different in different courses. For example, when a fact is taught in physics classes, acceptance is low, and the material generally less well received by students than in other courses. The same subject can have higher acceptance in more complex classes like *computational fluid dynamics*. This illogical behaviour of students is known from psychology as the effect of reactance, which is described in this work. Within gamification of founding a small company and designing (*CFD simulation*) and building their own air plane (*3D printing*) a competition between the students leads to better acceptance of the topic motivation and high motivation.

Keywords: *Computational Fluid Dynamics (CFD), Learn Team Coaching (LTC), Resistance, Motivation, Teaching, Gamification*

1. Introduction

In their search for ways to improve their teaching, the authors of this article have come across the learning team coaching method and implemented it in two courses. This article briefly presents the method of learning team coaching and discusses the motivational impact of the adapted approach in a *computational fluid dynamics* course.

2. Teaching Method Learning Team Coaching (LTC)

Learning Team Coaching (LTC) is as an inverted classroom teaching method for engineering classes. The method was developed in 1999 at the University of Applied Sciences Heilbronn, Germany. The method is based on the observation that the quality and quantity of acquired knowledge depends on the commitment of learners and their abilities to understand and apply the learning content. These skills can be strengthened if the learning content is elaborated by the students themselves in a co-constructive way. To support that, LTC focusses on three consecutive stages: self-learning, collaborative learning in teams, and team coaching by the lecturer (*see Figure 1*) (*Lorbeer et al*., 2000 & Fleischman and *Geupel*, 2003) [10, 12].

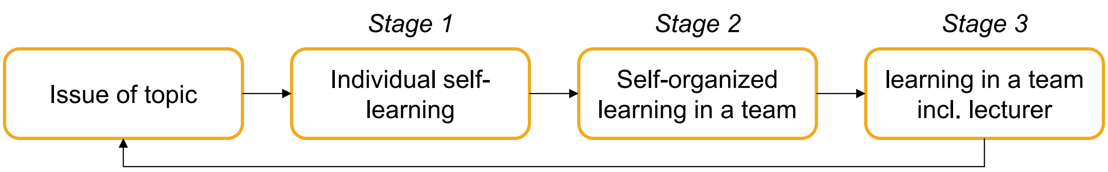


Figure 1: Stages of Learning Team Coaching acc. to (*Fleischmann*, 2003) [12]

The most important preconditions for the application of LTC are that the learning materials are suitable for self-learning (e.g. handouts divided into separated lessons with learning objectives, questions for repetition) and that the lecturer is willing to change their perspective from teacher-oriented lecturing to student-oriented coaching (*Lorbeer et al.*, 2000) [10].

To start the LTC process the lecturer distributes the prepared lessons to the students who then start with stage 1 "individual self-learning". In that stage students have to work through the learning material independently, i.e. they have to read and understand the lesson or mark all the aspects they do not understand. In stage 2 "self-organized learning in a team", students meet with their learning teammates and discuss their open questions from stage 1. Questions that cannot be answered within the team or other problems of comprehension are documented among other things in a learning team list. The list should consist of the following topics (*Lorbeer et al.,* 2000) [10]:

- Things we understood well
- Things we don't understand
- The most important topics for the coaching session
- How we organized us in stage 1 and 2
- Our problems while learning or within the learning team

In stage 3 "*supported learning in teams*" students and lecturer meet on a regular basis for coaching. In these sessions, students first present their findings and their learning list, and then these are used as the basis for the coaching process. Students and lecturer discuss and clarify open questions and problems of comprehension. At the end of the session, there will be reflection on the team process. Therefore, according to *Fleischmann* and *Geupel* (2003) the coaching session should be divided in three sections [12]:

1. ***Contract phase (5-7 minutes):*** The target of the contract phase is to present and to prioritise the topics on the learning list in order to set the agenda.
2. ***Core phase (up to 75 minutes):*** The target of the core phase is to solve students' problems of comprehension. Therefore, the lecturer must act as a coach in order to identify the individual gaps in knowledge or understanding barriers. After that, the lecturer has to start the joint learning process by exploring the learning topic together. This increases the individual understanding with subject to the level of prior knowledge.
3. ***Closing phase (5-7 minutes):*** First, the minute-taker summarizes the results of sessions. Second, there is reflection on the joint learning process, and for the topics that remained open a further learning process is defined.

In addition to the original concept, the authors added roles for each session that have to be clarified/repeated within the contract phase.

- ***Moderator:*** responsible person for setting and executing the agenda
- ***Time keeper:*** supporter of the moderator to enforce the time slots of the agenda
- ***Minute-taker:*** responsible person for documentation of the session

3. The effect of resistance against learning progress

In and after the introductory course of the LTC, a certain amount of scepticism on the student side was noticeable at first. In particular, the independent preparation of the course content together with "*unknown*" students, with whom a learning team was formed by chance, initially triggered doubts. The random choice of teammates even made this worse. In psychology, this effect is referred as *reactance*, which has a massive influence on decision-making. We want to take a closer look at this and summarise the points according to *Brehm* [1].

- Students feel inner resistance when it is forbidden to do anything that they want if they were already allowed to do so before.
- They just want to know the options that are denied to them.
- Students don't want to be persuaded.
- They resist if anyone wants to take something away from them that they already believed with certainty.

According to the research by *Wicklund* this reactance especially occurs when external factors try to influence social attitudes or views [2]. Any external attempts to exert influence that are intended to control the affected person trigger this behaviour. Furthermore, reactance can be observed when social pressure from inside of a group creates barriers that prohibit a certain action, which happens often in the first month of the academic program.

On one hand, coercion could lead to complete rejection of the choice between the alternatives, or it could lead to the student choosing an alternative that is not offered, e.g. by the docent. During the learning process, every student comes to a point where desperation occurs, as could be explained by Figure 2. This point of low motivation is called a „*valley of despair*“ and leads the student from high motivation to low motivation. The aim of LTC is to make this period a short as possible or bridge it, to come directly to the so-called „*routine phase*“. This can be done by social contacts that were strengthened during the „*euphoric phase*“ at the beginning of the studium and can help to bridge the valley of despair. This is why students have to be forced to build small groups with random members during the euphoric phase of the semester.

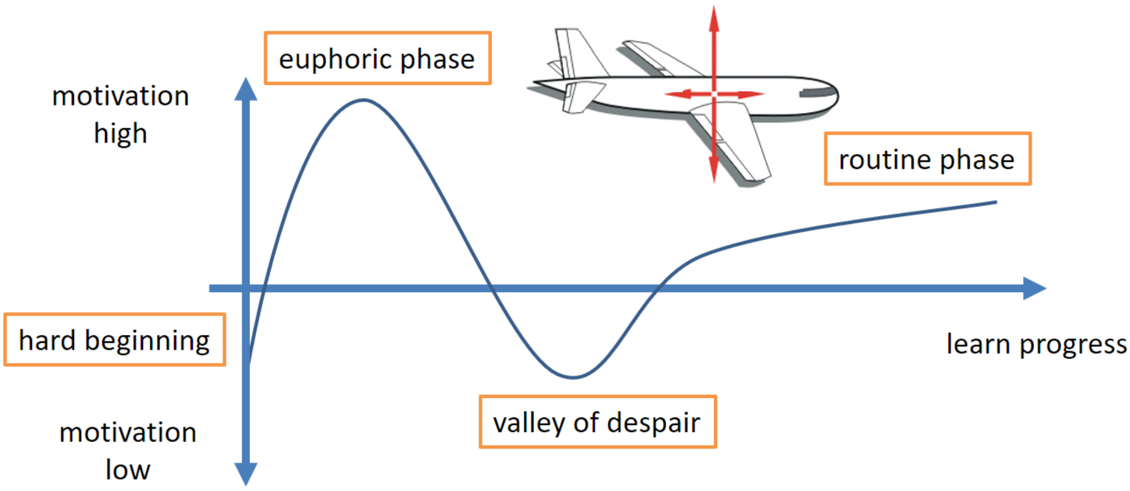


Figure 2: Desperation during ‚*valley of despair*‘ phase while learning

The strength of their reactance depends in particular on the extent of the subjective loss of freedom. In principle, it can be said that the more alternatives are threatened or eliminated, the stronger the reactance. Furthermore, the strength of the restriction of freedom has a great influence on the strength of resistance.

Different scientific definitions have emerged for this purpose. Reactance can be described as ‚*internal resistance to all restrictions on individual freedom of decision and action*‘ [3], in which an extremely motivating state of tension arises which concentrates exclusively on regaining the freedom that is threatened or even lost.

With the increasing threat of loss of freedom, reactance becomes stronger and stronger. It is significantly lower, for example, if a particular alternative is only threatened under very special circumstances. However, if the alternative option is lost forever, a particularly strong reactance occurs [4].

According to a more general definition, every individual assumes that they have the freedom to carry out all the activities he or she desires. Resistance behaviour always occurs when ‚*one of these freedoms is threatened or declared impossible*‘ [5]. The most recent definition of reactance, comes from *Raab* who describes reactance as ‚*motivation to restore a restricted or already eliminated freedom of movement*‘ [6].

4. Small working groups - high motivation

In our trial positive dependencies and a strong group cohesion among the students arose due to the teaching organisation, and especially due to regular small group coaching. As a result, the students continuously studied and exchanged information with each other about the course during the semester. Gaps in comprehension were closed in a timely manner and, in addition, the module description indicated in the module script was used optimally for preparation and follow-up.

Earlier evaluations of lectures by the students usually showed that the preparatory and follow-up periods were not continuously carried out over the semester and that follow-up work was only carried out at certain points shortly before the examination date. This corresponds to the so-called "*bulimia learning*", which reduces learning success, especially in the basic subject of physics, a science based on logical connections. This is also true with regard to other technical subjects. Other modules where the content is learned by heart do not show this effect so strongly.

Continuity of learning was positively strengthened by the fact that the students were well prepared throughout the entire semester and came to the coaching sessions. This was demonstrated by the fact that in each of the 54 coaching sessions for each learning team, it was possible to work out where there were still uncertainties and which contents of the course were already understood. The issuance of giving extra points for the exam was perceived by the students as a positive confirmation of their efforts, which, according to some students, had a strong motivating effect on continuing to study the lessons. (It must be added that student attendance was monitored.)

Strengthening independence was also promoted by defining roles. In the coaching sessions, each student took responsibility for his or her own learning team as a moderator, recorder or timekeeper and thus made a special contribution to the learning success and compliance with the necessary regulations. The simultaneous teaching of specialist knowledge and soft skills (such as teamwork skills, problem solving and conflict resolution, summary of the most important contents, facilitation) as well as personal responsibility for learning led, according to the unanimous opinion of the participating lecturers, to an increase in the independence and strengthening of the social competence of the students, especially at the transition from school to university.

However, in the LTC it has been shown that, due to the heterogeneous composition of the learning teams, a transfer of knowledge from students with a strong scientific and technical background to the less well-educated students has already taken place by self-organized learning within the team. This took place without the active participation of the lecturers.

An increase in self-organization was particularly evident in the ingenuity with which the learning teams organized their communication, ranging from the classic standard deadline to *ad hoc* communication in social media or via messenger service.

5. Fast feedback during design process by computational fluid dynamics (CFD)

The implementation of the LTC in the first semester led to an early meeting and a better networking of the students, so that the cooperation of many team members was also observable in the second semester. The method was also used for our course in *computational fluid dynamics* (CFD), where complex numerical simulations have to be performed by several student teams. Before construction and technical drawings of an airplane, pump, car, ship, power plants or any other technical system can be completed, functionality has to be proven [7].

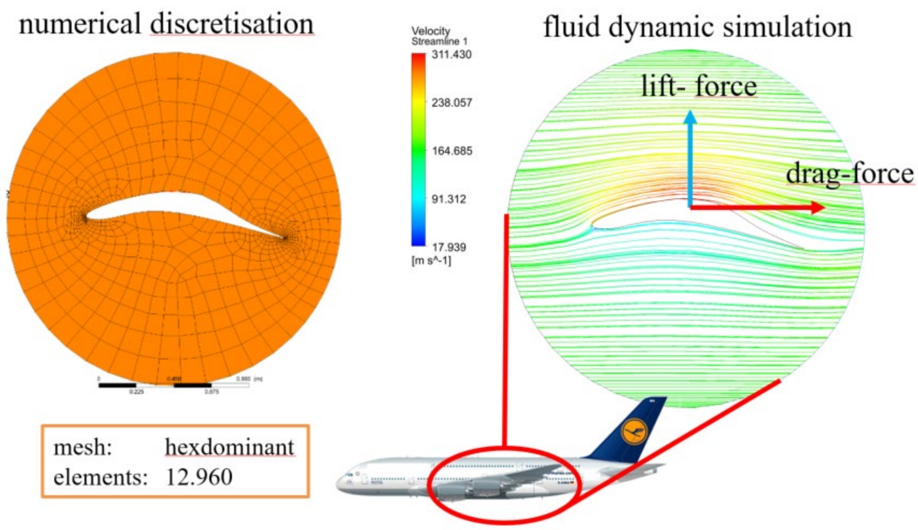


Figure 3: Numerical discretisation of wing profile and computational fluid dynamics simulation (CFD)

In modern design processes this is done by experiment as well as by simulation. In Figure 3 a design study of a modern airplane wing with the CFD code ANSYS CFX 18.0 is shown, including numerical discretisation of the airfoil with 12,690 numerical cells. Fluid dynamic simulation results are also presented.

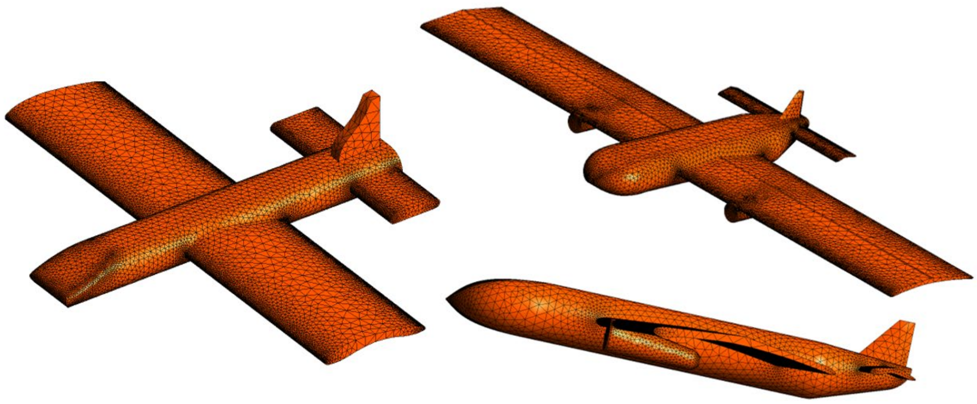
Due to the students' different educational backgrounds, e.g. business college, technical college, grammar school etc., the scientific/technical qualification of the students in the courses are extremely heterogeneous, which has been a problem in the past. Reactance against CFD classes can also be even higher than against physics classes. But it can also lead to higher motivation during learning process if it is used in the right way. However, if the student recognizes a transparent attempt by the docent to influence him, for example by a statement that a certain task must be completed immediately and must be finished before a certain deadline, this can lead to an inverse reactance because the student recognizes this attempt. The clumsy efforts of the lecturer indicate that he wants to accomplish the learning process very quickly. This is perceived by the student as a restriction of personal freedom of choice and therefore leads to resistance to the subject. Even if the student wanted to learn in time, he will refuse.

In *computational fluid dynamics* (CFD) classes, working in small groups offered the advantage of an open error culture, so that the inhibition threshold of disclosing knowledge gaps was reduced. In this way, the lecturers were better able to identify individual deficits and correct them by coaching in a targeted manner. There was a pleasant, team-oriented working atmosphere throughout the coaching sessions, which was characterized by an open approach to questions and discussions that would be difficult or impossible in large groups.

A particular challenge in CFD courses is the fact that complex numerical calculations and simulations have to be carried out in addition to the development of the theoretical content. Before finalizing the design and the creation of technical drawings of, e.g. an airplane, pump, car, ship, power plants, or any other technical system can be done, functionality has to be proven (*Rückert et al.*, 2001).

In a first step, the transport equations are set up, discretized and solved in the numerical flow simulation. A closer look at all equations reveals that their structure is very similar. Therefore, it has been possible to generalize these transport equations as described in literature (*Noll*, 1993) [15].

After setting up the transport equations, these are discretized for the numerical solution of the fluid mechanics problem. The total volume occupied by the fluid is divided into small, discrete volumes. These are also called control volumes or cells (*Wursthorn*, 2001) [14]. In modern design processes, this is done by simulation as well as by experiment.



› adaption of the NACA-Profile to the rear
› changes in the body of the plane
› addition of turbines underneath the wing

Figure 4: Direct feedback by simulation during design process of airplane geometry

Inspired by *Deubel et al.* (2006) [11], during CFD classes the students were assigned the task of creating their own innovative design of a complete airplane. Construction of the geometry was done with the ANSYS Design

Modeler, the benefit of which is that numerical discretisation of the whole plane is done automatically by a meshing algorithm (see Figure 4). The whole geometry is flexible and design changes can be simulated directly. Figure 4 shows the three examples for parametrised airplane geometries developed by different working groups, and similar to Figure 3 the discretisation for the geometry was generated by a meshing algorithm (*hex-dominant meshing*).

In addition to these qualitative findings, there are also positive quantitative findings. Figure 5 shows the results of the physics examinations of the CFD simulation. Due to the conversion to LTC in the lecture, the number of examinations passed in the first attempt could be considerably increased compared to previous years while retaining the same level of difficulty. From this, it can be deduced that the LTC has improved the transfer of specialist's knowledge and the procedure for solving problems (*assessment tasks*). The number of different designs where very high, so the students got the task to optimise drag-forces and to increase lift forces of each airplane.

In Figure 5 the lift forces on the whole airplane are visualised by arrows. The aim was to as achieve the highest lift forces possible for a given air velocity. Drag-forces and turbulence as well as swirl downstream of the airfoil are visualised by isosurfaces of the turbulent kinetic energy.

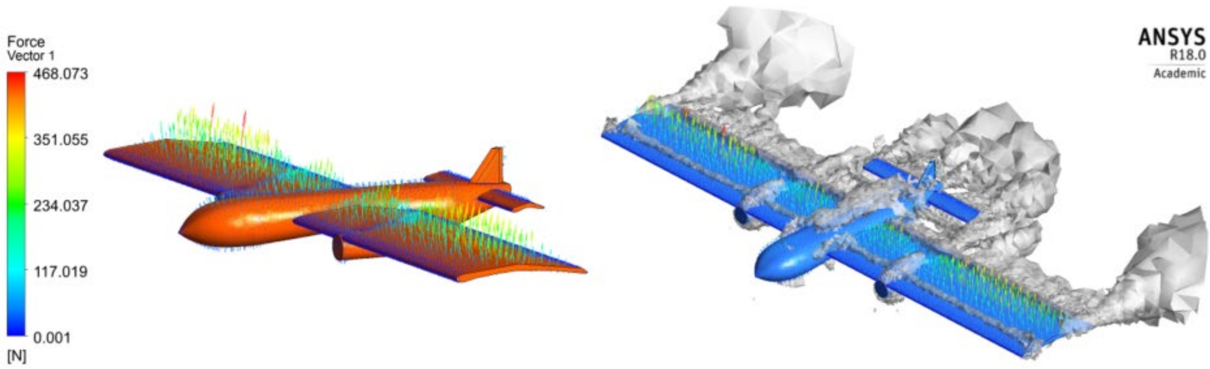


Figure 5: Design criteria for quality are lift-/drag-force, and turbulence

Every student team invented different design steps of their airplane and made several optimisation steps during the design phase. To get the best values for drag-force and lift-force a competition between the different student teams was organised. The lecturers were able to counterbalance this with a self-assured appearance, a coordinated concept and clearly formulated rules of the game.

6. Gamification - A handcrafted airplanes to prevent the valley of despair

After several weeks of learning progress during the *euphoric phase,* the *valley of despair phase* had to be prevented. Our idea was to give the constructors the choice to do something very different. This can be real handcrafted work. If a person is faced with a choice between different alternatives, each alternative is given a certain weighting. In the case of a pronounced reactance, those alternatives that have already been discontinued or could be discontinued in the foreseeable future will be assessed much more highly. These alternatives are considered important or necessary only because people's freedom of choice has been severely restricted [4]. In particular, the effect of reactance is particularly pronounced when it comes to alternatives that have been strictly banned or even censored in normal university classes.

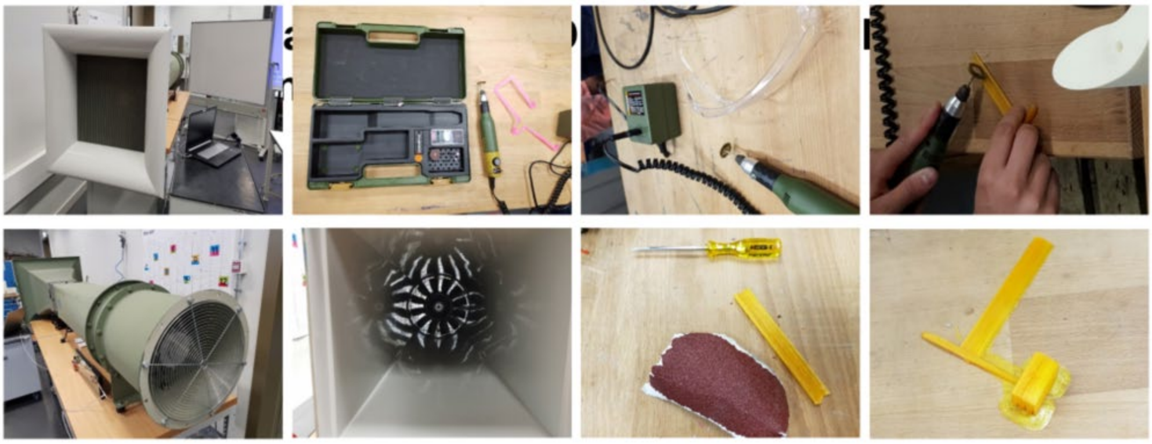


Figure 6: Handcrafting leads to better acceptance of theoretical work

We decided to let the students 3D print their own favourite airplane model and prepare it for measurements of its flight qualities. The lecturers also undertook a learning process and a change in behaviour during the transition to the coaching role. Questions and problems encountered during handcraft could not be planned and were therefore answered directly by the lecturer.

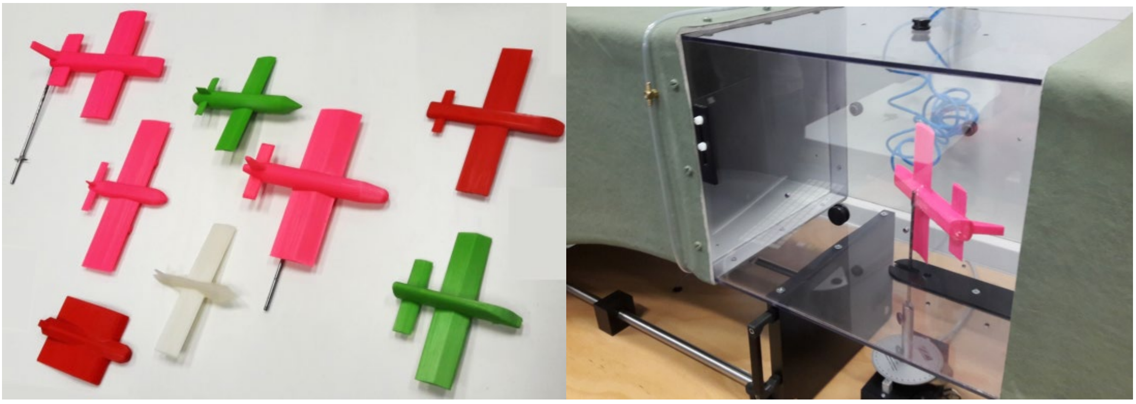


Figure 7: 3D printed plane models from each students-team; measurements inside in-house htw wind tunnel

For every team the best aircraft design was printed with the 3D printer (*Ultimaker 2++*) to examine fluid dynamic behaviour in the htw saar in-house wind tunnel (see Figure 7). The lecturers, together with the learning teams, first had to identify the gaps in knowledge and their causes more precisely in order to close them through questioning techniques and moderation. During this type of gamification students also had to prove their ability to work in a team in three parallel events because, for reasons of equal treatment and due to a joint examination, the exercises and coaching sessions had to be well synchronized and coordinated.

The students always like to bring their teams into a pole position. In the context of gamification, different behaviours are repeatedly restricted. However, this prevents a successful resolution of the conflict. Preventive measures of their mood must therefore be taken to prevent formation of reactance. The best results have been achieved by creating an understanding of the legitimacy of the restriction or ban through numerous discussions. The lecturer had the role to reflect on the results, give a ranking of the teams, announce the winning team, and finish the game within the classes, in order to prevent further conflicts.

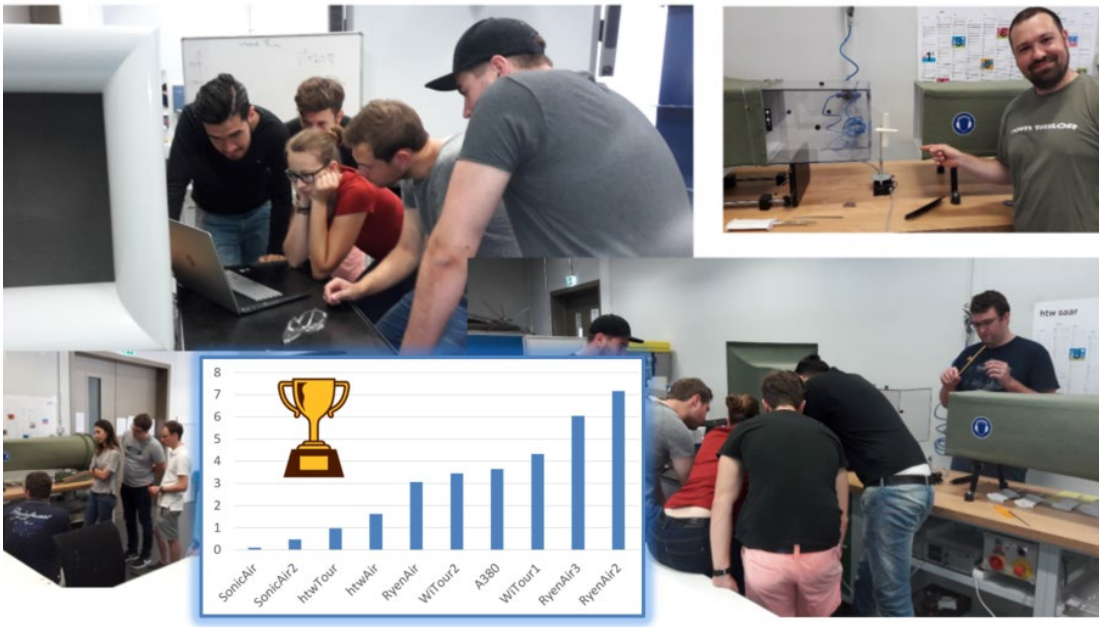


Figure 8: Gamification - students collaborate to support their own team

7. Conclusions - What effects does LTC have on the modern design process?

Student scepticism about LTC disappeared after the first coaching sessions and the LTC was perceived positively by the students in the postgraduate course and in comparison with lectures of other courses. The most important thing, however, is the possibility of participation. If the students were fully informed about the opportunities and possibilities of a new technology, they should be asked for their opinion during practical phase. In this way, possible doubts and fears about theory can be dispelled.

Regular internal coordination during LTC ensured that two new lecturers were able to integrate very quickly into HTW Saar and were directly confronted with the challenges of new forms of teaching. Through more intensive supervision in small groups, these lecturers got to know the students more thoroughly, which led to the fact that four of the first semester students could be nominated for a scholarship from the *„Studienstiftung des Deutschen Volkes“* [8], and two other students were already awarded job contracts in the second semester by htw saar.

Finally, it should be noted that learning team coaching (LTC), without considering the one-time initial preparatory effort, could be carried out with the same teaching load as the previous lectures with exercises, and thus the implementation was neutral to the teaching effort. The quantitative and qualitative increase in the output of the course can therefore be seen as an increase in teaching efficiency. Transfer of the method could be done from one course to another.

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Developing a Gamified Online Course on Serious Games

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Abstract

The primary objective of a serious game (SG) is more than entertainment. Due to the many different potential applications of SGs, their development requires involvement of experts from a variety of disciplines. To develop effective SGs, which effectively achieve their purpose, more education and skilled players in this field are needed.

Tampere University of Applied Sciences (TAMK) and Kajaani University of Applied Sciences (KAMK) were from 2016 till 2018 involved in the project "SeGaBu - Serious Games Platform for Business and Education" (http://segabu.fi), in which gamification of online courses played an essential role. Gamification elements were applied in several MOOC-type online courses on the DIGMA.FI platform, which is a Moodle-based learning management system (LMS). The course we mostly demonstrate as an example of gamification is "Basics of Serious Games". An objective of the SeGaBu project was to find a solution to educate a multidisciplinary audience about SGs via gamified online courses.

Social constructivism theory was used as a pedagogical approach in designing online courses on SGs. The pilot online course on SGs worth 5 ECTS was implemented and designed to serve open education and cross-institutional studies. The target group of the course included persons interested in expanding their expertise in serious games. The social interactions and dialogue between students were based on peer discussions and chats. The idea of intentional learning was the basis in planning the independent conduct of the course. In order to create a game-like visual look and feel to the course, the grid layout was applied on Moodle LMS. As a form of gamification, the course applied levels, the Moodle progress bar tool and Stash tool, which can be applied for picking up objects into a repository inside the course.

The feedback from students revealed that discussions during the course were considered fruitful, though some activating interventions were proposed. Positive attitude changes toward gaming were reported. A teacher's presence for support, communication, and feedback was expected, even though the courses were intended for independent studying. These findings support the results made in several previous research papers.

Keywords: serious games, gamification, moodle, e-learning, mooc, online learning, education

1. Introduction

Tampere University of Applied Sciences (TAMK) and Kajaani University of Applied Sciences (KAMK) were from 2016 till 2018 engaged in the project "SeGaBu - Serious Games Platform for Business and Education" (http://segabu.fi), in which gamification of online courses played an essential role. Other higher education institutions involved in the SeGaBu project were Oulu University of Applied Sciences and University of Oulu. Elements of gamification were applied in six MOOC-type online courses running on DIGMA.FI platform, which is a Moodle-based learning management system (LMS) administered by TAMK. A number of gamification elements were also applied for online courses in another Finnish, nationally funded ESF project, **Uutta avointa energiaa** (“New open energy”) (http://agileamk.wordpress.com). During these two development projects we have learnt a few significant lessons, and we can share some of our experiences on gamifying online courses, particularly on Moodle platform.

2. Conceptual background

It is commonly stated that the term Serious Games (SGs) refers to the use of games and game technology for other purposes than just entertainment (Djaouti et al, Susi, 2011 ;Johannesson & Backlund, 2007;Zyda, 2005). Due to the many different potential applications of SGs (Zyda, 2005; Kemppainen, Korhonen & Ravelin, 2014; Ricciardi & De Paolis, 2014), their development requires involvement of experts from a variety of disciplines. To develop effective SGs, which effectively achieve their purpose, more education and skilled players in this field are needed (De Troyer, 2017). An objective of the SeGaBu project was to find a solution to educate a multidisciplinary audience about SGs via gamified online courses.

Deterding et al. (2011) have defined gamification being use of game design element in a non-gaming contexts. Gamification can be seen as a service layer of reward systems and utilized in many different subject areas to engage users or improve user experience (Deterding, 2011). Lee & Hammer (2011) describes using gamification in education as a solution to motivate students. Huotari & Hamari (2012) on the other hand define gamification being “a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation.” Korhonen, Ravelin and Halonen (2018) state based on their action research study that gamification in course structure, such as levels and a progress bar, can be considered motivating, if they work well. If gamification has no connection to course structure, it can be seen as irritating.

Developing a SG requires not only game development skills and an understanding of good game design, but also the ability “to solve an organizational need or to be of utility in some other aspect beyond entertainment”(Backlund et al., 2017, p. 15). SG development requires input from many domains (Backlund et al., 2017). Client procurement skills are seen as a challenge: they have significantly high or low expectations, and they lack knowledge of possible solutions regarding gamification and SGs (Backlund et al., 2017). The education and consultancy of customers could be considered a solution for this challenge. De Troyer (2017) also presents the need for multidisciplinary tools to assist during the development of SGs, guidelines for developing SGs, and knowledge of SGs.

The conception of learning related to this development work is based on social constructivism theory. In social constructivism theory, social interaction between people is seen as the primary source of cognitive development in a learning context (Durairaj and Umar, 2015). Knowledge is constructed by exchanging dialogue in a social setting (Shaikh et al., 2017). The knowledge is co-constructed in the environment with others (Shaikh et al., 2017).

Social constructivism theory was used as a pedagogical approach in designing online courses on SGs. The pilot online course on SGs, *Basics of Serious Games*, worth 5 ECTS was implemented and designed to serve open education and cross-institutional studies. The target group of the course included persons interested in expanding their expertise in serious games. The social interactions and dialogue between students were based on peer discussions and chats. The idea of intentional learning was the basis in planning the independent conduct of the course (Durairaj & Umar, 2015; Shaikh et al., 2017).

3. Basics of Serious Games as an example of a gamified course

3.1. The context for gamification

During the SeGaBu project six MOOC-type online courses were created in all. The course we mostly demonstrate as an example of gamification is *Basics of Serious Games*. The specific objectives of the course were:

- To understand the concept of serious games, and the role and significance of serious games in the learner's own domain.
- To get familiar with the game development process and be able to act in a product owner's role in a serious game development project.
- To understand the technology perspective in gamification and serious games.
- To learn a variety of innovation methods, as well as apply a chosen method for generating and developing game ideas.
- To learn to present own game ideas, including relevant market research information.

The educational content of the course was created by KAMK, and the pedagogical design and gamification was implemented by TAMK. Not only did we offer a learning experience that complies to the objectives of the course, but we also intended to give an example of a gamified course, how it can be created despite all the restrictions of the Moodle LMS software.

During the course the students studied mainly independently, but to some extent also with their fellow students. Students proceeded to higher levels by learning the material and completing the assignments. The requirements increased from level to level. The course included group discussions, playing games assignments, competence tests, a comprehensive game evaluation and a brainstorming task for their own serious game.

3.2. Visual layout

In order to create a game-like visual look and feel to the course, the grid format was applied on TAMK's Moodle installation. The Grid Format, as shown down in figure 1, can be downloaded and installed as a plugin from Moodle Plugins Directory (2018). Although the Moodle Grid Format as such was not specifically designed for gamification, it met the needs of this course well.

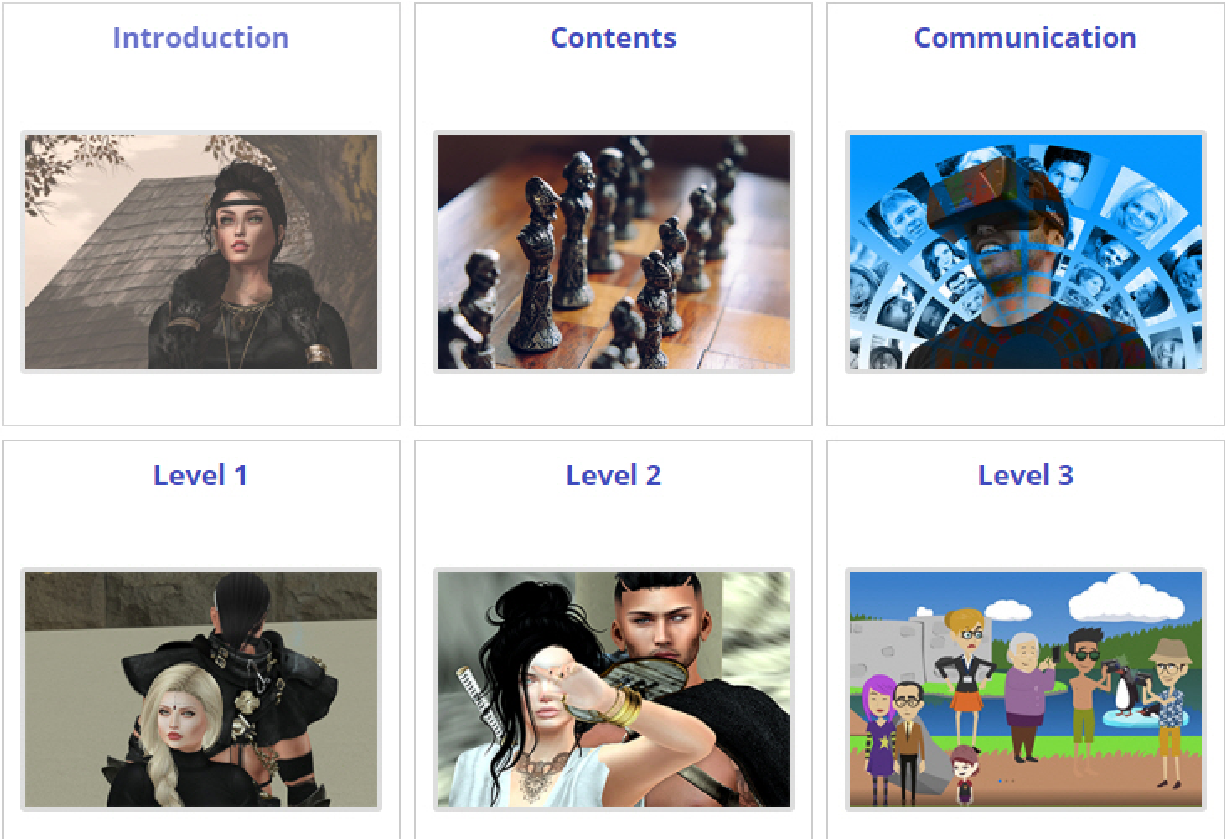

Figure 1: The Grid Format was used for navigating from one course section to another.

There are several Moodle plugins that are not specifically designed for gamification of a course, but they can be applied in context of gamification. The **Progress Bar** (figure 2) is one of them. This tool shows visually the progress of the students in activities and resources. Progress Bar is colour coded to quickly indicate which tasks are completed, uncompleted or viewed.

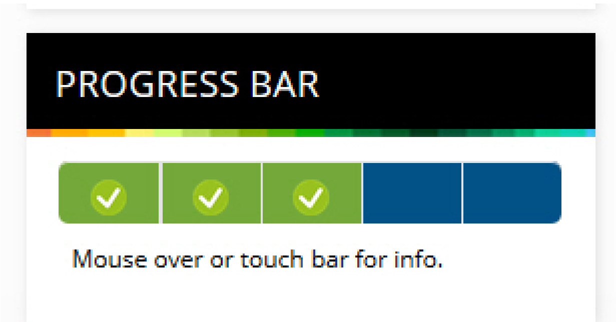

Figure 2: A student's view to the Progress Bar in our pilot course.

The Progress Bar is equally visual and helpful for the teacher, instructor or facilitator of the course (figure 3). Monitoring the students' progress is quick, and one can have a general view of the course progress at one glance.

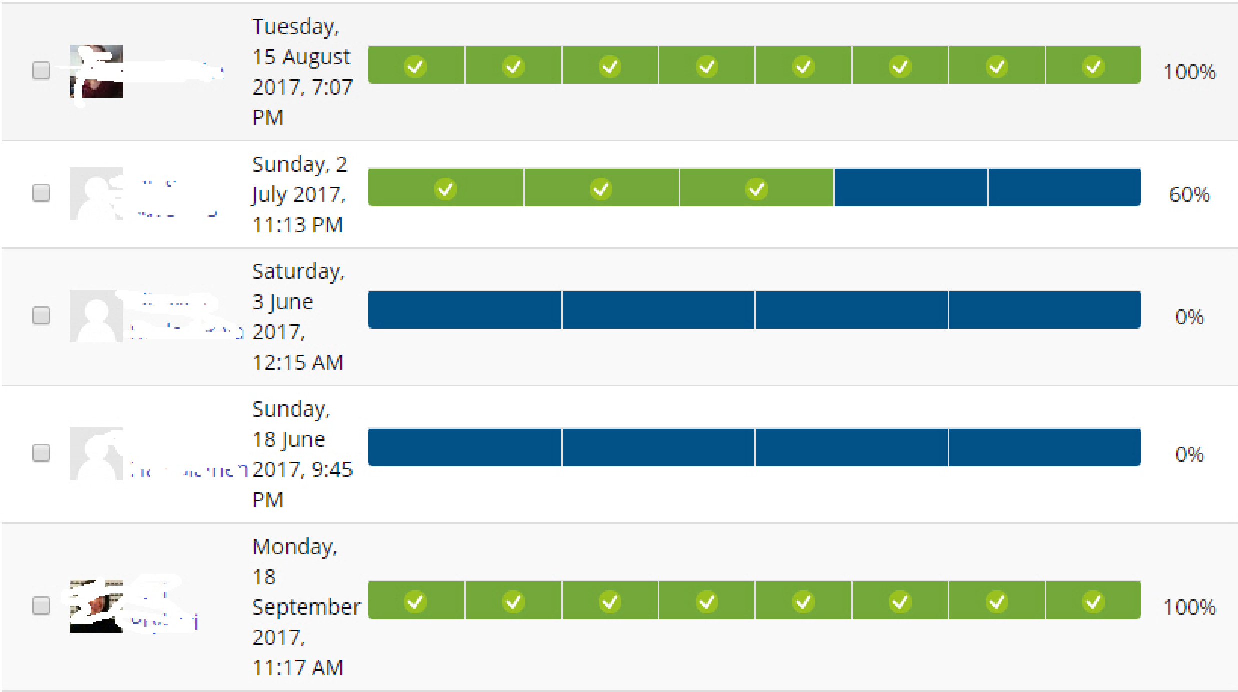

Figure 3: A teacher's view to the Progress Bar in our pilot course.

3.3. Levels

As a form of gamification, the course applied levels. We were aware that the Moodle **Level Up!** plugin adds automatically experience points to the student, according to how it is configured in the settings of the tool. The plugin illustrates the student's current level and moves him to a higher level, when a certain number of experience points is reached (Figure 4).

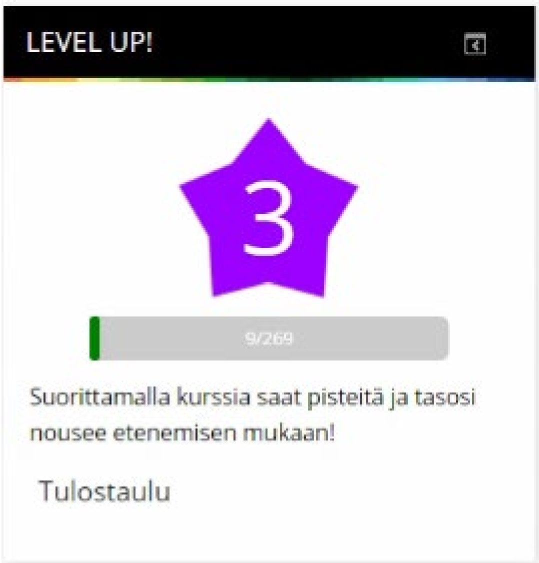

Figure 4: A student has just reached level 3 in the Level Up! tool.
A screenshot from a Finnish test version of the Basics of Serious Games course.

When used with default settings, the Level Up tool contains ten levels (Level up 2018.) However, as we tested it, the weakness of the plugin appeared to be that almost any of the student's activities seemed to accumulate their points. The student could thus reach a higher level by actively hustling around in the course, even though the required skills, knowledge and competences had not been achieved. Level up! is a plugin that according to our experiences is not suitable for tracking learning achievements, or monitoring if the students have reached their learning objectives. It serves the purpose of encouraging students to be more active during the course, and to come back soon to the course.

As a result, we decided to implement the levels on our pilot course by simply making use of some standard features in Moodle. Each level consisted of a section in the course. The higher levels (sections) were kept invisible for the student, until they passed the assignments required on the previous level. On the DIGMA platform this was implemented by enabling the standard Moodle course completion tracking, and then manually adjusting the conditions for opening the higher course sections (levels).

3.4. Stash

Stash tool is a Moodle plugin, which can be applied for picking up virtual objects into a course-specific repository (figure 5). The student's progress on the online course can be restricted or allowed by the fact that he has (or has not) collected certain objects. Pedagogically, the tool can encourage the student to explore comprehensively online material that might otherwise be uninteresting. The collected objects in the Stash can also have a rewarding role. (Stash 2018.)

Figure 5. The student has picked up four objects in his Stash repository, inside the course space.

In some other instances, we used a number of identical treasures to collect inside the course. On one of the course implementation, we urged students to collect golden coins, and in another instance, students were asked to look for blue birds in the course material. Unfortunately, very little feedback was gathered on how the students experienced this functionality.

As we can see in figure 6, Stash is also a very graphic tool for the teacher, instructor or facilitator. The use of Stash was optional during the course, because we anticipated that someone might consider it childish.

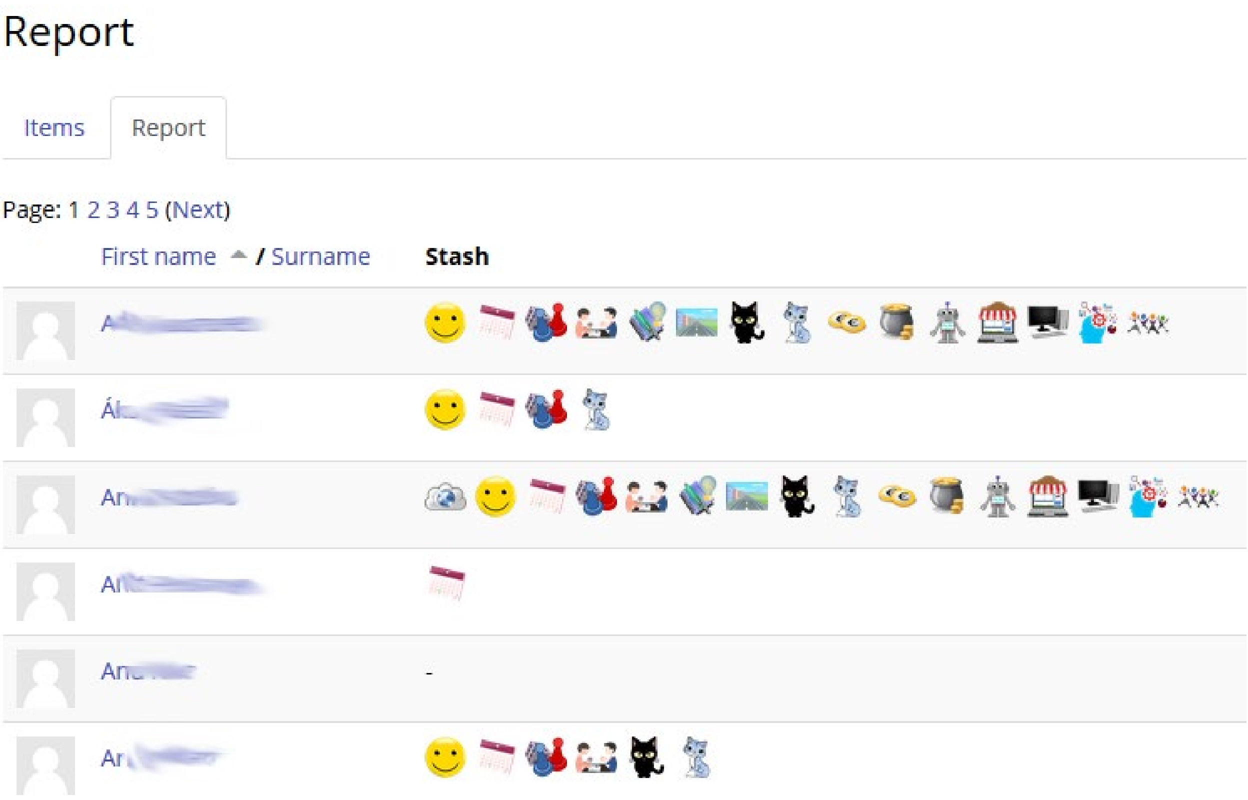

Figure 6. Teacher's view of the Stash tool

3.5. Ranking block

The **Ranking Block** is another plugin for Moodle LMS (Ranking block 2018). Different rankings are typical features for games. The Ranking block for Moodle shows a scoreboard based on the activity of the students. The Ranking Block can add a sense of play to an online course. Mainly some of the activities that are evaluated, can be linked to the scoreboard. These activities include, for example, discussion forums and assignments. As we can see in figure 7, the Ranking list displays scores on weekly, monthly and general, throughout the course basis.

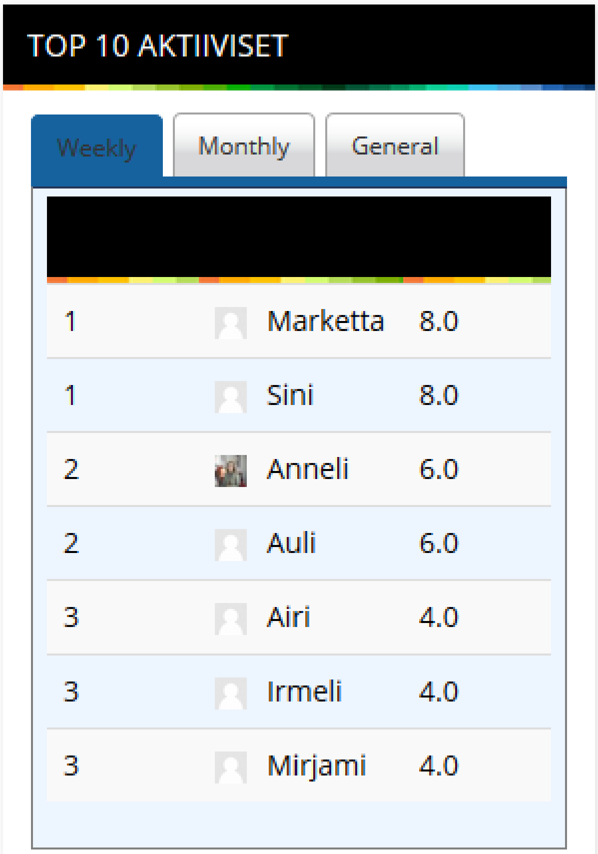

Figure 7. Top 10 activity ranking of students on a course on sustainable energy solutions. The language of this course was Finnish.

3.6. Game plugin for Moodle

Several plugins and add-ins were installed on the DIGMA.FI platform during the SeGaBu project to enable gamification. A plugin worth mentioning was the **Game** activity module (Moodle Game 2018). Game plugin builds on Moodle's questions, quizzes and glossaries, and creates a new layout on top of them. With the Game plugin it is possible to create interactive games, such as Hangman, Crossword, Cryptex, Snakes and ladders, Hidden picture, Millionaire and Sudoku. These games are, unfortunately, no team games. They are designed to be played independently. The visual layout of these games is quite simple and sometimes even harsh and old-fashioned. However, they are much better than no game layout at all.

4. Feedback and conclusions

The feedback from students revealed that discussions during the course were considered fruitful, though some activating interventions were proposed. Positive attitude changes toward gaming were reported. A teacher's presence for support, communication, and feedback was expected, even though the courses were intended for independent studying. These findings support the results made in several previous research papers such as Yunus and Salim (2008).

Some technical problems came up, and help for these situations were needed. The gamified tools did not work the way that was intended: the aim of the collectable coins was unclear, and the new progress bar did not always give the right information about students' progression, even though those were seen as good elements in the course.

According our experiences it is useful and fruitful to use gamification in an online course; it will make the course more interesting and engaging for the students thus having a positive influence on study motivation. Nevertheless, the means and tools of gamification have to be selected to suit the course and its students. This might be a difficult choice for a teacher but worth trying.

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eAMK Quality Criteria for Online Implementations

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Abstract

23 Finnish universities of applied sciences will open a shared digital courses offering in September 2018. The year-round digital courses offering will work under the name CampusOnline.fi. It will offer the students cross-studying opportunities between the educational institutions, as well as a new way of matching work and studying to shorten studying times, make study paths more versatile and, ultimately, secure better employment.

Behind the changes that are visible to the students, digital pedagogy and teachers' competences are being developed via nation-wide coaching programme. The program started early 2018 to ensure that the staff competence on digital pedagogy is up to date with the renewing operating culture and that the quality of the courses offered through CampusOnline.fi is consistent and as high as possible.

The coaching programme is based on a quality criteria for online implementations, which consists of 11 topics:

1. Target group and users
2. Learning objectives, learning process and pedagogical solutions
3. Assignments
4. Contents and materials
5. Tools
6. Interaction
7. Guidance and feedback
8. Evaluation
9. Development
10. Usability and visuals
11. Support services

The quality criteria is available online in several languages and it is free of charge. It can be used for organisation-wide development work as well as for self-assessment by teachers. In addition to the coaching programme, several Finnish universities of applied sciences have utilized the quality criteria in their internal quality development.

The workshop engages participants to try out and experiment practical ways to use the quality criteria.

Keywords: online courses offering, quality criteria

1. Shared digital courses offering by Finnish universities of applied sciences

eAMK – The new ecosystem of learning is a higher education development project funded by the Finnish Ministry of Education and Culture and carried out from 2017 to 2019. 23 Finnish universities of applied sciences are involved, and the purpose of the project is to create and open a shared digital courses offering by all Finnish universities of applied sciences all year round, providing students with extensive cross-studying opportunities. At the same time, the project involves developing digital pedagogy, teacher competence and working life co-operation towards a learning ecosystem where both working life practices and students develop through network-like and dynamic co-operation.

The shared courses offering will be compiled onto the CampusOnline.fi website, on which students can browse the selection and choose suitable courses provided by other universities of applied sciences. Students can take courses free of charge. The CampusOnline portal is based on the shared UAS summer study portal SummerSemester.fi, which has been in operation for a few years and has facilitated online learning during the summer. Last summer, the portal had more than 500 courses available. After the summer of 2018, SummerSemester.fi will merge with the CampusOnline.fi portal. At the same time, the courses will become available all year round. SummerSemester.fi has been a popular way to spend the summer among students who have not found a job or a practical training place for the summer. Feedback from SummerSemester.fi students has been positive, and the students have expressed a desire to have the courses offering available all year round.

CampusOnline provides students of universities of applied sciences with more flexible and versatile study paths, as well as specialisation opportunities – the students have more courses to choose from and can study topics that they find interesting. CampusOnline also supports the coordination of the students' studies and work, as it provides more online learning opportunities than before. The extensive online study opportunities can help students speed up their graduation and thus contribute to a swift transition to working life. From a working life perspective, the new digital education solutions guarantee that students have tools for developing their own digital capabilities for working life.

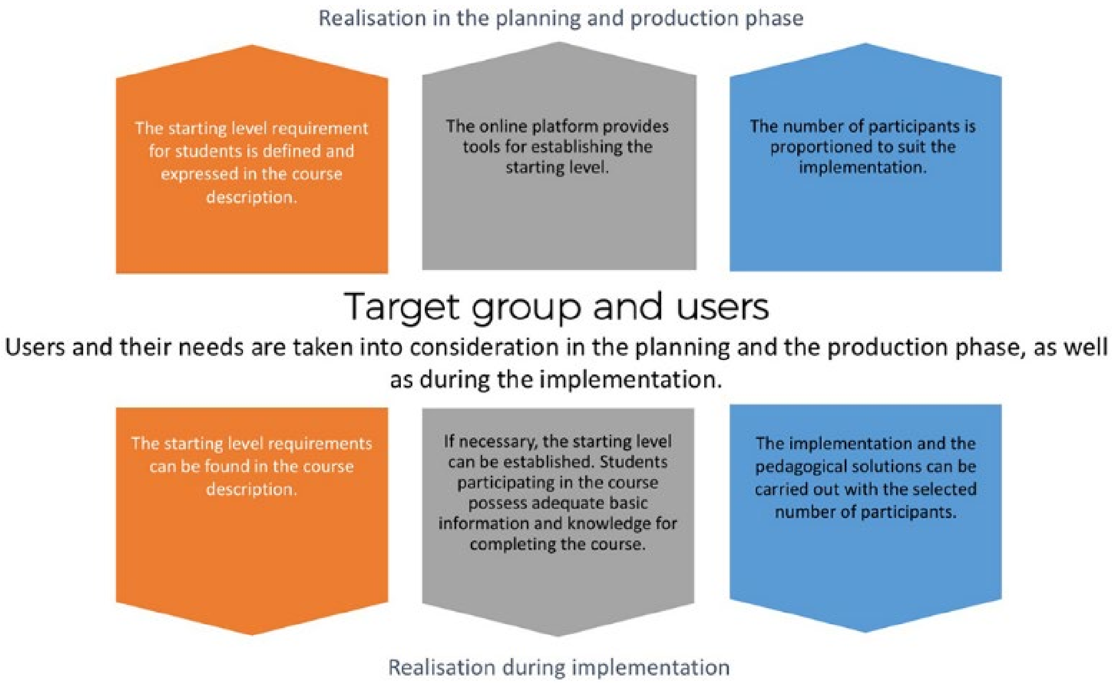
When the CampusOnline portal opens in the autumn of 2018, it will have around 60 pilot courses from more than 20 universities of applied sciences available. The courses offering will include courses from all fields, Bachelor's and Master's level studies, English-language implementations and joint implementations by several universities of applied sciences. The teachers of these pilot courses have taken part in the *Laadukas verkkototeutus* ("Quality Online Implementation") coaching programme. The coaching programme involved developing the teachers' digital pedagogy skills. The programme was based on jointly created e-teaching quality criteria, and the central theme of the coaching was guidance regarding the use of the quality criteria and support for the creation or updating of each teacher's own course in accordance with the quality criteria together with e-learning experts. This article presents the shared quality criteria.

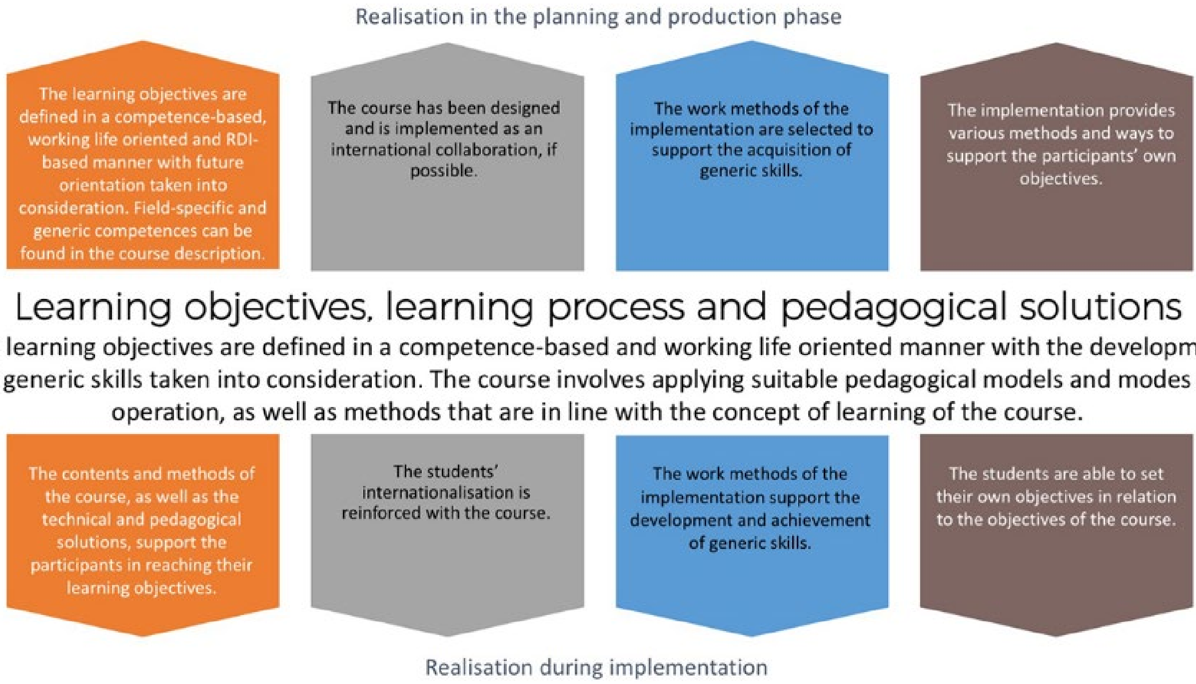
2. Quality criteria supporting the development of online implementations

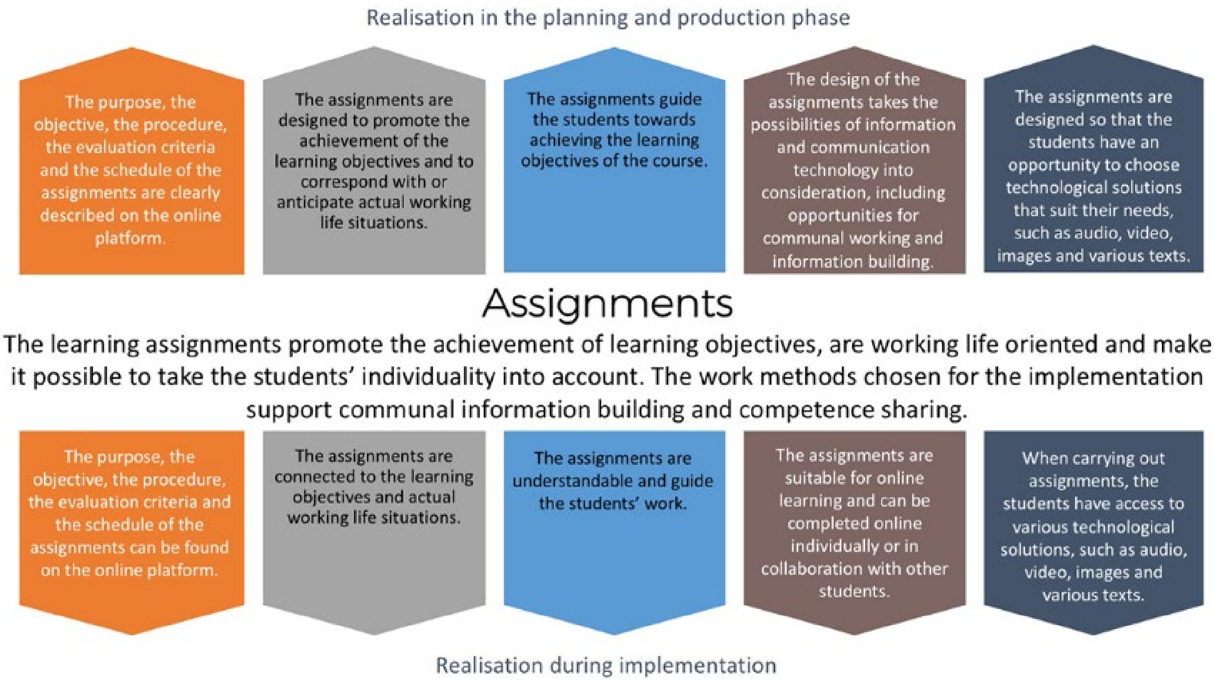
The quality of the courses provided through eAMK is ensured with a set of shared quality criteria. The criteria are utilised in evaluating existing online implementations, as well as design and development work for new online courses. The *Laadukas verkkototeutus* coaching programme of the eAMK project is built on the themes of the quality criteria, and the criteria are heavily involved in the training courses of the coaching programme. The quality criteria have also been put into extensive use outside the eAMK project, by institutions of higher education and other educational institutions. The criteria have been utilised diversely, especially as self-evaluation tools for online implementations.

Experts from institutions of higher education involved in the eAMK project took part in compiling the quality criteria. The goal was to achieve quality criteria that are as comprehensive, concrete and suitable for UAS courses as possible. Special emphasis was placed on internationalisation, working life co-operation and the perspective of Master's degree studies. Existing Finnish and European criteria for measuring the quality of online studies were utilised in the compilation process, most importantly the quality cards of the *Uutta avointa energiaa* ("New Open Energy") project and the JAMK quality criteria for online pedagogy. The criteria were exposed to open commenting online on two occasions and developed based on the criticisms received. The eAMK quality criteria were completed in December 2017. The criteria have been translated into three languages and can be utilised freely online: https://www.eamk.fi/en/courses-offering/quality-criteria/

The quality criteria consist of 11 themes, each containing 2–11 criteria. Every criterion is presented from two perspectives: 1) how it comes up in the design and production phase and 2) how it comes up during the implementation. This makes it possible to evaluate the quality of the online implementation both in the preparatory phase and when the implementation is underway.




Realisation in the planning and production phase
The learning objectives are defined in a competence-based, working life oriented and RDI-based manner with future orientation taken into consideration. Field-specific and generic competences can be found in the course description.
The course has been designed and is implemented as an international collaboration, if possible.
The work methods of the implementation are selected to support the acquisition of generic skills.
The implementation provides various methods and ways to support the participants' own objectives.
Learning objectives, learning process and pedagogical solutions
The learning objectives are defined in a competence-based and working life oriented manner with the development of generic skills taken into consideration. The course involves applying suitable pedagogical models and modes of operation, as well as methods that are in line with the concept of learning of the course.
The contents and methods of the course, as well as the technical and pedagogical solutions, support the participants in reaching their learning objectives.
The students' internationalisation is reinforced with the course.
The work methods of the implementation support the development and achievement of generic skills.
The students are able to set their own objectives in relation to the objectives of the course.
Realisation during implementation


Realisation in the planning and production phase
The purpose, the objective, the procedure, the evaluation criteria and the schedule of the assignments are clearly described on the online platform.
The assignments are designed to promote the achievement of the learning objectives and to correspond with or anticipate actual working life situations.
The assignments guide the students towards achieving the learning objectives of the course.
The design of the assignments takes the possibilities of information and communication technology into consideration, including opportunities for communal working and information building.
The assignments are designed so that the students have an opportunity to choose technological solutions that suit their needs, such as audio, video, images and various texts.
Assignments
The learning assignments promote the achievement of learning objectives, are working life oriented and make it possible to take the students' individuality into account. The work methods chosen for the implementation support communal information building and competence sharing.
The purpose, the objective, the procedure, the evaluation criteria and the schedule of the assignments can be found on the online platform.
The assignments are connected to the learning objectives and actual working life situations.
The assignments are understandable and guide the students' work.
The assignments are suitable for online learning and can be completed online individually or in collaboration with other students.
When carrying out assignments, the students have access to various technological solutions, such as audio, video, images and various texts.
Realisation during implementation

Realisation in the planning and production phase

- The contents are designed and the pedagogical solutions selected so that the students are able to combine new information with previously learned information and apply it.
- The students are guided on the online platform in terms of selecting study materials.
- The materials are ensured to be up to date and reliable. Any outdated materials have been updated.
- The online implementation utilises materials to which the institution has an access right. References and copyright information have been marked appropriately.
- An agreement has been made regarding the storage and utilisation practices related to materials produced by the students during the course.

Contents and materials

The contents and materials support the achievement of learning objectives.

- The contents help the learners combine new information with previously learned information. The contents support the application of information.
- The students receive guidance for selecting study materials that support their learning objectives.
- The teachers and the students produce and select materials that are up to date and compiled from reliable sources.
- References and access right information are included in the materials.
- Information about practices related to the storage and utilisation of materials produced by the students can be found on the online platform.

Realisation during implementation

Realisation in the planning and production phase

- The implementation utilises online tools that support the achievement of learning objectives, the pedagogical approach used and the work processes of the professional field in question.
- Downloading applications (e.g. e-books, software designed for different fields) or creating new user accounts must be based on learning objectives. Any downloaded applications must be free-of-charge and secure.
- Instructions for using the online platform and any applications and tools used, as well as creating a user account, are easy to understand and located on or linked to the online platform.
- The online platform utilises tools that enable the collection of metadata and learning analytics.
- The course description lists the basic equipment required for completing the course, as well as other necessary applications.
- The implementation is designed so that completing the course does not require an online connection that is faster than conventional connections for homes or housing companies.

Tools

The online tools support learning and learning objectives.

- The implementation involves using online tools that support the achievement of learning objectives, are pedagogically justified and are suitable for professional work processes.
- If the achievement of learning objectives requires downloading applications or creating a new user account, the matter is explained on the online platform. Any downloaded applications are free-of-charge and secure.
- Instructions for using the online platform and tools, downloading applications and creating a user account can be found on the online platform.
- The teacher and the students receive metadata from the online platform. The teacher may utilise said data for e.g. guidance, and the students may utilise the data for purposes such as monitoring the progress of their studies.
- Information about the basic equipment required for completing the course, as well as any other necessary applications, can be found in the course description.
- The course can be completed with a conventional online connection speed.

Realisation during implementation

Realisation in the planning and production phase

The implementation utilises modes of interaction and tools that support the achievement of learning objectives in an optimal manner.

Appropriate tools have been selected for collaborations with stakeholders, such as labour market representatives, and the use of said tools has been confirmed.

Interaction

Interaction supports the achievement of learning objectives.

The teacher and the students have an opportunity for mutual interaction, communal working, learning from others and sharing experiences online.

Stakeholders, such as labour market representatives, are able to easily take part in collaborations during the implementation.

Realisation during implementation

Realisation in the planning and production phase

The arrangement and implementation methods of student guidance are described on the online platform.

The implementation is designed in a manner that enables the teacher, other students and stakeholders to provide guidance and feedback during the course.

The online platform provides the students with an opportunity to participate in guiding discussions using a variety of tools.

The analysis tools of the online platform are available for supporting the students' progress and guidance.

The responsible persons, channels and schedules related to student guidance are described on the online platform.

The online platform has a channel for the students' feedback and questions.

Guidance and feedback

Guidance and feedback are timely and available for the duration of the course.

Information about student guidance and its implementation methods can be found on the online platform.

The students have an opportunity to receive guidance and feedback from teachers, other students and stakeholder representatives during the course.

The students are able to actively take part in guiding discussions utilising a variety of tools.

The analysis tools of the online platform are utilised for monitoring the students' progress, encouraging them to make progress and supporting their guidance.

The responsible persons, channels and schedules related to student guidance can easily be found on the online platform.

The students are able to give feedback and ask questions for the duration of the entire course.

Realisation during implementation

Realisation in the planning and production phase

The evaluation criteria are based on the learning objectives of the course. The criteria and evaluation methods are detailed in the course description.

The evaluation can be carried out continuously with versatile evaluation methods and tools, such as self-evaluations, peer reviews and various automatic tests.

Evaluation

The evaluation is transparent, continuous and versatile with a focus on developing reflection skills.

The implementation method, the subjects and the areas of the evaluation can be found in the course description. The evaluation is carried out in accordance with the evaluation criteria.

Evaluation takes place throughout the learning process, and it is carried out by utilising versatile methods. The students participate in self-evaluations and peer reviews using the tools of the online platform.

Realisation during implementation

Realisation in the planning and production phase

Updating and keeping the course up to date has been taken care of; the revision of aspects such as learning objectives, contents, methods, evaluation and online tools is taken into consideration in the development work.

Feedback collection from the course teachers and the students is planned and scheduled. Collected feedback has been reacted to and the implementation is developed and updated based on the feedback.

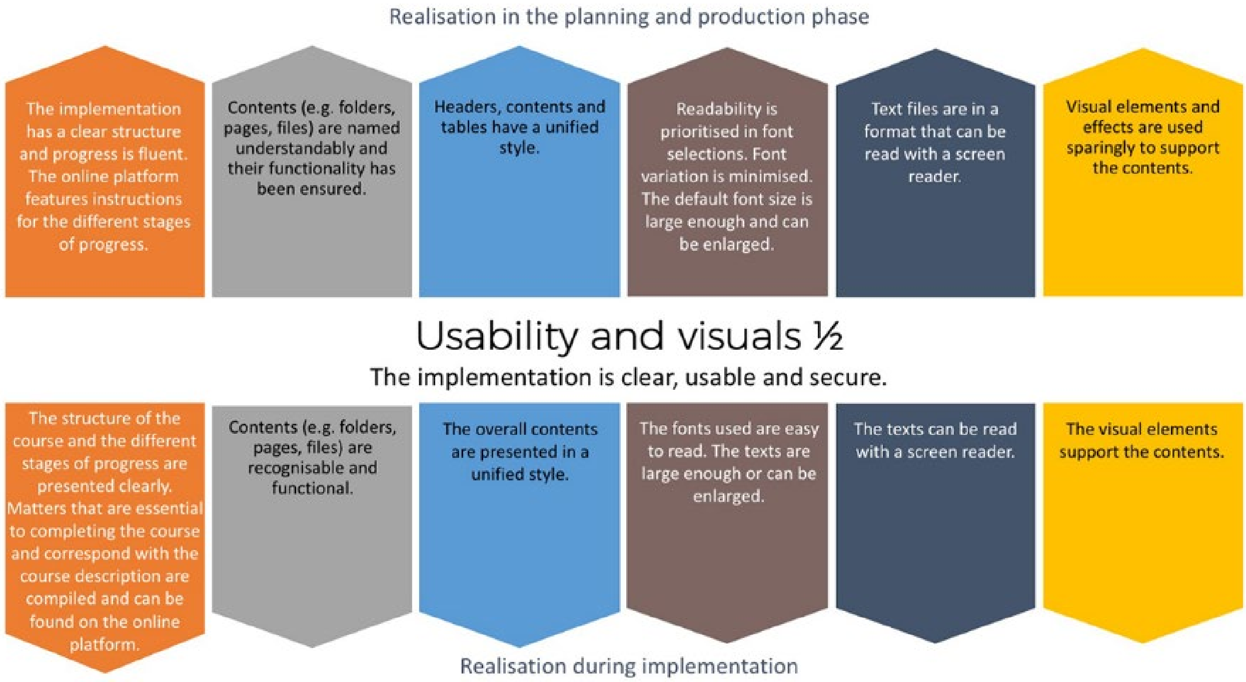
Development

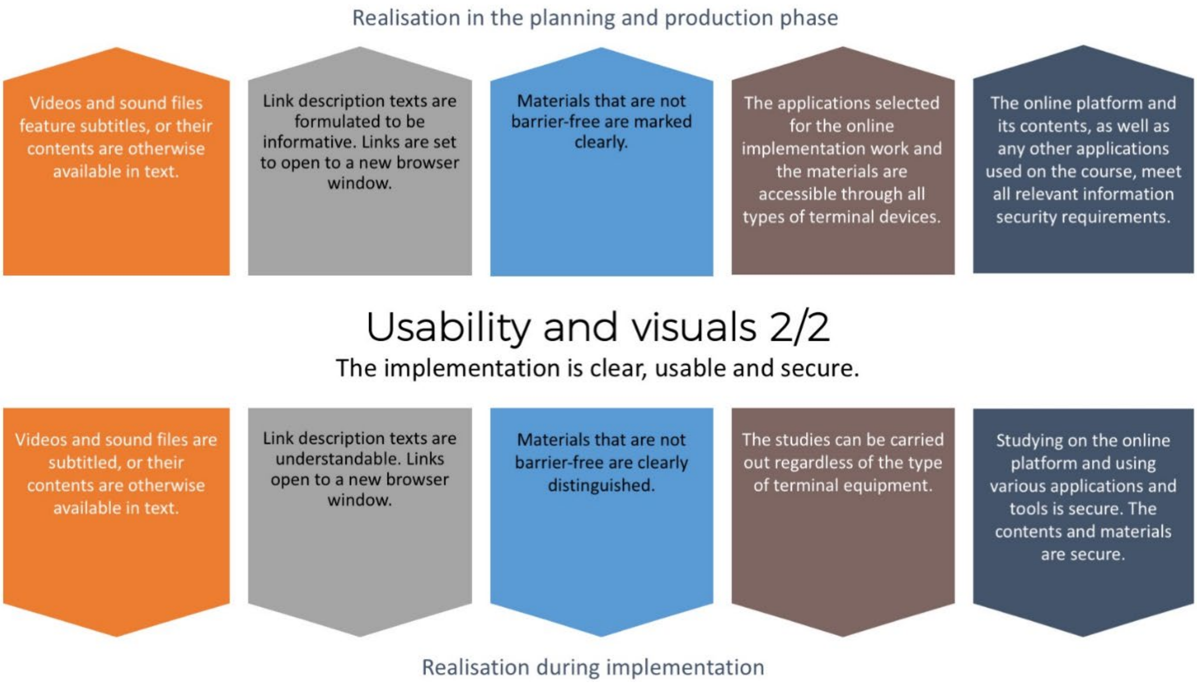
The online implementation is developed constantly.

The course is up to date and updated in terms of aspects such as learning objectives, contents, methods, evaluation and online tools.

Feedback is collected from the teachers and the students at least after the implementation. The course is developed based on the feedback received.

Realisation during implementation


Realisation in the planning and production phase
The implementation has a clear structure and progress is fluent. The online platform features instructions for the different stages of progress.
Contents (e.g. folders, pages, files) are named understandably and their functionality has been ensured.
Headers, contents and tables have a unified style.
Readability is prioritised in font selections. Font variation is minimised. The default font size is large enough and can be enlarged.
Text files are in a format that can be read with a screen reader.
Visual elements and effects are used sparingly to support the contents.
Usability and visuals ½
The implementation is clear, usable and secure.
The structure of the course and the different stages of progress are presented clearly. Matters that are essential to completing the course and correspond with the course description are compiled and can be found on the online platform.
Contents (e.g. folders, pages, files) are recognisable and functional.
The overall contents are presented in a unified style.
The fonts used are easy to read. The texts are large enough or can be enlarged.
The texts can be read with a screen reader.
The visual elements support the contents.
Realisation during implementation


Realisation in the planning and production phase
Videos and sound files feature subtitles, or their contents are otherwise available in text.
Link description texts are formulated to be informative. Links are set to open to a new browser window.
Materials that are not barrier-free are marked clearly.
The applications selected for the online implementation work and the materials are accessible through all types of terminal devices.
The online platform and its contents, as well as any other applications used on the course, meet all relevant information security requirements.
Usability and visuals 2/2
The implementation is clear, usable and secure.
Videos and sound files are subtitled, or their contents are otherwise available in text.
Link description texts are understandable. Links open to a new browser window.
Materials that are not barrier-free are clearly distinguished.
The studies can be carried out regardless of the type of terminal equipment.
Studying on the online platform and using various applications and tools is secure. The contents and materials are secure.
Realisation during implementation

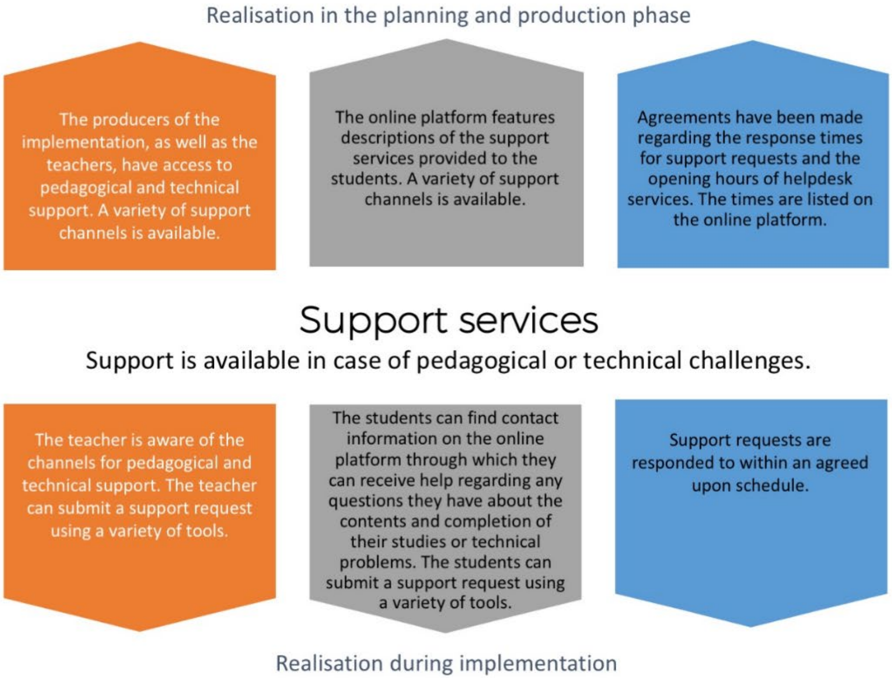


Figure 1: Quality Criteria for Online Implementations

3. Conclusions

CampusOnline expands constantly, and after the pilot phase in the autumn of 2018, universities of applied sciences will be free to bring courses to the portal. However, the aim is to maintain a high level of quality for the courses, and universities of applied sciences are required to use the quality criteria in evaluating any courses to be added to the shared courses offering. Because the courses offering is expected to expand rapidly, the courses will not be checked or evaluated by any organisation or operator. Instead, the institution of higher education or consortium implementing the course will be responsible for its quality.

After completing the quality criteria, we determined that there is a need for them beyond the eAMK project. In addition to the UAS sector, the criteria have been put into use extensively by other educational organisations, and the feedback regarding them has been enthusiastic and positive. The quality criteria are an essential part of the development work for the shared courses offering of the eAMK project. As the project progresses, the criteria will be reviewed and, if necessary, developed further based on the feedback received.

In the future, the shared courses offering will be developed with aspects such as internationalisation and working life co-operation taken into consideration. In other words, the aim is to complement the offering with studies that are produced in co-operation with international partners and the working life sector. The development will also take needs related to lifelong learning into consideration, and the aim is to open the offering for those in working life as well in the future. What is important is that all Finnish universities of applied sciences have endeavoured in close collaboration to provide their students with opportunities to select studies from other institutions of higher education as well, and they are motivated to pay special attention to the quality of the studies.

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Embedding and sustaining inclusive practice in online and blended learning

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Abstract

UK higher education data has shown persistent differences in degree outcomes for specific student groups (HEFCE, 2015; HEFCE, 2018). Consequently, the Office for Students (the UK government's higher education regulator) are funding 17 projects to address these inequalities. Building on its expertise in this area, our institution is leading the project 'Embedding and sustaining inclusive STEM practices' (referred to here as IncSTEM) alongside colleagues from two other universities, to evaluate, scale up and promote inclusive

teaching and learning practice, within Science, Technology, Engineering and Mathematics (STEM) disciplines in higher education.

There are challenges with inclusive distance learning, many of which are highlighted in STEM disciplines by the use of practical and field activities (Kennepohl, 2012), the widespread use of groupwork, and the use of text that is rich in symbolic notation (Cliffe & Rowlett, 2012). Online and blended learning approaches, including access to digital learning resources, bring opportunities for more inclusive practice, but can also lead to unforeseen and unquantified barriers for students. Integrating an inclusive approach to teaching and learning requires universities to embed and sustain practices that consider the diverse needs of students throughout curriculum design and delivery, bringing benefits to all students. The IncSTEM project is identifying examples of good practice in many areas and is evaluating and improving these so they can be scaled up across higher education.

In this paper, we present data on staff perceptions and practices regarding accessibility and inclusion; explore examples of inclusive practice, and discuss how these can be applied by practitioners in order to create a higher education environment in which students of all backgrounds and characteristics are able to succeed.

Keywords: inclusive, accessibility, STEM, online learning, distance learning

1. Introduction

Data gathered across the UK higher education (HE) sector shows the persistence of differences in degree outcomes for specific student groups, even when other background characteristics and prior attainment are taken into account (HEFCE, 2015). One of these groups of students represents those that have declared a disability; gaps exist between disabled and non-disabled students both in attainment and in progression to further study and employment (HEFCE, 2014; HEFCE, 2015; HEFCE, 2017a). This is particularly concerning since the number of students declaring a disability is also growing; in the UK there has been a 56% increase in the number of full-time, first-degree students declaring a disability since 2010 (HEFCE 2017a). In response to this, the Office for Students (previous known as the Higher Education Funding Council for England) have committed £7.5 million to fund 17 projects that aim, in various ways, to tackle these inequalities in their ‘addressing barriers to student success’ programme (HEFCE, 2017b).

It is recognised that Science, Technology, Engineering and Mathematics (STEM) subjects can create or exacerbate barriers to learning for disabled students (IoP, 2017). Activities such as laboratory work, fieldwork, or manipulation of large datasets present challenges that may be less prevalent in other disciplines (IoP, 2017). STEM degrees are also often accredited by professional bodies with specific requirements that might appear to exclude alternative arrangements for some disabled students. Online and blended learning approaches can offer flexibility for students and bring opportunities to develop more inclusive assets and activities (Cooper, 2004). However they can also lead to unforeseen and unquantified barriers for students, still resulting in requests for adjustments to learning and teaching (e.g., Paniagua and Simpson, 2017). Rather than benefitting, this can have a detrimental effect on students’ study experiences.

To minimise the alternatives or necessary adjustments for individual students requires universities to integrate inclusive approaches to teaching, learning *and* support that consider the diverse needs of students throughout their study experience. Building on its expertise in this area, our institution is leading an Office for Students-funded project on *Embedding and sustaining inclusive STEM practices* (IncSTEM) that intends to evaluate, scale up and promote inclusive practice within STEM disciplines and the wider HE sector. The project focuses on disabled students, but it is intended that creating an inclusive HE environment for disabled students will enable students of all backgrounds and characteristics to succeed.

2. The IncSTEM Project

The IncSTEM project is a partnership between three HE institutions in the UK: The Open University, The University of Leeds and the University of Plymouth, who have successfully developed inclusive approaches to fieldwork, laboratory work and other forms of STEM teaching, learning and student support. The project draws together these experiences, and others, and shares them across the UK HE sector. This paper describes the approach and work undertaken at the lead institution, The Open University, including some preliminary results and emerging themes. It is important to disseminate the early findings as a mechanism for encouraging others to consider their own institution's stance on inclusive practice, including where this could go beyond pedagogical approaches.

The Open University team have adopted a collaborative and consultative approach to IncSTEM, incorporating experiences of those involved in STEM teaching and learning and the wider network of individuals and units that are pivotal to the success of students. To that end, the institutional project team consists of STEM academics, accessibility practitioners (STEM-specific and institution-wide), digital content creators and researchers, along with involvement from other units and disabed students, as appropriate for the individual work packages that comprise the project.

The project team initially scoped out examples of inclusive practice based around on-going institutional developments, but consultation with heads of STEM departments and directors of teaching identified additional examples of good practice and specific challenges that were acting as barriers to the development of inclusive practice. Unsurprisingly, not all of these were related directly to pedagogical approaches, but were also related to institutional decision making and support structures that directly impacted on the inclusion and success of students.

The following criteria were developed to select examples from those identified for further attention:

- Student-centred: the example presented a clear focus on the perspectives of, and benefits to, students
- Necessary: the example identified a gap in provision for one or more groups of students that needed to be filled
- Impactful: the example would have outcomes that would clearly contribute to improvements across several groups and/or across STEM HE more widely
- Forward looking: the example presented an activity that would meet the needs of future students, staff or others as UK HE evolves
- Challenging: the example would be critical of current practice and offer constructive alternatives
- Innovative: the example presented a novel and interesting way of addressing a particular issue
- Simple: the example would be straightforward to undertake and disseminate
- Success: the example explored the benefits and/or pitfalls of approaches already adopted or trialled
- Excellence: the example emphasised a core competency of the institution.

Using these criteria, the project team individually reviewed and ranked 15 proposed 'work packages', and from the resulting list, eight work packages were shortlisted for development, along with a survey work package to collect qualitative information about staff and student perceptions of inclusivity. Ethical approval was obtained from the Human Research and Ethics Committee at The Open University and, where it was required by the individual work packages, approval was also granted by the two panels with responsibiliy for the conduct of research involving staff and students. This process ensured a robust check on the approach, methodology, language and sample, where appropriate.

This paper focuses on the results of the staff survey and the emerging findings from a selection of work packages that illustrate a systemic view of the factors that impact students' experiences; namely student support, curriculm specification, digital tools (online labs), and pedagogical activities. The following subsections provides a short overview of the other work packages.

2.1 Degree accreditation

It has been identified that, in some disciplines, curriculum staff feel constrained by the requirements of degree accrediting bodies, which they interpret as preventing the use of reasonable adjustments (Disabled Students Sector Leadership Group, 2017). This work package therefore addresses the relationship between teaching and learning, degree accreditation and disabled students. The team has undertaken a review of the accreditation guidelines from a number of STEM accreditating bodies to determine whether, and how, they consider and address inclusive teaching and learning practices. The competencies that accrediting bodies require degree programmes to include have been also reviewed to identify those that may present specific challenges for disabled students. The work package intends to collate reasonable adjustments that have been effective for disabled students, and work collaboratively with professional bodies to determine the extent to which these would be acceptable on accredited programmes, thereby establishing a set of examples of reasonable adjustments in specific disclipines.

2.2 IT procurement

In collaboration with staff from the institution's finance unit, this work package reviews the process and decision making when procuring software applications and delivery platforms used by students. With reference to a range of publications, such as Accessible technology procurement protocol (BDF, n.d.) and the Official Journal of the European Union (OJEU, n.d.), it will identify when, how and who should make decisions on the accessibility of third party products, and make recommendations that can be adopted internally and disseminated across the HE sector. In addition, the work package will review the post-procurement process and the steps taken to ensure students and staff have guidance on overcoming barriers to the use of any resulting system. Although initially limited to software and platforms used for teaching and learning, the procedures and decision making processes reviewed in the work package so far are the same as those used for procuring 'service' software for students and staff, so the outcomes are likely to have an impact on the inclusivity of software and systems institution-wide.

2.3 Development of an accessibility policy

This work package reviews how our institution developed a policy on accessible teaching and learning for students with accessibility needs. Many UK universities do not have such a policy, and our own institution, despite having inclusivity at the heart of its guiding mission, did not previously have one. Thus, the development, approval and implementation of this across our institution could be used as a model for others. This policy was predominantly developed 'bottom-up', gaining momentum as units progressively contributed to its development. This work package involves interviewing those involved in the policy's development, to identify the personal, institutional and political barriers and enablers that were encountered during the process. From this, it is intended to establish appropriate methodologies that could be adopted by other institutes seeking to develop similar policies.

2.4 **Discipline-specific inclusion groups**

Discipline-specific inclusion groups are a way of sharing practice and developing staff knowledge and skills around a particular subject discipline. This work package is taking an institutional example of a discipline-specific accessibility group and investigating why and how this developed, the motivations of those involved, and how it has been able to make an impact within its own, and other, curriculum areas. It is intended that this example of, and guide to, good practice be disseminated across other disciplines, and will include the confounding factors that might hinder the sustainability of such groups.

3. Survey to review staff practices and perceptions

Given the project intended to draw on existing intitutional activities, the project team joined with an existing institution-wide initiative to survey staff attitudes to, and practices in, accessibility. To that end, a survey was designed and distributed to a cross section of the following staff groups across the university to obtain quantitative data for analysis:

- Academics and curriculum management staff (those that write teaching materials, and manage the delivery of courses)
- Student support staff
- Curriculum production and technical staff (those that design, edit and build courses, i.e. media designers, editors, graphic artists)
- Associate Lecturers (those that deliver tuition and directly support students)

As part of IncSTEM, alongside responses from curriculum production and technical staff and student support staff that do not sit within a discipline, data from the academic and curriculum management staff and Associate Lecturers in STEM were analysed. These are the data presented in this paper.

The survey consisted of statements about accessibility practices and perceptions, and utilised a five-point Likert-style scale (‘strongly disagree’ to ‘strongly agree’) with a ‘not relevant’ option. The survey also asked staff to indicate their role, duration of employment, specialist area and included an open question for further comments regarding inclusion and supporting students with disabilities.

The survey questions focused on four key areas considered central to embedding inclusion:

- Knowledge and awareness of disabilities and inclusive teaching
- Skills and confidence
- Attitudes towards accessibility, inclusion and disabilities
- Effectiveness of support (e.g. training, guidance and human support).

We asked staff to state their knowledge, skills, attitudes and perception of how supported they were, and we tested their knowledge of sector-wide disability issues, such as degree outcome gaps. The questionnaire was piloted with a sample (n=42) of technical staff involved in the production of curriculum content, but no changes to the questionnaire were required; the responses from the pilot were included in the overall analysis. The final survey was hosted on JISC Online Surveys and distributed by email between July-November 2017, and *via* the Associate Lecturers’ intranet. Table 1 shows the numbers and rates of responses from the staff sample. Summary analysis was carried out using Microsoft Excel using descriptive statistics (i.e., mean, median, mode, and range). Responses of ‘not applicable’ were discarded, since they were considered a non-response.

Table 1: Sample size and response rates from each staff group targeted. Academic and curriculum management staff, and Associate Lecturers were STEM staff, while production and student support staff were

not discipline-based. N/A is not applicable, because the invitation to Associate Lecturers was open; there is no information about how many staff in that category saw the opportunity to respond.

Target	Sample size	Responses received	Response rate/%
Academic and curriculum management staff (STEM)	284	72	25.3
Curriculum production and technical staff (STEM)	248	57	23.0
Student support staff	251	82	32.7
Associate Lecturers	(Open invitation)	56	N/A

The conflated results for all staff groups revealed three key findings. Firstly, the majority of staff (96%, n=252) felt personally committed to accessibility and felt that the institute and their colleagues were also committed to accessibility (Figure 1). Secondly, most staff (73%, n=187) felt confident supporting disabled students within their role (Figure 1). When looking at individual disability categories, however, staff were relatively confident with categories such as visual, hearing and mobility impairments, but were less confident supporting students with mental health issues (48%, n=69) and students on the autism spectrum (46%, n=58) (Figure 2).

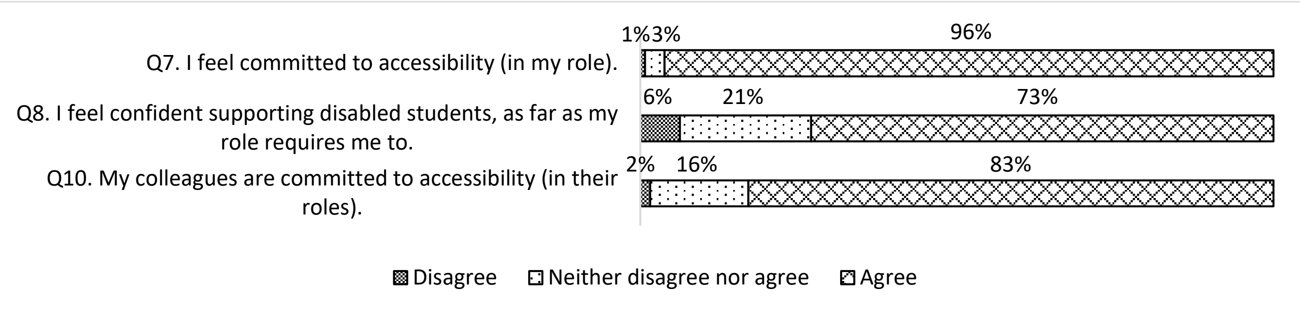

Figure 1: Responses to survey questions regarding commitment to accessibility and confidence in supporting disabled students.

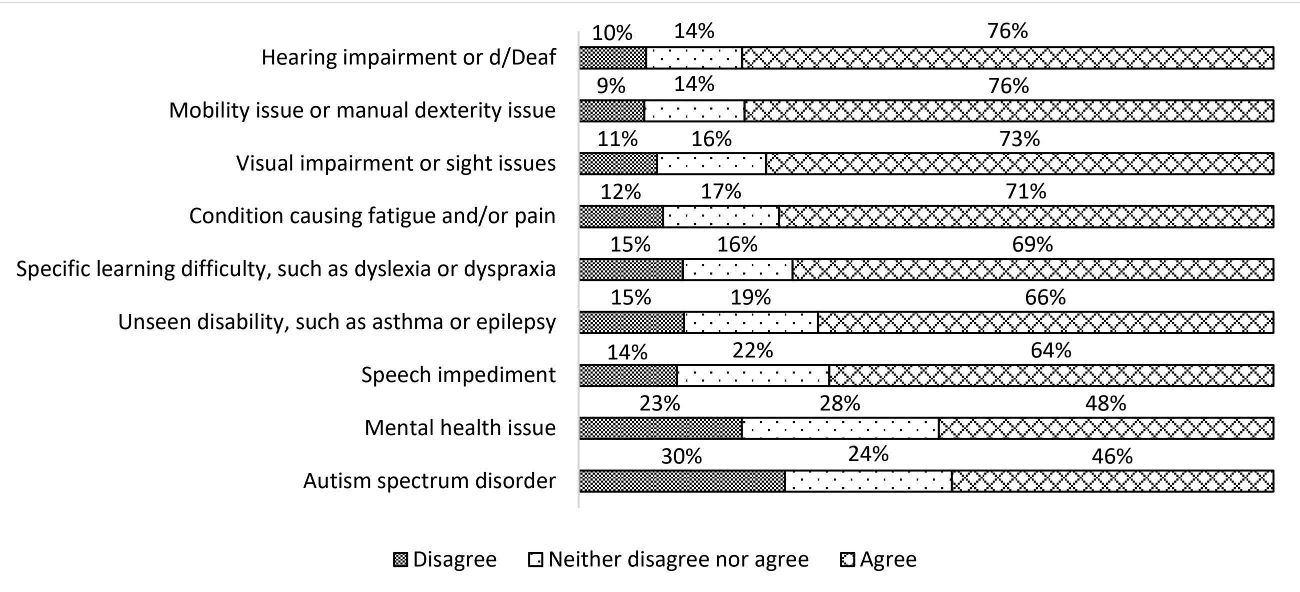

Figure 2: Responses to survey question: 'I feel confident supporting people with the following disabilities through my role'.

Most staff (81%, n=213) were confident that they could recognise potential accessibility issues, but fewer (66%, n=169) were confident that they could signpost students to further sources of support (Figure 3). Indeed, fewer staff were satisfied with the training (45%, n=115) and guidance (51%, n=132) they received (Figure 3). Surprisingly, most staff (60%, n=157) were unaware of sector-wide issues such as degree outcome gaps and fewer were aware of the internal and external barriers that students face when studying or in the world of work (44%, n=115) (Figure 4).

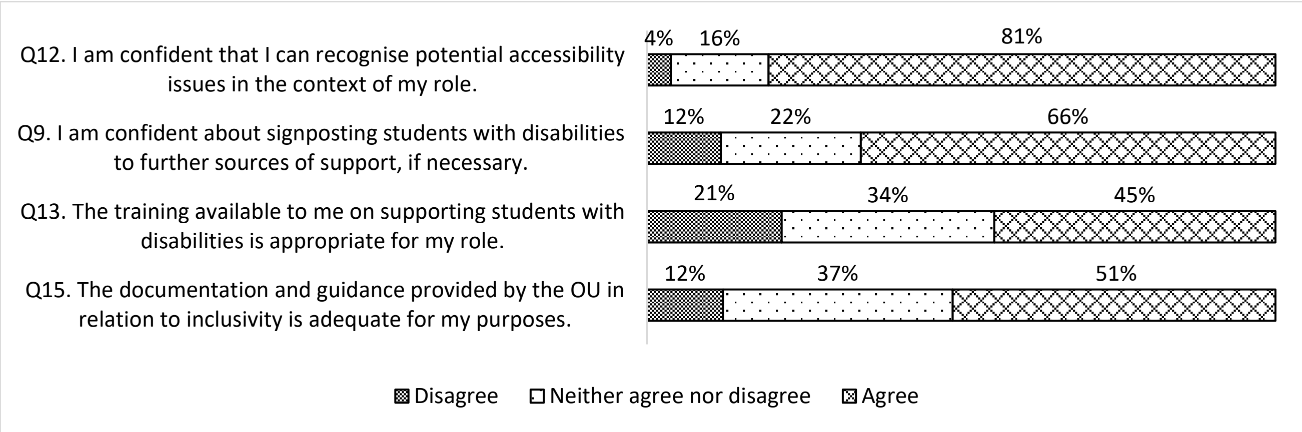

Figure 3: Responses to survey questions regarding ability to recognise potential accessibility issues and confidence in signposting students to support.

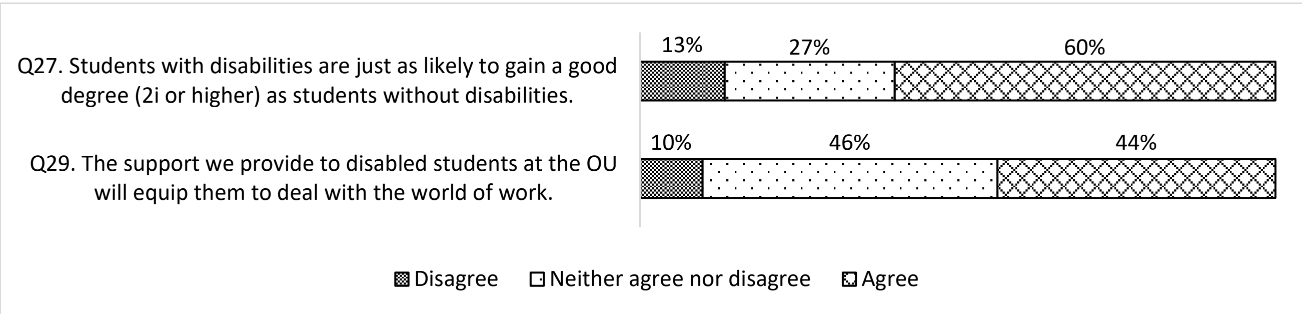

Figure 4: Responses to survey questions regarding confidence in supporting disabled and awareness of attainment gaps.

When looking at individual STEM staff groups, some additional findings emerge. Within the Academic and curriculum management group, most staff agreed (62%, n=33) that they design teaching and learning resources to be accessible and inclusive. Additionally, most agreed (63%, n=33) that they design their assessment tasks so that all students engage with them, regardless of disability (Figure 5).

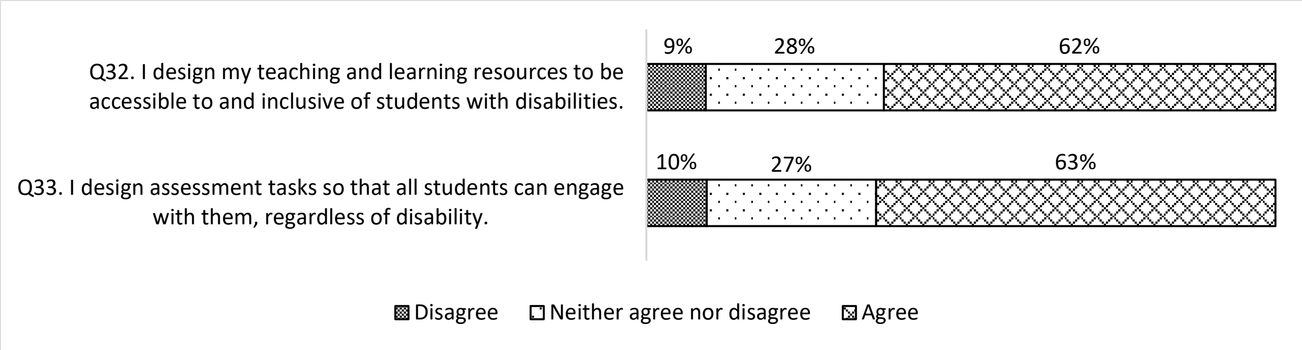

Figure 5: Responses to survey questions regarding perceived accessibility of teaching and learning.

Within the Associate Lecturer group, the majority (86%, n=48) were confident that the learning objectives set for the tutorials they design and deliver could be met by all students, regardless of disability (Figure 6). Also, the majority felt confident interacting (80%, n=44), teaching (80%, n=45) and leading face to face sessions (85%, n=45) with students with disabilities (Figure 6). This result is unsurprising since this staff group are those with the most direct contact with students.

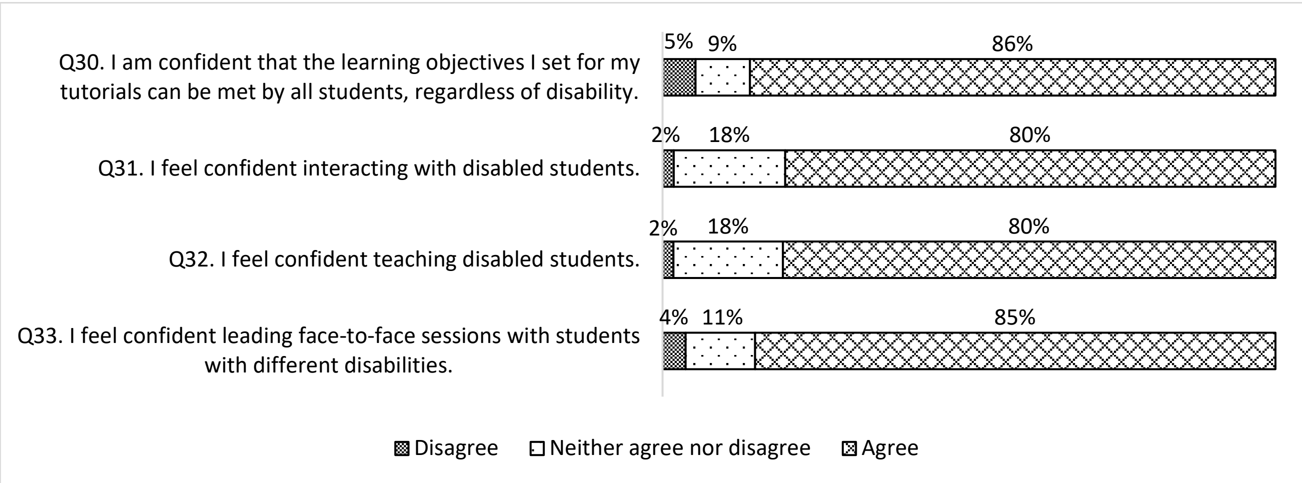

Figure 6: Responses to survey questions demonstrating the confidence levels of Associate Lecturers.

The results of this survey identify a clear need to raise awareness among staff of the internal and external support services and challenges faced by students with disabilities; given the positive attitude towards accessibility it is hoped that such training would be welcome. Further, staff need support in addressing the needs of students with mental health issues, in particular, and it may be pertinent to review the training and development of academic and curriculum management staff in the context of that provided to Associate Lecturers, who overall felt more confident meeting the needs of disabled students.

4. Inclusive Language work package

This work package focuses on one aspect of student support, namely communication with students. This builds on previous work (A Sociolinguistic Study to Investigate Student-driven Terminology, ASSIST) looking at the language students prefer to use to discuss their disability and study needs, and methods by which staff can be encouraged to adopt student-driven language norms. By adopting such approaches, students will feel more comfortable declaring disabilities and discussing study needs, thus ensuring they get the support they need to help them succeed.

The ASSIST project identified gaps between the language students use to describe their own disabilities and the language often used in university communications. The language was categorised into three models of language: a 'deficit' or 'medical' model, focusing on the disability itself and the issues it causes; a 'support' model' focusing on 'barriers and obstacles to study' and the institution supporting the student; and an 'empowerment' model, focusing on student 'needs', autonomy and 'independence', with the institution enabling and empowering the student. However, ASSIST revealed that no single language model was consistently preferred, i.e., students' preferences regarding language and terminology were highly dependent on the context of the communication and its intended message. For example, there was a clear preference for a 'medical' language model to be used for a disability disclosure question. This suggests that a one-size fits-all approach is not appropriate to choosing language used to communicate with students. ASSIST also revealed that students had strong preferences around the language used to identify people as disabled, and the term 'disabled student' (the term most commonly used in UK HE) was the least popular amongst the students surveyed, with 'student with a disability' (also commonly used in UK HE) the second least popular; although preferences did vary according to participant demographics. Instead, students considered terms such as 'additional study needs', 'your circumstances' or 'conditions that affect your study' as most appropriate, again depending on the communication context.

This finding presents a striking contrast to the official position of our institution and the language commonly adopted within HE institutions in the UK, and provides strong evidence for the value of a participatory approach to understanding the preferences of students towards the language used about them. Discourse around language and disability has also traditionally focused on contrasting different disability models, such as social or medical models, with the assumption that consistent language should be used that emphasises these perspectives.

In the Inclusive Language work package, the aim was to disseminate this message in a way that would enable greater understanding of students' preferences regarding language. To do this, the team created guidance for students, student-facing staff and researchers, and policy makers that would enable and empower them to adopt more participatory and inclusive approaches to using language. A participatory approach was taken to create the guidance, co-writing it with stakeholders and consulting widely on drafts, both within the institution and beyond. This approach aimed to ensure that the guidance was relevant and meaningful to the stakeholder groups.

4.1 **Students**

Evidence from ASSIST and elsewhere indicates that students, whatever their circumstance, are often unsure of how to engage with disability terminology (e.g., Evans, 2014; Fuller et al., 2007; Rose, 2006). In many cases students were unsure whether they were 'disabled enough' to seek support, or they felt that their study needs were 'not a disability'. Furthermore, younger students in particular, who were used to the term SEN (Special Educational Needs) used in UK schools, reported that the transition 'from SEN to disabled' was difficult for them to make. Some students do not find the information that they need because they do not consider themselves 'disabled' and do not read the infomation provided by the university for 'disabled students'. Therefore, the work package team created guidance for students on commonly-used terms that they might not know how to engage with (such as 'disabled students' allowance' and 'reasonable adjustments'), what these terms meant for them practically, and how they could engage with them. The guidance also included a section for students on choosing and advocating for their preferred language, with the intention that, although students may be required, to some extent, to engage with particular phrases, for example in official paperwork, they should feel empowered to ask staff members to use their preferred phraseology.

4.2 **Student-facing staff**

ASSIST found that many student-facing university staff, including academics, Associate Lecturers, student support staff and other roles, are unsure of what terminology to use when discussing disability. Literature in the field has also identified gaps between language used by disability communities and practitioners that engage with these communities (e.g. Kenny et al., 2016; Rosenblum and Erin, 1998). Our institution provides basic guidance on acceptable vocabulary, but this adopts a top down 'say this, not that' approach, and does not deal with the nuance and range of student preferences. Therefore, the project team created simple guidance on 'speaking to students about disability and study needs', that covered the importance of language, how to listen and mirror students' language, general demographic preferences (for situations when staff are initiating contact) and encouragement to ask students about their language preferences and record them on the university system for future conversations.

4.3 **Researchers and policy makers**

The findings of the ASSIST project are highly contextualised, and therefore a strong recommendation from the project was that other institutions replicate the study in order to investigate their own contexts. The guidance for researchers and policy-makers produced in the Inclusive Language work package provides a five-step guide for 'Improving your communication by engaging people with disabilities in the language used by your organisation'.

4.4 **Next steps**

Empowering students to make informed choices about their language, and enabling university staff to adopt more inclusive and participatory approaches to language, promotes more heterogeneous, context-driven interaction between students and university staff. This lays the foundation for greater understanding and awareness between staff and students, for more effective disclosure of study needs and disabilities, and for a more equitable study experience for students in HE. The guidance is currently being actively disseminated through formal channels, and a proposal has been made for further dissemination through a network of champions within stakeholder groups, following AIM Change Management Methodology (IMA, 2018). A plan for evaluation of the guidance and its impact is being developed for 2019-20.

5. Curriculum Specification

The Curriculum Specification work package critically reviews how inclusivity considerations become embedded into the specification, design and creation of new teaching and learning. By taking into account inclusivity at an early stage, and designing the learning content to be accessible and inclusive, learners with different needs are able to participate to the best of their ability without being required to engage with content, activities or assessment that is inaccessible to them.

The neglect of inclusivity has been found to result in increased numbers of requests for reasonable adjustments and consideration of special circumstances, as well as student complaints and lower attainment levels for disabled students (among other groups). Although frameworks and guidance are available to support this (e.g., Kingston University, n.d), the work package team explored the hypothesis that that the process of utilising a framework, guidance or template to facilitate embedding inclusivity presented its own challenges to staff that could impact on student success. The work package aimed to identify where improvements could be made to the specification process to mitigate the challenges identified.

5.1 **Approach**

The specification process was mapped from the perspectives of those that complete, review and approve the documentation in which inclusive approaches should be outlined. At our institution, this is part of a wider specification that also defines content, tuition and delivery modes, with the definition of the inclusivity aspects supported by a framework and guidance. The process of creating the specification documentation requires academics and curriculum designers to identify challenges for certain groups of students, and as a by-product, creates text for describing the curriculum in promotional material, supports allocation of budget and provides a record of decisions to which module teams can be held accountable.

5.2 **Stakeholder review**

The process mapping identified a number of stakeholders with varying responsibilities and opportunity for iput and individuals that had recently engaged with the specification process were invited to respond to an email questionnaire or one-to-one interview. This included curriculum staff (academics that define the content and curriculum management that oversee curriculum creation and delivery), inclusivity specialists (who may review the specifications before they are submitted for approval) and senior management (e.g., Directors of Teaching and Associate Deans who approve the specifications). The intention was to elicit understanding of the collective individuals' understanding of the process, identify barriers and enablers to using any framework or guidance, and any perceived limitations of the specification process itself. Initial results from academic and curriculum management staff indicate that the process of specifying inclusive approaches is too complex, administratively cumbersome and time consuming. Indeed, an unexpected outcome of this work has been to find a number of different frameworks and guidance in circulation, which added to the complexity and time commitment required from staff to navigate the process itself. Furthermore, the framework and guidance were open to interpretation, and staff were unclear of what was practically required.

In addition to this, the process of approving (and therefore validating) the specification documentation was not considered transparent; academic and curriculum management staff were unaware of whether approvers were trained in inclusivity and therefore able to adequately review the completeness and accuracy of the specification. They were also unaware of how (and whether) the specification was used, once approved. This led to the specification being seen as a procedural exercise rather than a pedagogical one, a sentiment supported by the observation that direct contribution from academics to the specification was highly variable and could be minimal.

5.3 **Next steps**

To date, the work package has focused on those responsible for completing the curriculum specification. The next steps involve evaluating the knowledge, skills and input of those that review and approve it. Recommendations around improvements to the process and a single framework and guidance are expected. Given the early emerging themes, another expected output is the raising of awareness of the importance of the curriculum specification, emphasising practical ways in which the final specification can be used beyond the approval process to set student expectations and drive the specifics of inclusive curriculum creation.

6. Online labs: OpenSTEM Labs

Many types of software simulations, whilst opening up access to STEM experiments, are often not real enough to give students suitable experiences of practical work. The OpenSTEM Labs provides students with access to laboratory work 24/7, using a sophisticated range of interfaces to archives of real data and to remote-controlled (robotic) apparatus (Drysdale and Braithwaite, 2017; Kolb et al., 2018). Access to real instruments allows students to plan experiments, make mistakes and try again and collect real data, providing a more authentic experience (Brodeur et al., 2015) and an alternative for those unable to access traditional laboratories (Colwell et al., 2003). However, making cutting-edge laboratory equipment both available and accessible online is a challenge that requires careful consideration of interface design and robust coding to link the user to the equipment for control and data retrieval. High-speed synchronous control and monitoring over the internet is significantly more challenging than simply adding a webcam and a digital control panel to existing kit. In addition, remote apparatus needs to be accessed *via* a booking system that allocates apparatus in a timely manner.

This work package investigates the inclusivity of a number of digital tools available within the OpenSTEM Labs in terms of their technical accessibility and the ways in which they are used in the curriculum (OpenSTEM Labs, 2013). Several of these tools were identified by heads of schools and directors of teaching during the consultation phase at the beginning of the IncSTEM project as being paramount to the success of students on their qualifications (e.g., digital microscopy tools), and so these have been prioritised.

6.1 The Practical Preview pilot

The OpenSTEM Labs consists of a suite of tools that are used extensively across the STEM curriculum at The Open University. Although consideration of technological accessibility is made during their development, individual students' needs still result in requests for alternatives or adjustments. Most issues with connectivity and operability are only identified at the time of first use yet adjustments or alternatives can take time to put in place, once requested. This risks some students being disadvantaged by late diagnosis of issues with functionality and their experience of online practical work is thereby degraded. Hence, as part of this work package, a 'Practical Preview' was devised to offer students an opportunity to engage with the digital tools and associated activities (equivalent to those they might encounter in their studies) outside the structure of their degree programe. To be run initially as a pilot in Autum 2018, the 'Practical Preview' is an online workshop in which disabled students are introduced to the range of microscopy tools (light microscope, petrological microscope and scanning electron microscope) that they might encounter during their STEM qualification.

The development of the workshop has been twofold, addressing technological and pedagogical inclusion. Firstly, existing tools were tested by an expert within the institution, to identify potential accessibility and usability issues that disabled students might encounter if they were using assistive technology, or if they had other, disability-related, issues. Any issues identified were taken to the OpenSTEM Labs developers to seek a resolution, and practical work-arounds were identified that students might adopt for any issues that could not be resolved. The intention is to incorporate these work-arounds into guidance documents for students to use as study companions. Secondly, the workshop content was defined, including teaching about the microscopy techniques, demonstrations of the associated digital tools, and a facilitated discussion about the tools' accessibility and usability.

The workshop will be delivered through the OpenSTEM Lab using the university's interactive web broadcasting platform, which is used within the STEM curriculum and beyond, to demonstrate and introduce practical STEM activities (e.g., Holliman et al., 2017). The workshop will be hosted by an accessibility expert, centralising the inclusivity angle, and the lab apparatus and activities will be presented by three experienced academics demonstrating the use of microscopy in different STEM disciplines. During the live broadcast, students will be able to pose questions *via* a chat box displayed alongside the live video stream. After the workshop, the students will be able to access the apparatus and try some hands-on activities, supported by a forum facilitated by moderators with relevant disciplinary and accessibility expertise. The evaluation of this pilot will determine whether the Practical Preview approach can be rolled out more widely, using other examples of the digital tools to prepare students for STEM study. The anticipated benefit of enabling students to try the apparatus outside their formal study programmes, to identify accessibility issues, and take steps to address them in good time, prior to those students needing to use them in a future module.

7. Inclusive groupwork activities

Investigating an example of pedagogical activities, this work package explores the challenges faced by disabled students when participating in groupwork, whether online or face to face, and investigates approaches that can help to mitigate these. Such tasks can include collaborative practical activities, shared presentations, data collection activities or academic debates. There are a range of challenges being considered including those faced by students with some social anxiety disorders, for whom groupwork can exacerbate pre-existing anxieties or prevent them taking part in any collaborative task. Current alternatives for these students include working 1:1 with a tutor or support person, accessing 'dummy' data or using versions of outputs from previous collaborative tasks, none of which replicate an authentic experience of groupwork.

The aim of the work package is to create tools and guidance to enable academics to create and lead groupwork activities that are inclusive, and to consider what types of reasonable adjustments may be appropriate. Furthermore, it aims to develop a guide for all students to help them think about what it means to work effectively in a diverse group. In the first instance, a focus group was held to understand disabled students' experiences of groupwork. This also explored their perspective on what curriculum designers and Associate Lecturers, who deliver groupwork, can do to improve the experiences of disabled students. Following the focus group, the team interviewed a range of staff across the institution (academics and others delivering groupwork, and staff supporting disabled students), to explore perceived barriers to inclusion, identify good practice and investigate successful (and unsuccessful) reasonable adjustments.

7.1 **Emerging themes**

Discussions with students raised the importance of how groupwork is initiated: how the tone is set by the facilitator; the icebreaker chosen, etc. They also emphasised the importance of detailed information on group activites in advance of course start, including information on dates and duration, so that they are able to plan for things like time needed for non-medical helpers, etc.

In contrast, interviews with staff have raised issues around design, such timings, group roles and the importance of making groupwork activities 'authentic'. It is clear that while conducting groupwork online is beneficial to some students, it can present additional challenges for others. For example, audio conferencing may present significant difficulties for students with hearing impairments but provide an accessible solution for those unable to reach face-to-face events. The work package team are in the process of creating both staff development materials (e.g., a slide pack of information and guidance, videos of personal stories, discussion pieces and prompts for preparation and reflection) and student-facing materials (i.e., guidance around inclusivity when working in groups and video clips such as personal stories).

8. Conclusion

The growth in the number of students declaring disabilities in UK HE has increased over recent years. To address this, HE institutes are increasingly adopting inclusive approaches to education, yet attainment gaps still exist between those that declare a disability and those that do not. The IncSTEM project was designed to identify, through a consultative approach, inclusive practices in STEM teaching and learning that could be scaled up and applied across discipines and institutes to empower educators and those that support disabled students. This paper presented the progress of a selection of work within the project, which addressed inclusion through: staff perceptions and skills, communication with students, curriculum design, online practical work and groupwork.

Some important themes have emerged even from this early work. Firstly, developing and embedding inclusive approaches to teaching and learning go beyond how to design and deliver the curriculum; they must consider the processes, services and support structures that directly and indirectly impact on students, to ensure they study in an environment which is comfortable, flexible and empowers them to learn. Secondly, staff often have the commitment but not necessarily the skills or confidence to develop and deliver inclusive approaches; a key facet of many of the work packages is that training needs have been identified. Therefore, the project is working with colleagues across the university to develop and embed ongoing professional development and training support for staff and students, building on existing good practice and informed by the work undertaken in this project. The themes emerging from the work packages are significant because they are unlikely to be unique to our own institution, or even to STEM disciplines, indeed some could be applied beyond, for example in higher education more broadly or within other public or private sector organisations.

The IncSTEM project is ongoing, and as such it is too early to evaluate its overall success. However, the project has had several early successes, and at this stage it is appropriate to publicise the achievements to date. To this end, the team welcome input from those also interested in inclusive practices that can positively affect the lives and experiences of disabled people.

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Examining engagement with an online toolkit for academic writing in blended-learning initial teacher education programmes

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Abstract

The Academic Writing Toolkit was developed by Hibernia College in 2017 in response to feedback from both faculty and students of the College's Primary and Post-Primary ITE masters programmes. This feedback indicated a need for guidance and instruction on academic writing that was both student-teacher focused and distance-learner focused. Designed for asynchronous online delivery, the Toolkit covers standard academic-writing skills such as referencing, grammar, formatting and style. It also provides tailored guidance on reflective writing, assessment writing and dissertation writing from teacher education experts. Such writing practices form a crucial component of teacher formation by fostering skills in reflective practice and critical thinking (Day, 1999; Whitehead, 2000) as well as supporting the development of teacher self-identity as practitioner-researchers (Stenhouse, 1975; Argyris & Schön, 1976). This paper summarises the theory and principles guiding the Toolkit's design and draws on a study of quantitative and qualitative data to obtain insight into students' usage patterns and their experience of the Toolkit. The study focused on Primary and Post-primary programme cohorts (n=315) and used data derived from a combination of user logs, online surveys (n=52) and student records. Ethical approval for this research was obtained from the College's Research Ethics Committee. Among the findings from the study were strong preferences expressed by students for instructional modalities that enhance the sense of teaching presence in online content (Garrison et al., 2000) and a scheduling approach that recognises the patterns and workload of distance-learning students.

Keywords: academic writing, online, toolkit, learning analytics, initial teacher education, blended learning, distance learning, inclusiveness, reflection, identity, teacher as researcher, teaching presence

1. Introduction

The ability to write academically is a key skill for students in higher education. In addition to being a pivotal tool for assessment (Lillis, 2001), the skill helps students to understand and construct subject-based knowledge (Wingate, 2006). However, it is only relatively recently that explicit instruction in academic writing has been identified as an urgent need in higher education institutions, as a response to the widening of access to third-level education and the varying levels of writing skills students bring with them (Wingate, 2012) as well as increasing cross-disciplinarity (Coffin & Hewings, 2003). In the specific context of initial teacher education (ITE) at postgraduate level, professionals who choose to retrain as teachers may be 'crossing over' from a scientific discipline to a humanities-based one and therefore lack the experience of writing discursive academic papers. The decision to retrain as a teacher may also be taken several years after leaving education; even students from humanities backgrounds may struggle with academic writing if they have not written academically in some time. The challenge for Hibernia College, which provides masters programmes in teacher education via online blended learning, is how to use distance-learning methods to improve academic writing skills – particularly given that many of its students are studying part-time and balancing busy lives with an already demanding and time-consuming academic programme. While academic writing instruction cannot be separated from subject content and learning (Wingate, 2006) and needs to be threaded throughout the curriculum, a recent review of the literature by Scott et al. (2017) highlights the increasing prevalence of defined academic writing supports in blended-learning environments. Nallaya & Kehrwal (2013) suggest that online resources – particularly step-by-step directions, models and examples – support the development of students' academic literacies in a way that is easily accessible and allows revisiting of content multiple times throughout their studies. Similarly, a study by Tuomainen (2016) of student reception of a blended-learning academic writing course highlights "convenience, flexibility and greater allowances for individual time management" as benefits of the online approach. From a pedagogical perspective, the availability of on-demand academic writing resources that can be accessed over time may even be more valuable to students than similar instruction scheduled early on in their studies; Chanok et al. (2009) concluded that writing skills instruction is more useful for students after they have received feedback on their first essays, when they were better able to understand the specific writing issues they needed to address. Online resources, however, should not be relied upon exclusively; Scott et al. (2017) highlight the need for face-to-face interactions to offer feedback and reassurance, as well as careful consideration of the technologies used for delivering writing instruction online.

1.1 **Toolkit design**

In addition to covering the 'technical' areas of academic writing – such as referencing, grammar, formatting and style – the Toolkit aims to provide discipline-specific guidance on the ethos and nature of academic writing, as well as tailored guidance on reflective writing, assessment writing and dissertation writing from teacher-education experts. Such writing practices form a crucial component of teacher formation by fostering skills in reflective practice and critical thinking (Day, 1999; Whitehead, 2000). Linked to this remit, and a key driver of the design of the Toolkit, was the concept of *teaching presence*. In their Community of Inquiry model, Garrison et al. (2000) identify teaching presence as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile outcomes". In the digital context, this process begins during instructional design and is manifest in the pedagogical and technological choices made during course development. A key requirement of the Toolkit was to harness the expertise of the College's academic staff in writing academically and, importantly, their wealth of knowledge and experience in doing so as teachers and educators. An important aim in constructing the Toolkit, therefore, was to impart to students this sense of teacher identity – the teacher as not only a practitioner but as a researcher (Stenhouse, 1975; Argyris & Schön, 1976) – through and alongside the provision of accessible academic writing instruction.

From the perspective of student experience, a crucial principle governing the Toolkit's content was that it should be 'bite-sized' in structure – no more than 20 units, and each unit should take no longer than 20 minutes to complete. This brevity and conciseness of design would, it was hoped, encourage students to use the Toolkit and not feel daunted by it. The name 'Toolkit' was deliberately chosen to emphasise the resource's utility and helpfulness, as something that students could visit repeatedly for what they need and find it without difficulty. The learning design of the Toolkit aligned with this principle by using a variety of technology-enhanced learning modalities to accommodate diverse learner preferences, situations and device usage. In keeping with the principle of enhancing teaching presence, the Toolkit featured video and podcast interviews with academic staff; Balzotti & McCool (2016) suggest that the video format, in particular, increases the motivation of students to learn when a friendly conversation style is employed.

Because of how it was envisaged to be used, the Toolkit required a different learning-design approach to the programme's core online instructional components. Unlike other online modules taken by students, the Toolkit is a non-compulsory, supplementary resource that students are pointed towards and encouraged to engage with as needed throughout their studies. As such, it was necessary to embrace asynchronous delivery and exclude quasi-synchronous approaches such as the "chunking model" (Harris & Greer, 2016). This means that collaborative-learning activities such as discussion forums, for example, would not be effective as students would log in to the Toolkit at different times and for different purposes. However, this limitation was mitigated by the fact that, during their orientation, students participate in an introductory webinar on academic writing and, later, a comprehensive research-methods module featuring discussion forums and webinars where aspects of their writing and research practices can be discussed collaboratively. The eventual design of the Toolkit successfully incorporated several features recommended by Lowenthal & Parscal (2008) as ways of incorporating social and teaching presence in online environments: student and teacher profiles, audio and video activities, reflective questions to foster critical thinking, and self-assessment opportunities. The graph in Fig. 1 gives an overview of the Toolkit's structure in terms of activity type and number.

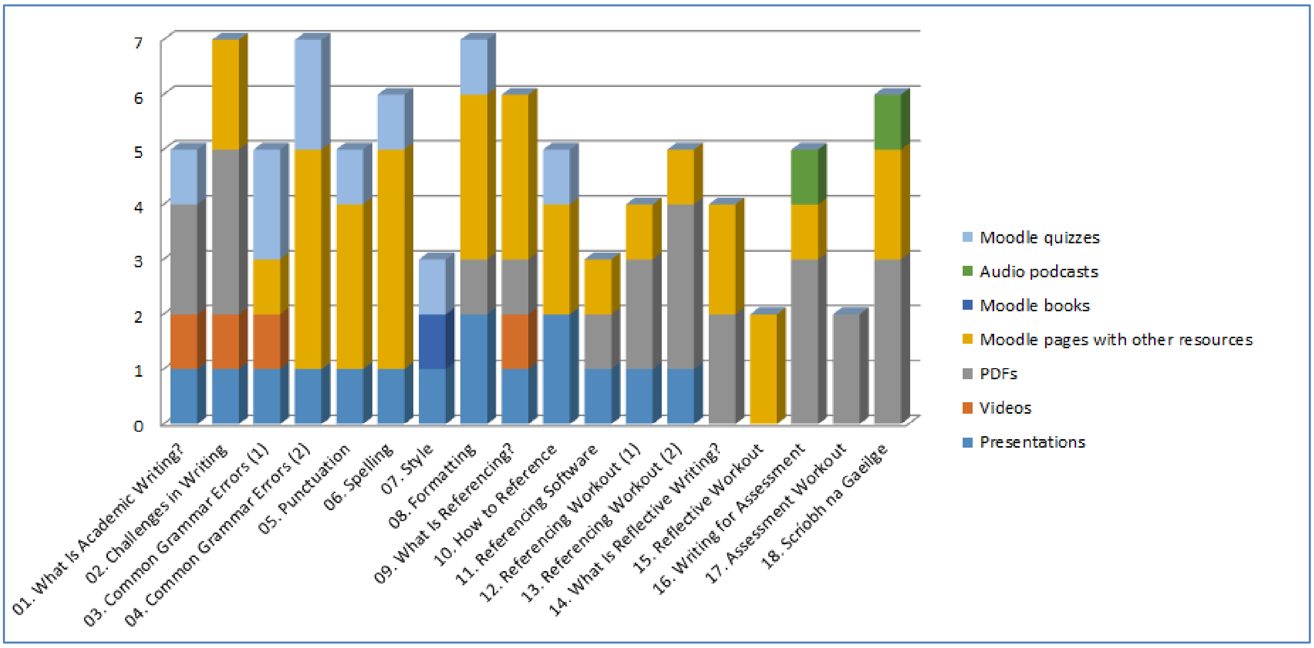

Figure 1: Activity structure of the Academic Writing Toolkit

The purpose of this study is to explore how the Toolkit was used and experienced by students during the first five months of their programme, from April through August 2017. The overarching question that can be answered by the survey data is: What do students think of the Toolkit? In examining online engagement via learning analytics, a potentially useful approach is to begin with overall activity data and then drill down into the kind of active learning tasks that are generally regarded as predictive of overall engagement – in this case, quizzes (O'Dowd, 2018). In doing this, the study aims to answer these two questions:

i. Does Toolkit activity in the first five months indicate that students might return to the Toolkit over time?
ii. Is there a relationship between quiz re-attempts and overall online engagement?

2. Methods and design of the study

The population for this study comprised all students enrolled in the two programmes that began in the College in April 2017. This cohort comprised a total of 315 students: 70 in the Post-Primary programme and 245 in the Primary programme. Although the Toolkit is not a compulsory module, all students in this cohort were asked to complete it as part of their student orientation module at the start of their academic programmes. The data for the study was derived from two sources: activity and completion logs from the Moodle VLE and an anonymised, voluntary post-module survey conducted online. Analysis of VLE activity logs provides a range of proxy measurements of student engagement with course content: time spent logged in, downloads, patterns of use, contributions to activities, and scores achieved in graded activities. The challenge with such data is in its interpretation and in how to use it to improve learning, a need that is driving the growing field of learning analytics (Rienties et al., 2016; Ferguson & Clow, 2017). The VLE data in this study is first analysed to draw some inferences from students' (n=315) online interaction with the Toolkit resources over the first five months, particularly with a view to ascertaining if there is evidence of repeated, formative engagement. An inferential analysis explores whether there is a relationship between levels of student engagement with the content of the Toolkit, expressed as the number of online events logged in the VLE, and the extent to which students interact with Toolkit quizzes formatively as an iterative learning tool. The survey results will also be analysed to identify salient patterns and themes in students' responses and, it is hoped, give some additional insight into the analytics data findings.

2.1 Ethics

Ethical approval for this research was obtained from the College's Research Ethics Committee, and the research was conducted within the parameters of the College's research ethics guidelines, which align with those of the British Educational Research Association (BERA, 2018). With regard to participant consent, all students enrolling on Hibernia College programmes sign a Data Protection Statement as part of their registration. As the purpose of this research was to improve the design of online content, it is covered by the College's specification of "aggregate or anonymised information gathered [and] used/published to feed back into internal academic research [...] and overall programme enhancements including programme design, content, delivery and validation" (Hibernia College, 2018). Participant consent was thus obtained for the use of secondary data through the students' signing of this form. Moodle VLE is a fully secured online learning environment that adheres to international data protection standards. All data from the VLE and the online survey have been subject to a stringent anonymisation process in the first instance, ensuring that no personal information is retained or discernible. The survey was completely anonymous and conducted outside of the VLE to ensure the impossibility of linking responses to student IDs. Students were informed, on the survey home page, that participation or non-participation in the survey would have no effect on their academic progression, grades or records. They were also informed that the data generated would be used to improve the quality of the Toolkit and that, while data may be used in published reports and papers examining aspects of online delivery, this would always relate to trends and patterns at the cohort level only and personal information would never be included. In addition, students were informed that survey participation was entirely voluntary and they could exit the survey at any time. The data for this study will be stored on a password-protected securely-stored external drive in compliance with ethical and legal data-protection requirements.

3. Analysis

i. Does Toolkit activity in the first five months indicate that students might return to the Toolkit over time?

The activity data graphed in Figure 2, below, shows that, although logged student use events for the Toolkit are far more frequent during the first two weeks of release than thereafter, there are occasional peaks of use in later months – for example, at the beginning of May, end of June and middle of July, all of which correlate directly to release dates of module assignments. Use events, in this instance, capture student activities such as viewing a page or activity, clicking on an activity link, attempting a quiz and submitting a quiz attempt.

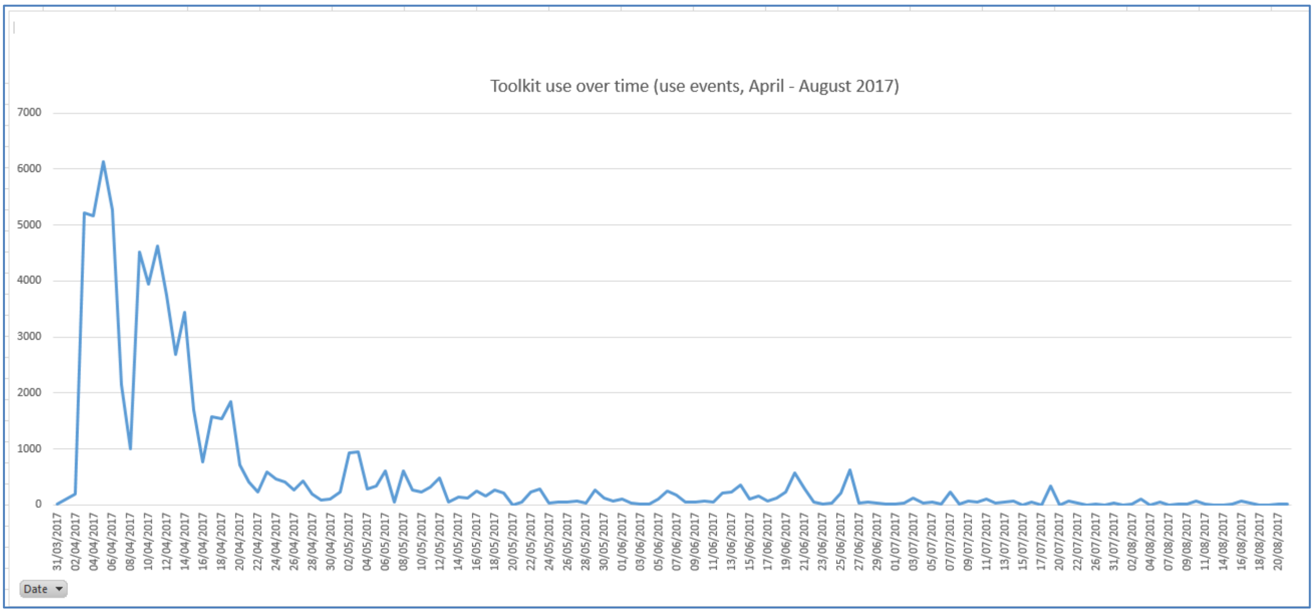

Figure 2: Toolkit use events from April through August 2017

Overall, it appears that interaction with Toolkit activities decreases considerably after orientation, with small numbers of use events in evidence thereafter.

ii. Is there a relationship between quiz re-attempts and overall online engagement?

A Pearson correlation test was used to determine if there is a relationship between the number of times quizzes were re-attempted and the degree of engagement with other (non-quiz) activities in the Toolkit. This test involved 201 participants, a subset that had both engaged with the VLE non-quiz activities and completed one or more quizzes. Table 1 summarises the descriptive statistics for the two variables to be correlated.

Table 1: Descriptive statistics for quiz re-attempts and overall online engagement variables

Variable	Min.	Max.	Mean	Standard deviation
Quiz re-attempts	0	8	1.488	2.3497
Online engagement	0	733	264.846	174.247

A moderately positive correlation was found in relation to the number of quiz re-attempts and the number of interactions with non-quiz activities, and the correlation was found to be statistically significant ($p < 0.0001$, $r = 0.562$; $n=201$). The result is significant at $p < 0.05$. Figure 3 shows the graphed correlation and line of best fit.

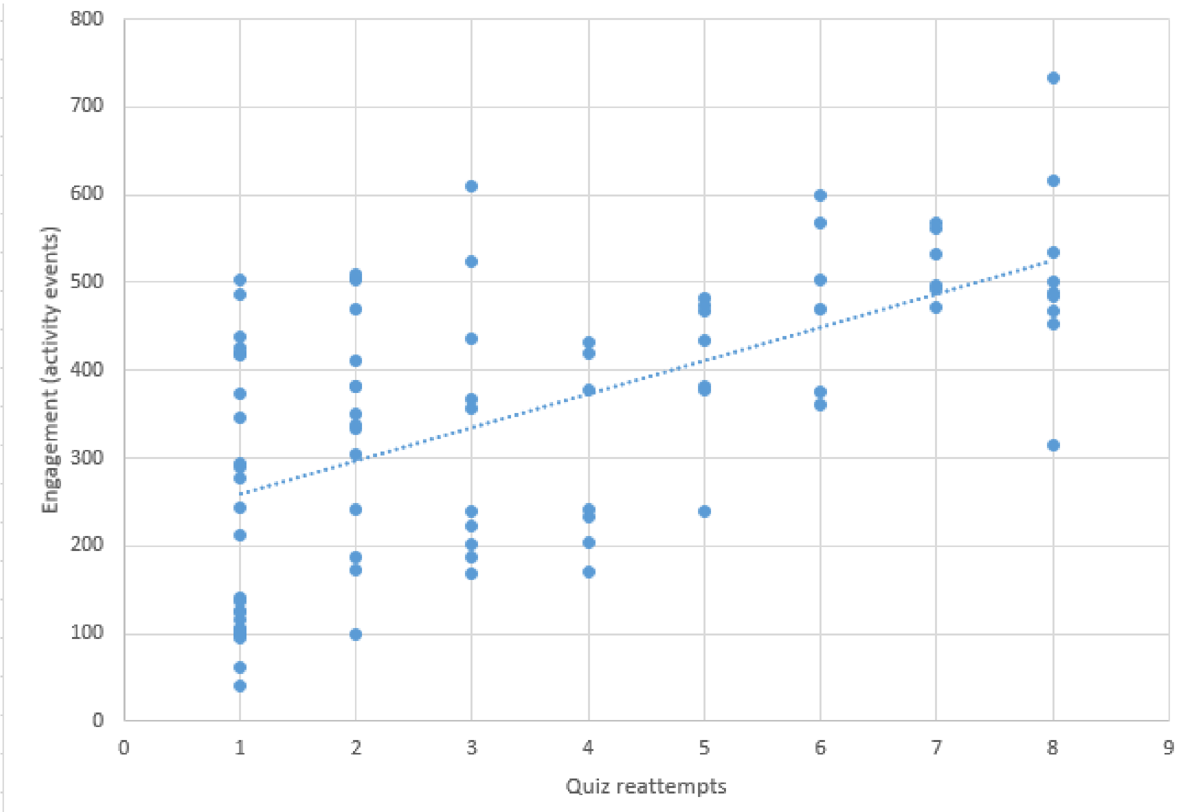

Figure 3: Scatterplot of correlation between engagement and quiz reattempts

iii. What do students think of the Toolkit?

There were 52 respondents to the online survey, representing 16% of all students who accessed the Toolkit units from April through August 2017. The age groups and gender of the respondents are shown in Figures 4 and 5 respectively.

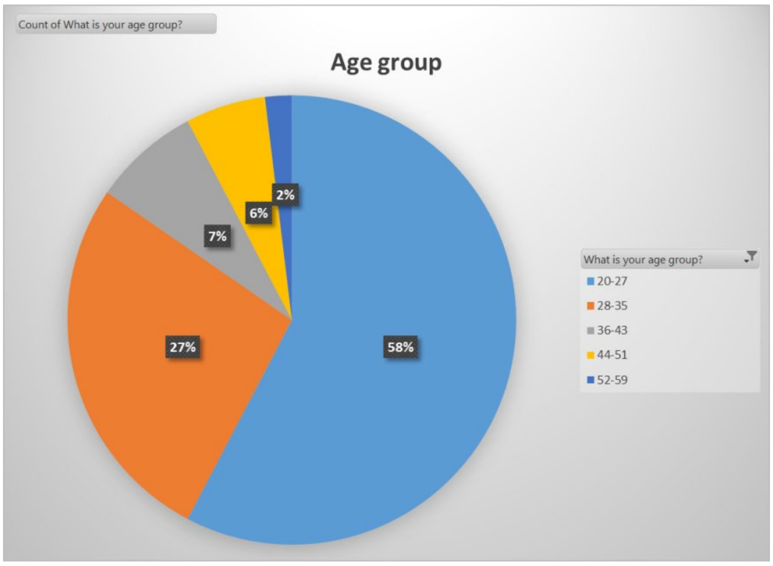

Figure 4: Respondents by age group

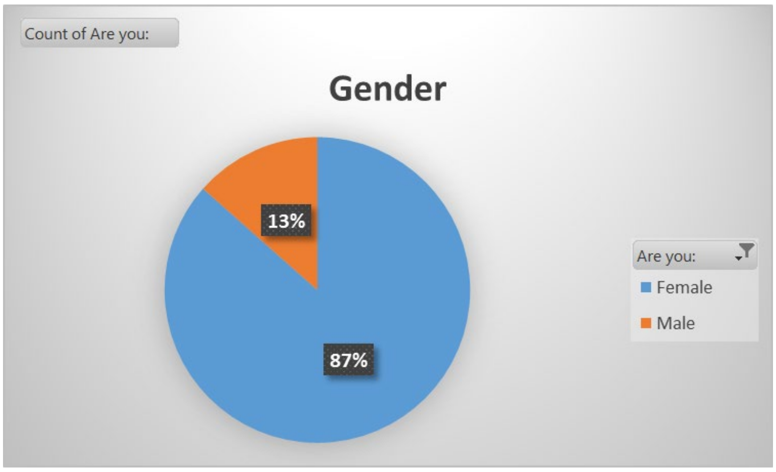

Figure 5: Respondents by gender

Analysis of free-text responses on the Toolkit's usefulness shows a number of predominating themes, which are graphed in the bar chart below (Fig. 6). By a substantial margin, referencing was cited as being the most useful aspect of the Toolkit, with reflective writing coming second in terms of frequency of mentions. This suggests a level of unfamiliarity with reflective writing among students; the fact that more than half of all responses that mentioned reflective writing as being useful also mentioned referencing (Fig. 7, below) suggests that both are perceived as areas in which similar levels of support are required. Grammar and assessment writing were also identified as useful. Interestingly, those who completed this question tended to adhere to unit topics rather than comment on aspects of the Toolkit such as mode of content delivery. The only exception to this was two mentions of the video content of the Toolkit as being useful.

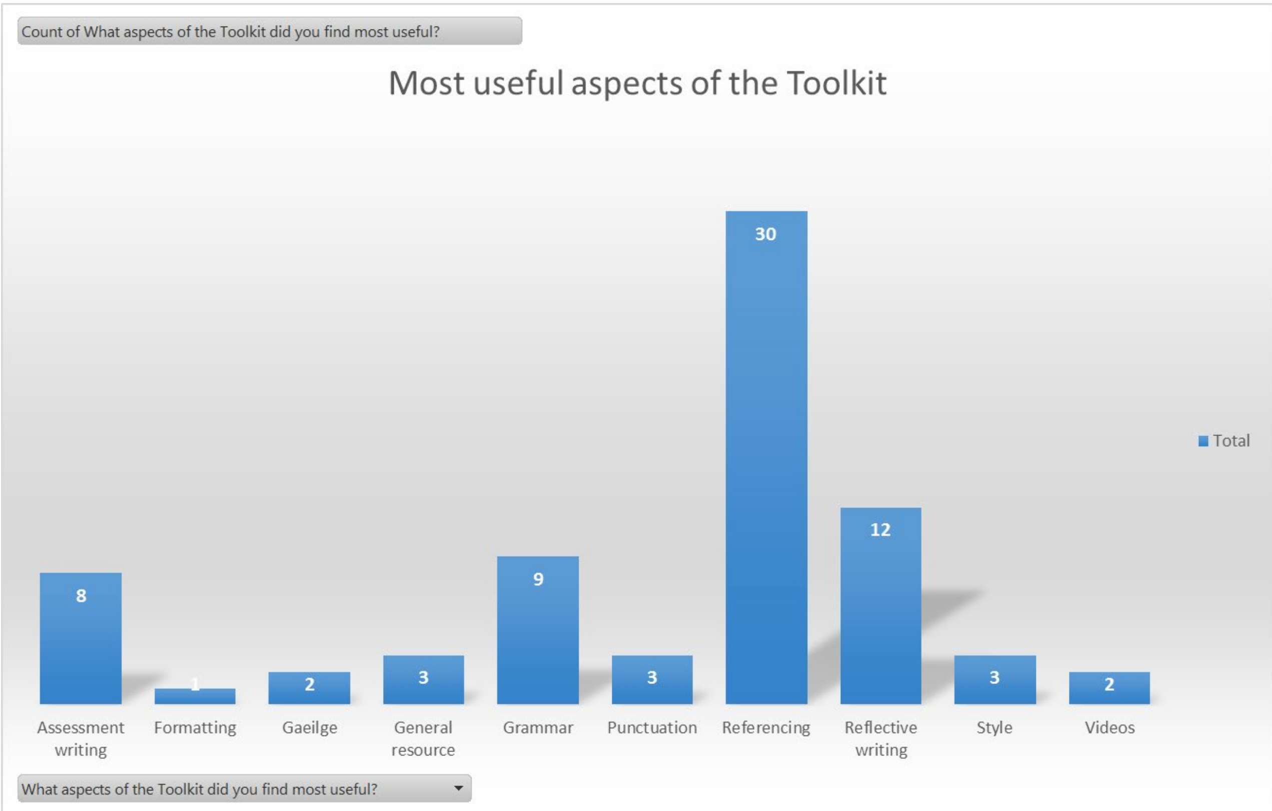

Figure 6: Most useful aspects of the Toolkit as expressed in free-text responses

What aspects of the Toolkit did you find most useful?
Referencing, reflective writing, Scriobh as Gaeilge
Referencing and Reflective Writing
Referencing section and reflective writing
Referencing, reflective writing and assessment writing
The section on reflective writing and the refresher on referencing
I found the referencing and reflective writing very helpful
referencing and reflective writing

Figure 7: Comments mentioning both referencing and reflective writing as useful

Analysis of free-text responses on suggestions for improvement are graphed in the bar chart below (Fig. 8). The most frequently mentioned area for improvement was the volume of content covered in the Toolkit, which some students felt should be reduced. One student said that it was "slightly overwhelming trying to cover all these areas in very first 2 weeks of course"; other students suggested fewer exercises as a way of reducing the time needed to complete the Toolkit. Another student found the Toolkit "very time consuming" to complete but added that "there is not much information that you could cut out". Some comments focused on modes of content delivery, suggesting more videos and podcasts and the inclusion of webinars, tutorials and forums. This would appear to indicate that students place a high value on teaching presence in the area of academic writing instruction, as they do in other aspects of their programmes. Eight respondents commented that they felt no improvements were necessary and that they were fully satisfied with the Toolkit as it is (Fig. 9).

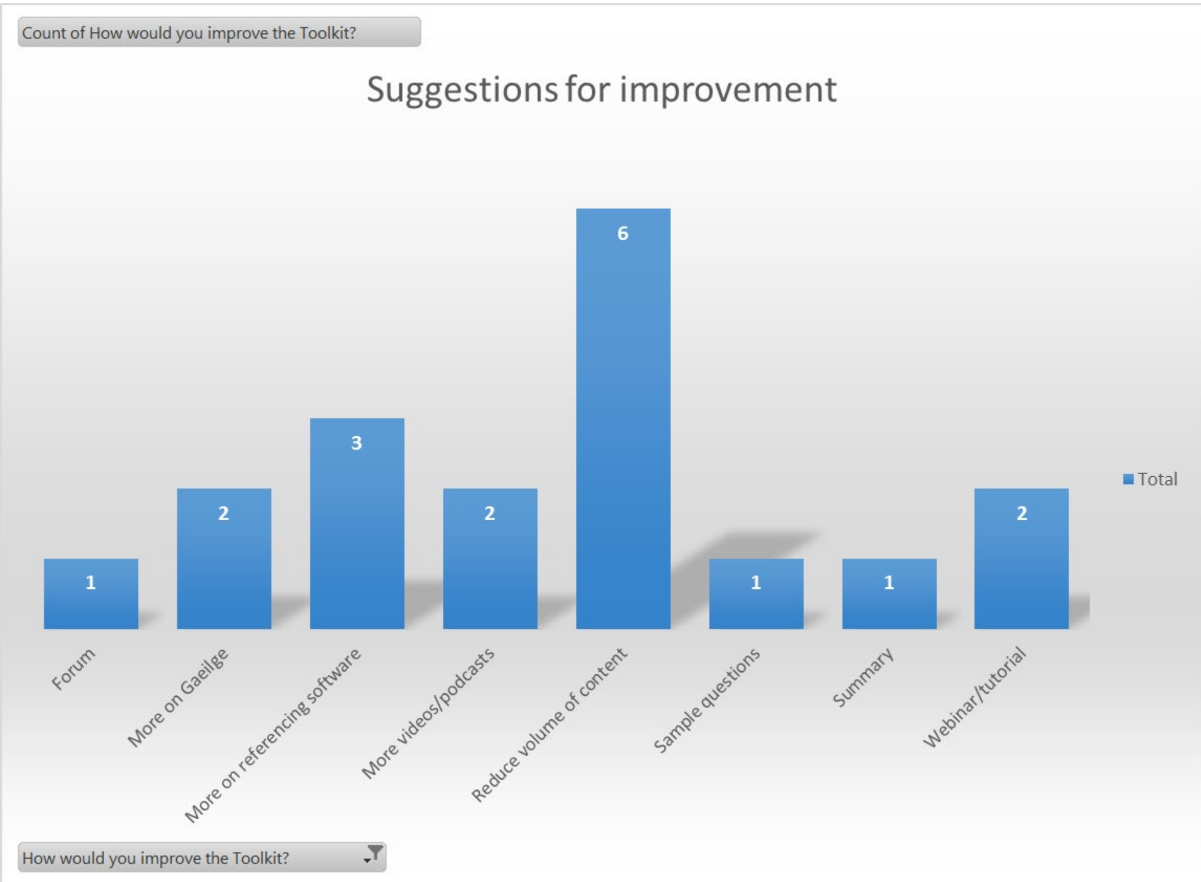

Figure 8: Suggestions for improvement of the Toolkit as expressed in free-text responses

How would you improve the Toolkit?
I would not improve anything. It was very helpful.
Cannot see any problems
I think it was really useful.
Nothing. very informative and very well laid out.
NA
I found it very helpful and interesting.
I think it is effective as is. I appreciated it greatly, thanks.
I think ye've thought of everything!

Figure 9: Comments indicating full satisfaction with the Toolkit

4. Discussion

Interpreting learning analytics may be viewed as an art as well as a science; as a discipline still in its infancy, there is a growing need for reliable frameworks for interpretation as the body of research grows. In using learning analytics, it is necessary to acknowledge its limitations and recognise what the data cannot capture. Among the key limitations of this study is the short period of time it covers, meaning that meaningful longitudinal data analysis was not possible. This limited the study's ability to draw firm conclusions about the first research question concerning students' revisiting of the Toolkit as a resource over time. Within the parameters of the available data, however, it seemed clear that the Toolkit was not being used in the manner envisaged. This provided a body of evidence, albeit partial, from which to examine what might be producing this outcome. In addressing the second research question on the relationship between the incidence of students re-taking quizzes and the level of engagement more generally, one interpretation of the evidence suggests that students who engage more with online content may be more likely to use the quizzes in way they're intended – as formative tools for learning rather than as summative tests. While more research is needed in order to establish the direction of this relationship, it establishes a link between the two areas, offers a useful proxy measurement for student engagement and, crucially, contributes towards the evidence base for enhancement of online engagement through learning design.

The survey responses suggest that students' experience of the Toolkit has been positive, with the majority of comments expressing positive opinions about coverage and quality. Nonetheless, it is possible to discern from the data some areas for improvement and future inquiry. One enhancement that would respond directly to student feedback is the repurposing of some of the Toolkit content (where possible) in formats such as video and audio, to enhance teaching presence and a sense of a community of inquiry. Tutorials and forums were also mentioned as possible improvements, although the nature of the Toolkit's temporal use would make these difficult to implement. A more explicit connection between the Toolkit and the other academic writing supports (modules, webinars and forums) could be drawn to highlight the breadth of support available and the Toolkit's role in this. Many survey respondents expressed a feeling of being overwhelmed by the volume of content, and this may have been exacerbated by the requirement to complete the Toolkit in two weeks during the orientation, when they were already absorbing a lot of information. This raises the question of how the Toolkit should be 'promoted' to students and whether it should or should not form part of the initial orientation in future cohorts. A more sustained approach whereby faculty and student-facing staff take a proactive role in guiding students towards the Toolkit at key points throughout the programme might be more beneficial. It is, however, important to recognise and plan for the eventuality that, as their programme progresses, students' workload will increase and pragmatic decisions regarding time spent on non-compulsory content will come into play.

Potential research beyond the scope of this study could use learning analytics to examine in more detail students' time on task and ascertain the accuracy of the completion time estimates provided with each task and unit in the Toolkit. Because the survey was anonymous and user data was anonymised, it was not possible to correlate individual student logs to survey responses. If such analysis were possible, it could yield interesting findings about the alignment of students' perceptions of the Toolkit and their online learning behaviours. It would be useful to continue to look at analytics data longitudinally to assess whether the Toolkit is, as envisaged, a resource that students return to for help throughout their programme. Of course, the ultimate aim of the Toolkit from the beginning has been to improve students' academic writing, and research should eventually be carried out, in collaboration with the programme teams, to examine whether and to what extent use of the Toolkit has impacted the quality of the writing and research produced by the students.

5. Conclusions

This study aimed to answer three research questions relating to student engagement with and experience of the Academic Writing Toolkit: whether the engagement observed in the first five months indicate that students might return to the Toolkit over time; whether there is a relationship between quiz re-attempts and overall Toolkit engagement; and what students' experience of using the Toolkit was. Patterns of engagement suggest that there was a fall-off in engagement with the Toolkit following the first two weeks, with minor resurgences of engagement at points where assignment submissions were due in other modules. The study found a moderate correlation between quiz re-attempts and overall Toolkit engagement, suggesting that students who use quizzes formatively are likely also to be more engaged online. However, this is not a straightforward causal relationship. Surveyed students' experience of the Toolkit was generally positive, with proposals for improvement falling under two categories: more teaching presence, and more regard for the scheduling needs of distance-learning students.

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Exams taken at the student's home

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Abstract

During the last two years, we have conducted an experiment of proctored exams taken at the student's home. The proctoring is carried out by the webcam and an application allowing the supervisor to interact in the student's screen. This experiment has been realised thanks to a project of the french higher education ministery and in partnership with FIED within a European project. The first important result is to note that there is no significant difference in success rates between the online proctored exam and the traditional exam taken at university sites. Others results are interesting on the quality of the experience lived by the students, on questions as different as the stress during the test, the impression of intrusion in the private life, the possibility of cheating, the absence of the teacher during the examination, the contact with the remote supervisor...

Last October, we launched a public market offer to find a proctoring provider enabling us to increase number of students registered at our institution. Then, we work with a French company, Managexam. Last February, 45 students took 191 exams at home around the world. The quality of the work with Managexam, its adaptation to our constraints and the positive feedback from students encourage us to further develop online exams proctoring.

More widely than distance learning students, online proctoring could also provide interesting solutions to all the students who have troubles to access to classical exams for several reasons (long life learning, disability, sickness, …).

Keywords: online proctoring, remote examination

1. Introduction

Our article deals with the modification of examination conditions for students enrolled in a full distance learning higher education course. Evaluation of distance learning on learning platforms (LMS) can allow individual and group activities, but these activities are not monitored. For examinations, the conditions and identity verifications must be as robust as if the examination took place in the institution.

Today, in most cases, students enrolled in a distance learning course must travel to the university to take their examinations, which are held synchronously with the students studying on campus and with the same exam subject. In some cases, universities have foreign partners who can arrange examinations near the student's place of residence. This solution may be, on the one hand, costly in terms of administrative organisation, or even impossible for large numbers of students on the other. It is also financially expensive for students and becomes impossible when time differences are too great. Students currently have difficulty understanding that training activities and support from online platforms at home are possible, but that they must continue to travel purely to take the exams at the institution. We found that many distance students choose to take their exams only at the end of the second semester during the "catch-up" exam session which, therefore, ends up being their only exam period, violating the rules of fairness for students. It is easy to understand that for students who live far from the university and especially for students abroad, or students who work, going to university can be expensive (asking your employer for leave, transport, hotel costs, accommodation and so on). For some students, this constraint may even be the reason they decide not to enrol in programmes when they are offered online. This problem makes distance learning unattractive for potential students. Different solutions are now available for remote examinations and can solve this problem. These methods must be tested and evaluated according to their cost, security, resistance to fraud, stress on students and conditions of implementation.

This paper describes how we are using examinations supervised by a webcam at the student's home (and screen-sharing with the proctor). Our students are Master degree students in the field of health management enrolled in the e-learning modality.

2. Online proctoring

We describe here the work that began with an experiment which has been carried out since December 2015 at the University of Caen Normandie. This involves testing in real conditions (i.e. with students during training and assessment) alternative examination methods to face-to-face onsite examinations as part of distance learning. In the first part, we explain the context of the experiment. In the second part, we report on the progress of the experimental sessions. Then we provide some results from the sessions from the administrative point of view and the candidate point of view.

2.1 Context

During the past two years, we have conducted an experiment to remotely monitor exams taken at the student's home (Beust & al. 2016, 2017); this remote monitoring being carried out through a webcam and an application which allows the invigilator to control the student's computer. This experiment was carried out as part of a DGESIP/MESRI (Ministry of Higher Education, Research and Innovation) AMI MiPNES 2016-2018 project, in partnership with FIED (french association of higher education distance learning), and as part of the European Erasmus+ OP4RE project. The results have been very encouraging, and an extension of the experiment is underway.

Notably, the first important finding to emphasise is that there is no significant difference in success rates between the online remotely monitored examinations and the examinations taken traditionally at university sites. Next, several results are interesting regarding the quality of the student's experience on issues as different as stress during the exam, perceived intrusion into private life, the possibility of cheating, lecturer absence during the exam, contact with the remote invigilator and so on.

In October 2017, we launched a public call for tenders (MAPA) to find a service provider who would enable us to offer remote examination monitoring to an increasing number of students registered at our institution. We have since been working with a French company, ManagExam.

The remote monitoring of examinations in e-learning courses is interesting for two reasons:

- It provides the flexibility students demand
- It raises the question of examination methods in a genuine re-consideration of pedagogical engineering, in particular by responding to a need for alignment between learning and teaching and evaluation methods. Constructive alignment (cf. Biggs, 1996) is used in the field of educational sciences to describe a quality feature of a learning program. There is constructive alignment when learning objectives and activities are linked to the kind of evaluations used in this learning program. It’s clearly not the case when exams are not taken online in e-learning programs.

2.2 Protocol adopted

At the beginning of the academic year, registered e-learning candidates volunteer to have their examinations conducted using remote monitoring at home. Before volunteering, they must check on a test platform that their technical equipment and conditions (microphone, camera, bandwidth) are adequate to allow remote monitoring. Depending on their personal situation, and, in particular, their geographical remoteness, we are selecting a number of students who will benefit from the service. This is what allows us to manage our costs for the benefit of those whose need is greatest. Students who are not selected for remote monitoring will be invited to the University of Caen Normandie in the usual way. The selected students sign an online form declaring that they accept responsibility for the technical requirements of the examinations.

The students selected must take a short practice exam before the first examination session where there is no paper to submit, purely to have experience of the examination protocol:

- The students connect to the provider's site;
- They install an applet which replicates their screen for the invigilator;
- They are connected with an invigilator;
- The invigilator asks each student to show the webcam an identity document proving that they are the person expected for the examination;
- The invigilator asks the student to turn their webcam through 360° to obtain a complete view of their work environment;
- He/she asks them, with a mirror or a smartphone in selfie mode, to show the screen of their machine, their keyboard, their desk etc.
- The invigilator gives each student access to their exam;
- The invigilator remains online throughout the test, monitoring the webcam, the student's activity on the screen and any sounds in the room where the student is working;
- At the conclusion of the examination, the student submits the paper and disconnects.

The submissions are sent to the University, and reports on the progress of the tests can be consulted by the University's distance learning managers, with the option of consulting the videos taken. If a student deviates from the examination rules stipulated by the University, the invigilator will inform the student and prepare an incident report. The examination proceeds to its conclusion, and the University decides on possible disciplinary action based on the reports and videos.

3. Results

In total, for the year 2018 (over two sessions: February and May), 45 students took 191 exams at home in the four corners of the world. Before these 191 exams, we organised, at least once with each of the students, a remotely monitored practice examination, i.e. a subject without questions requiring the submission of a blank paper. In total, 63 practice exams were carried out during the year (a total of 254 remote monitorings). The purpose of these practice exams was two-fold:

- To check, for each student, the feasibility of remote monitoring in relation to their technical circumstances (already tested under normal conditions by the student using the online verification tool set up on the provider's site)
- To show to the students, through experience, how their exams would actually take place without them discovering the conditions on the very day of the first examination.

Here are some results:

- Success rate: overall, similar to classroom exams. If the subject was adequately designed to be completed in two formats, "paper" and "electronic" copies, the success rates are very similar. We found some differences when the subject required the production of tables and diagrams requiring a little more time to produce with a word processor than in writing;
- Less than 5% of technical problems, primarily identified during practice exams and requiring students to organise themselves differently;
- One case of cheating detected;
- Was the teacher's absence during the exam an inconvenience for the students: no, it was not a problem for 92%, on the contrary, apparently it was likely to reduce their stress levels;
- Students' feedback on the ability to cheat, the feeling that it would be easy to cheat: 70% felt as closely monitored as in an examination room or even more so!
- Only 2% of students felt it was an invasion of their private lives;
- 80% would do it again and would advise a friend to do the same;
- 90% are satisfied and prefer to accept the technical requirements of the examination to having to travel.

4. Discussion

Our experience with remote monitoring naturally encourages us to extend the service to all students registered remotely at our institution who need it. At the University of Caen Normandie, 1331 students are enrolled this year in a 100% e-learning course. A good number are not geographically remote and can free themselves to take their exams on university premises. It can be estimated that about one-quarter of these, about 350 students, is the real target audience for remote monitoring. At an average of five exams per student, this would represent a volume of 1750 remotely monitored exams per year.

We note above all that the success of the remote monitoring of examinations outside traditional university premises requires significant human support for the students, even if the monitoring itself is entrusted to a quality provider. Prior management of the students, providing them with information on the procedures, following up their examinations, communication with administrative and teaching staff, and frequent contacts with the service provider were estimated this year at the equivalent of half-time for a learning technology staff member within our distance education department. In addition to the human cost of student support, the university's IT and data protection services (Direction des Systèmes d'Information, Correspondant Informatique et Liberté IT) were called upon for CNIL advice and approval of the service within the framework of the GDPR.

The personnel costs involved, and the price charged by the provider (€10 exc. VAT per student and hour of monitored exams) encourage us to work on an economic model for the extension of the service. So far, we have made a choice not to pass on these costs to students because we were financially supported within the framework of a Ministère de l'Enseignement Supérieur, de la Recherche et de l'Innovation (Ministry of Higher Education, Research and Innovation) project. This question will arise in the future.

The quality of the work with the service provider, its adaptation to the constraints of the university environment, but above all the very positive feedback from students on the service provided and the attractiveness of distance learning encourage us to further develop remote monitoring, both within our institution and nationally with FIED.

5. Conclusions

In the context of the development of lifelong learning in public higher education, flexibility in learning and teaching methods is a necessity. The offer of education to all, while respecting increasingly complex and heterogeneous constraints and lifestyles, is guaranteed to be attractive. Although digital technology has already significantly changed distance learning (by moving from the correspondence learning and teaching model to e-learning), certification and examination procedures still need to evolve in the same way. Indeed, one of the current barriers to the attractiveness of online distance learning is still having to travel to take exams. Our work is helping to make methods of remote monitoring of examinations in the student's home proven and reliable. Through the FIED network, we seek to share our experiences with the distance learning centres of French universities. To this end, we are in the process of finalising a framework agreement between FIED and the company ManagExam (the service provider used by the University of Caen Normandie). Through this framework contract, universities will have easy access to a-quality service and shared expertises.

Looking more widely than the general public in distance learning, remote monitoring could also provide interesting solutions to the development of hybrid presence-distance learning and to the problems of disabled students enrolled in face-to-face sessions who do not necessarily have easy access to examination rooms and who often benefit from part-time attendance.

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Federated Electronic Practical Resources using PILAR as VISIR Integrated Tool

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Abstract

Practical training is a pillar in technical education. Traditionally, these benefits have been acquired through hands-on laboratory sessions. However, at present, the educational models tend to rely on distance education tools either totally (e-learning, m-learning, etc.) or partially (b-learning). To provide practical training in those educational scenarios is challenging. Remote laboratories —real laboratories, working on real systems and under real conditions, controlled remotely— can play a fundamental role. Nevertheless, remote laboratories not only provide advantages but disadvantages of both environments involved in the process: real laboratories and remote communications. Furthermore, remote laboratories add new limitations due to constructive constraints. VISIR (Virtual Instruments System In Reality) is a remote laboratory on top of the state of the art for wiring and measuring electrical and electronics circuits, but VISIR system has his own particular restrictions

like any other remote lab. In this context, PILAR (Platform Integration of Laboratories based on the Architecture of visiR) Erasmus Plus project development aims for a federation of five of the existing VISIR nodes in Europe: Blekinge Institute of Technology (BTH), Spanish University for Distance Education (UNED), University of Deusto (UDEUSTO), Carinthia University of Applied Sciences (CUAS), School of Engineering of Polytechnic of Porto (ISEP). This paper describes the benefits that PILAR project will provide to the consortium, and how these physical constraints of the VISIR system can be compensated through the federation, after one year and a half of the project development and having the first draft of the federation and website running.

Keywords: Remote Laboratories, Federation; Practical Competences, General Electronics Practical Environment, Open Educational Resources, VISIR, PILAR.

1 Introduction

Distance education has become widespread in the last decade and has fostered lifelong learning and continuing education patterns, allowing access to learning resources at any time and from anywhere. It has been possible thanks to the internet development and technologies associated with learning tools for a new teaching pedagogy. To support life-long learning and students' autonomous learning activities, remote experimentation has become a challenge in electronics courses. The way the universities and educational organizations or institutions deliver remote experimentation to students in distance learning environments has become a challenge.

Nowadays, there is an extensive variety for providing theoretical contents in distance learning (videos, documents, tutorials, scaffolding activities, peer-to-peer reviews, forums, etc.) to students. These tools, by an efficient and appropriate selection from professors and use from students, can complement or replace successfully in-person education, even they can reach some aspects that in-person education cannot achieve. Unfortunately, practical issues are not as developed as theoretical ones are. A first approach to this problem is clearly the use of simulators and virtual labs. Although, they are still a bit far from providing to the students the real performance and features of equipment under real-life operating conditions. The major challenge is the provision of laboratory working online along with the theoretical contents in a massive context.

The essential difference between remote laboratories and in-person laboratories results from how the interaction between student and workbench is performed. Therefore, remote laboratories have very limited ability to provide manual skills; However, physical presence is only a subjective mental reality (Sheridan, 1999), (Biocca, 2001). The possibility of a direct comparison between the different alternatives is constrained by a lack of uniform criteria with which to evaluate the effectiveness of laboratory. Therefore, it is impossible to conclude that any type of laboratory is superior to another objectively, but also each one provides different learning outcomes (Ma & Nickerson, 2006; Naef, 2006; Nedic, Machotka & Nafalski, 2003).

A review of the current literature shows a great number of universities or organizations that have created their own virtual and remote laboratories to support life-long learning and students' autonomous learning activities (Jara et al., 2011; Rojko, Hercog & Jezernik, 2010).Remote labs provide flexibility to learning scenarios, "the concept is about providing new possibilities for students to do laboratory work and become experimenters by adding a remote operation option to traditional instructional laboratories to make them more accessible for students, irrespective of whether they are on campus or mainly off-campus" (Gustavsson et al, 2007).

Remote laboratories also provide controlled and safe scenarios at the expense of flexibility. This loss of flexibility when experimenting is due to the protections and constraints established by teachers in the design stage of the experiments and limitations established by remote lab operation. For example, destructive experiments that students may be carried out erroneously in in-person laboratories, cannot be allowed in remote labs. But sometimes, this loss of flexibility in the interest of safety also limits the students' freedom, thus limiting students' options to explore. Some of these limitations cannot be overcomed. However, a federation of VISIR, systems such as the one proposed in PILAR, establish a new scene for electronics remote experimentation. PILAR is an Erasmus+ PILAR project that aims to interconnect the partners' VISIR remote laboratories, creating a grid of shared VISIRs in order to expand and empower the circuit repository of all participants: each institution may design certain experiments and their students perform these experiments and others installed at other institutions, and vice versa. But PILAR project is not only for institutions with a VISIR remote lab installed, it would be also possible for an organization without VISIR to participate. This paper aims to describe the PILAR project: the need and reason of PILAR, its goals and challenges.

2 VISIR remote laboratory

VISIR is a remote lab for electric and electronic circuits experiments developed at Blekinge Institute of Technology (BTH) in Sweden and in use in several universities all around the world (Garcia-Loro et al., 2018). In VISIR the traditional equipment (DC-power source, function generator, multimeter and oscilloscope) are replaced with an equipment platform, which is suited for remote control such as PXI (PCI eXtensions for Instrumentation), LXI (LAN eXtensions for Instrumentation) and GPIB (General Purpose Interface Bus) (Gustavsson et al, 2007). Therefore, VISIR is a real laboratory as hands-on laboratories are, but designed for remote control interaction.

The VISIR project started in 2006 at the Department of Signal Processing, BTH, in cooperation with National Instruments and Axiom EduTech and with financial support from VINNOVA (Swedish Governmental Agency for Innovation Systems). However, VISIR origin is in 1999 "to ascertain that it is feasible to design a remote electronics laboratory comprising standard equipment to supplement local instructional laboratories and provide free access to the experimental equipment to students enrolled in circuit analysis and electronics courses" (Gustavsson et al, 2007).

VISIR remote laboratory can be divided into two blocks: The hardware block —instrumentation platform and relay switching matrix— and the software block —experiment client, measurement server and equipment server—.

2.1 Hardware description

The instrumentation platform of VISIR is based on PCI eXtensions for Instrumentation (PXI) from NI. The NI PXI platform consists of a controller card (embedded/external PC), instrument module cards (DC power supply, digital multimeter, oscilloscope, and function generator), and a chassis into which all the cards are plugged. The terminals of the NI PXI-modules are connected to a relay switching matrix. The matrix communicates with the controller through a USB cable. All the equipment described is shown in Figure 1.

The relay switching matrix is a stack of "PCI/104" sized boards. The matrix installed at UNED consists of three instrument boards and 10 component boards. The matrix can house up to 15 component boards at maximum. Each component board comprises 10 sockets and each socket is connected to a Double-Pole Single-Throw (DPST) relay, four of these sockets can be connected instead to 2 Single-Pole Single-Throw (SPST) relays. So, each component card can accommodate 6 two-leads components (6 DPST relays), and 8 single pole connection which is used to allocate any type of component and provide flexibility in order to optimize sockets. The circuits are constructed in the matrix by opening/closing relays with regard to the received circuit design from the controller. The connection of the NI PXI-modules' terminals through the instruments cards and the components' leads on a common 10 nodes (A-I, 0) propagating through all the boards of the matrix.

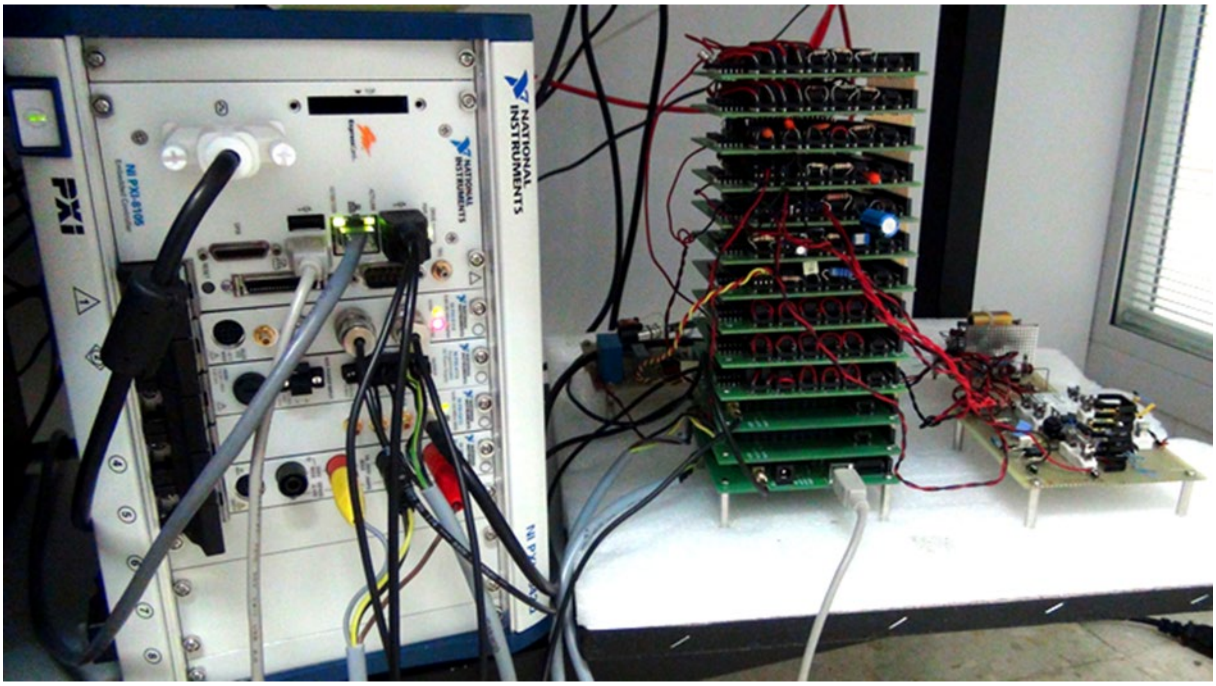

Figure 1. VISIR hardware at UNED.

2.2 Software description

The VISIR software is an open-source that is released under GNU General Public License (GPL):

- Experiment Client: It is the Graphical User Interface (GUI) and the simulated workbench of VISIR as shown in Figure 2. The user drags the selected components to the virtual breadboard, wires his/her circuit, and configures the instruments. When the user wants to experiment with his/her designed circuit, presses the "perform experiment" button. The designed circuit created by the user is transferred first to the "Measurement Server" in form of an XML-based protocol, called "Experiment Protocol".
- Measurement Server: It is a software application written in Microsoft Visual C++. It is responsible for the periodical authentication versus database during sessions for more security, queuing simultaneous requests, and verifying designed circuits created by users versus maximum allowed parameter values listed in the "maxlists" (i.e. these lists are configured by the teacher depending on the specification of the available components) in order to avoid hazardous circuits. After validating and sequentially arranging the requests, it starts to send them in order to the "Equipment Server".
- Equipment Server: It is a software application for instrumentation control developed by LabVIEW and hosted in the NI PXI controller. It receives users' verified circuit designs from the "Measurement Server" in "Experiment Protocol" format and executes them through the physical equipment. Eventually, the results return back to the users on their PC-screen (i.e. in the instrument interfaces) with the same sequence.

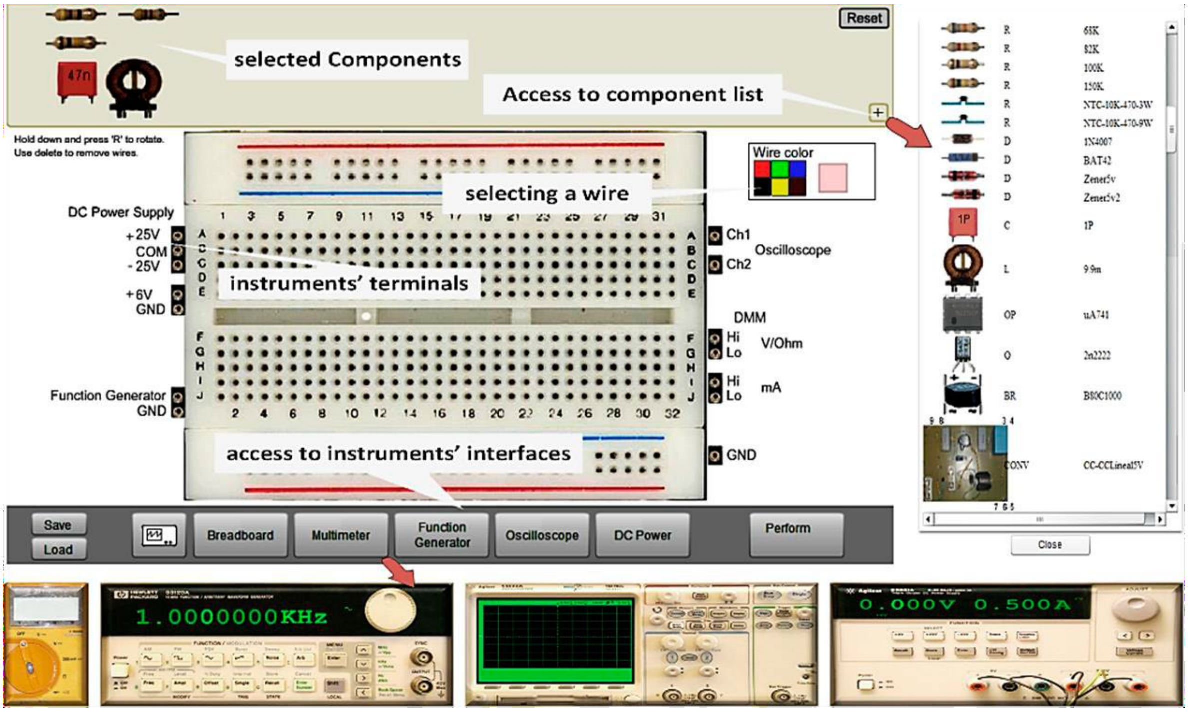

Figure 2. Simulated workbench of VISIR.

2.3 VISIR reliability

So far, VISIR remote lab units are installed in thirteen different Higher Education Institutions (HEI) from eight different countries: in Argentina at National University of Rosario (UNR) and National University of Santiago del Estero (UNSE); in Austria at CUAS and FH Campus Wien for Applied Sciences; in Brazil at Federal University of Santa Catarina (UFSC), Federal Institute of Santa Catarina (IFSC) and Pontifical Catholic University of Rio de Janeiro (PUC); in Georgia at Batumi Shota Rustaveli State University (BSU); in India at Madras Institute of Technology (MIT); in Portugal at ISEP; in Spain at UDEUSTO and UNED and in Sweden at BTH. VISIR remote lab has served well several thousands of students and has been incorporated at different educational levels and types of courses: lower secondary (Blazquez-Merino et al., 2018), upper secondary (Claesson et al., 2013), undergraduate (Marques et al., 2014), postgraduate (Tawfik et al, 2015), MOOCs (Massive Open Online Courses) (Garcia-Loro et al, 2016), life-long learning or professional development (Garcia-Loro et al., 2016).

In Intellectual Output 3 (IO3) some metrics have been analyzed from the VISIR nodes: the operational availability (in order to measure the percentage of days (of planned ones) which VISIR was available for students, and the system availability (in order to measure the percentage of days which VISIR was available). The results were satisfactory: an operational availability over 95% on average and a system availability over 90% on average. Since its origin VISIR has been improved continuously (both, hardware and software); new versions of component and instrument boards have been released, and the software layer has been upgraded several times. This continuous improvement, together with the measured results, confirm that VISIR is a robust and reliable system.

3 PILAR project

PILAR partnership is composed by 8 participants: BTH, the origin of VISIR; UNED, CUAS, IPP and UDEUSTO, four institutions with VISIR experiences, some of them shared, and finally, the IAOE (International Association of Online Engineering), an international non-profit organization with the objective of encouraging the wider development, distribution and application of Online Engineering. EVM has wide experience in EU projects and will colead and coordinate the dissemination activities. OMNIA is a multi-sector education provider that will colead the training activities.

3.1 Goals

PILAR is a project that addresses the following needs:

- Need of real, extensive and intensive, online, cheap practices for building and interacting with electrical and electronics circuits in engineering subjects of university level, and also as a lifelong learning activity (industry oriented) and at a school and high school level.
- Need of reliable, highly available, remote laboratory services offered through the Internet by a robust remote labs service provider, that will enhance a stronger digital integration for learning and teaching
- Need of having these practices available at any time and from anywhere, in a timely and controlled manner, helping to increase the number of graduates at the university that cannot easily access these practices

The main objectives pursued by PILAR are:

1. Based in the different implementations of VISIR in several of the partners in the project (BTH, CUAS, UDEUSTO, IPP, UNED), the first objective is building a reliable, highly available, unique international VISIR platform federation, that integrates all the different resources used by VISIR in each of the partners.
2. Once established, this federation will be completely opened to other partners in Europe, through easy gateways to the federation, allowing to extend the capabilities of PILAR to much more interested educational institutions.
3. Building a set of remote practices, based in this new platform, for electrical and electronics circuits, at school, grade and master level, and also as a lifelong learning activity, that will be offered as remote lab services, to students in all the partners institutions and, as a second step, to anyone interested. The results will bring added value at EU level because the activities cannot be attained in a single country.
4. Those new remote lab VISIR Internet services must allow, in a transparent way, the use of the best set of remote learning services of each partner in each moment.

3.2 Federation aspects

Four different aspects can be faced using a federation of the existing VISIR nodes:

1. Scalability. The VISIR system is designed to support around 50 users at the same time because the hardware is multiplexed. But if a huge amount of users are expected we need to scale the VISIR using a federation. If the circuits are replicated in different VISIR nodes, more users can access the platform and experiment through the federation.

2. Reliability and availability. Redundancy. If one node is not available for any reason, its effort can be supported by other nodes. That is: if one user is accessing the VISIR in his institution but it is down he will be automatically redirected to another available VISIR node (in other institution). This process will be transparent for the user. In this case, the federation mechanism must know what circuits are available in what VISIR nodes.

3. Set of experiments. VISIR is a REAL remote lab, it is like in the classical lab. There you can construct any circuit, but it is not true because in the lab we do not have all the components, we have a set of them (some resistors, some capacitors, some…). In VISIR is the same, we can offer any circuit, but not all of them at the same time. In this situation the federation is very interesting because each VISIR node can implement a set of circuits (DC circuits, AC circuits, Operational Amplifiers circuits, etc.) but the user will not access only to the set of experiments of his institution, but also to the total set of experiments of all the VISIR nodes.

4. Tracking system. The federation must be able to know how many users are accessing each VISIR node, to balance the use of the VISIR federation. The federation software layer must have a system to assure the balance of the nodes and to control the accessing priorities of the different users

3.3 Partners

The partnership and the federation will act as a resource multiplier at EU level, allowing all partners to introduce their best resources and efforts into the project and have the results evaluated globally. The PILAR project will combine the partners' capabilities to develop the technical solution, create contents and deliver these experimental solutions to courses and technical workshops.

UNED

UNED has been part of the VISIR consortium for the last 6 years. During these years VISIR has been used routinely by hundreds of students each year. In this case, due to the "at distance" nature of UNED, these students have taken particular advantage of VISIR practices. VISIR has also been used twice as the practical part of the first completely free MOOC dedicated to learn how building electrical and electronics circuits (6.000 enrolled students). UNED will coordinate the whole project, leading project management, serving as a large provider of pilots for PILAR, leading evaluation and organizing one of the multiplier events and one of the training sessions.

BTH

BTH is the institution where VISIR was born and is the inspiring institution for many of the new approaches in VISIR. BTH will coordinate all the work related with VISIR's state of art and integration in PILAR official documentation. BTH also will organize one of the multiplier events and will be a pilot site.

UDEUSTO

The University of Deusto is part of the VISIR consortium for the last 8 years. Thanks to the knowledge acquired during these years. More than 150 students have been using the platform every academic year due to its integration as a learning tool used by professors and learners. Furthermore, UDEUSTO has offered access to its VISIR platform to high schools in the framework of Olarex project ("OLAREX”, 2018). UDEUSTO will lead the building and maintaining of the Project Management Center, will colead and coordinate the dissemination effort and will coordinate the training sessions with high schools, besides being also a pilot site.

ISEP-IPP

The Polytechnic of Porto (IPP) is a public higher education institution created in 1985. With over 18500 students, IPP is the largest Polytechnic of Portugal. The School of Engineering (ISEP) hosts about 6500 students enrolled in the 11 bachelors and 11 master degrees in engineering. The educational approach is designed using logic of applied knowledge, which favours "hands-on" approaches and an entrepreneurial mindset. ISEP has already tested its VISIR system with more than 1000 students accessing it, during a single semester. ISEP will lead the coordination of all the project reports, will lead the building of the set of new remote VISIR services, federated and balanced through PILAR federation mechanisms and will lead the coordination of one of the multiplier events.

CUAS

CUAS Is also part of the VISIR consortium and their VISIR implementation is used routinely as part of subjects in different matters in engineering grades. CUAS will coordinate all the jobs related to federation policies and will organize one of the multiplier events.

IAOE

The International Association of Online Engineering (IAOE) is an international non-profit organization with the objective of encouraging the wider development, distribution and application of Online Engineering (OE) technologies and it's influence to the society. As can be seen in http://online-engineering.org/, the association seeks to foster practices in education and research in universities, higher education institutions and the industry on OE. IAOE will coordinate the analysis of all the results, will help especially with the dissemination through different associations and journals related with remote engineering and will lead the building of a VISIR alliance.

EVM

EVM has a wide experience with different Erasmus + projects, adding specialized skills to the knowledge and experience of its customers and partners to optimize revenue with the lowest request of operating resources from them. EVM has vast experience in providing training and consultancy services to various types of organizations, both public and private (higher education institutions, VET Providers, schools...). EVM has wide experience in EU projects and will colead and coordinate the dissemination activities. with UDEUSTO.

OMNIA

OMNIA is a multi-sector education provider that offers upper secondary vocational education and training as well as apprenticeship training for young people and adults, general upper secondary education, youth workshop training as well as non-formal education courses. Omnia offers flexibility to combine study and leisure activities into meaningful entities for different learners of all ages. Omnia has an important role in developing vocational education and training on regional, national and international level through its wide partner networks. OMNIA will colead and coordinate WP4 with UDEUSTO.

3.4 Workplan (2016-2019)

The methodology and work plan applied for PILAR are based on a structure of work packages (Figure 3), in order to clearly define what activities should take place when and relate them to the outputs presented. The intellectual outputs are directly related to the different work packages. The intellectual outputs of the project are the following:

- IO1- VISIR Alliance (01/03/2017-30/08/2019)
- IO2- Advances in VISIR's state of the art (02/01/2017-31/07/2017)
- IO3- VISIR federation policies (10/07/2017-30/11/2017)
- IO4- Results on PILAR pilot (02/10/2017-30/04/2018)
- IO5- Set of open remote VISIR electrical and electronics practices (01/02/2018-30/09/2018)
- IO6- PILAR set of technical and methodological documentation (02/04/2018-30/11/2018)
- IO7- Evaluation plan and evaluation results analysis (02/07/2018- 29/03/2019)
- IO8- Dissemination outcomes (03/04/2017-30/08/2019)

Work packages:

- WP1: Project management and global coordination.
- WP2: Building PILAR federation. (Intellectual Outputs related: IO1, IO2, IO3, IO5 y IO6)
- WP3: Using PILAR in academic institutions: university level. (Intellectual Outputs related: IO4, IO5, IO6)
- WP4: Using PILAR in academic institutions: VET, high schools. (Intellectual Outputs related: IO4, IO5, IO6)
- WP5: PILAR Evaluation. (Intellectual Outputs related: IO7)
- WP6: Dissemination, impact and sustainability. (Intellectual Outputs related: IO8)

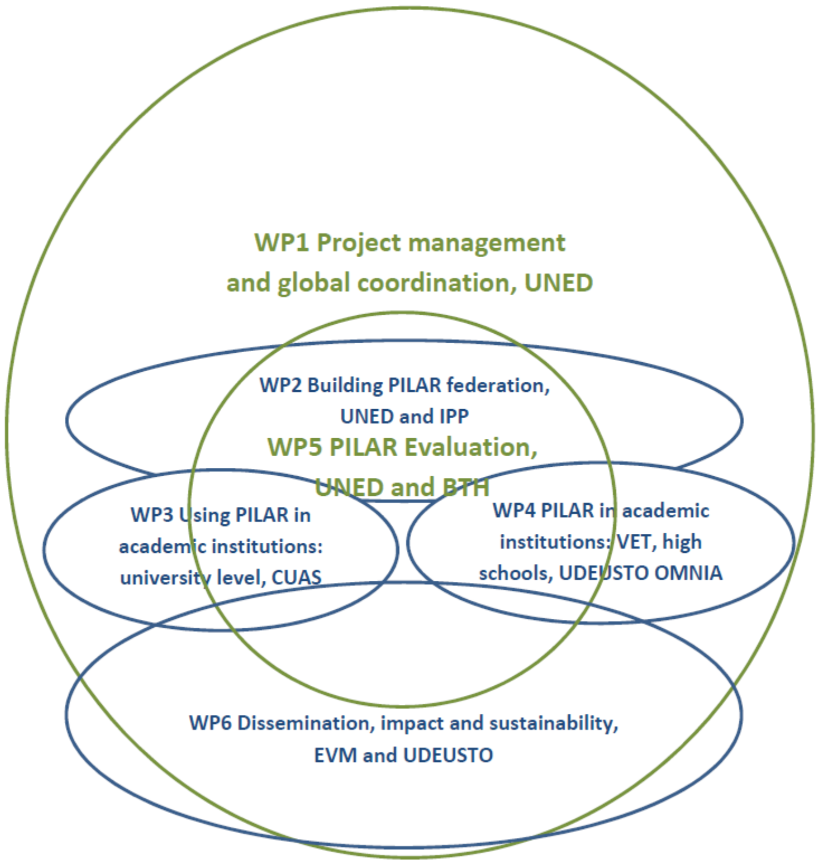

Figure 3. PILAR Workpackages structure.

3.5 PILAR challenges

There is a constraint imposed by the VISIR system on the number of concurrent requests that a VISIR system is able to manage (60). Therefore, this is the number of maximum concurrent users connected. However, for a good immersion feeling, a quick response of the system is required. Figure 4 to Figure 6 show how an increasing number of concurrent users slow down system time response. A federation of VISIR systems allows a balanced design between the nodes for the more demanding practices.

All VISIR nodes have a limitation on the available components and feasible circuits. This limitation derives from the number of component boards installed —the maximum allowable of component boards installed at each VISIR system is 15— and the number of components installed.

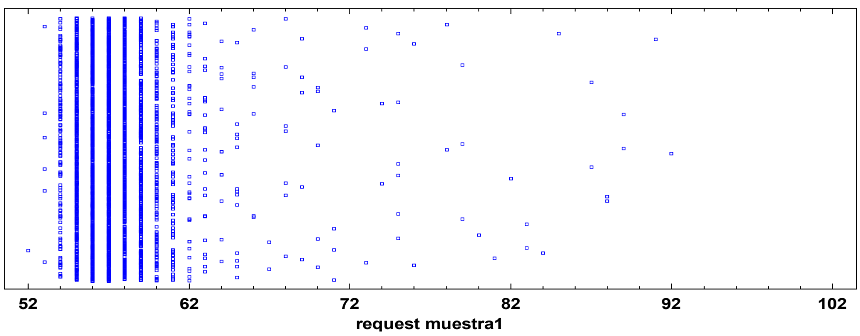

Figure 4. A unique user, time response in milliseconds; 5 minutes in continuous mode.

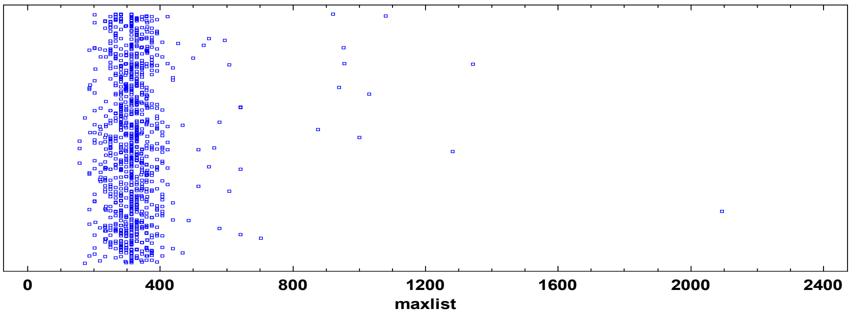

Figure 5. 5 users simultaneously measuring, sample time response in milliseconds; 5 minutes in continuous mode.

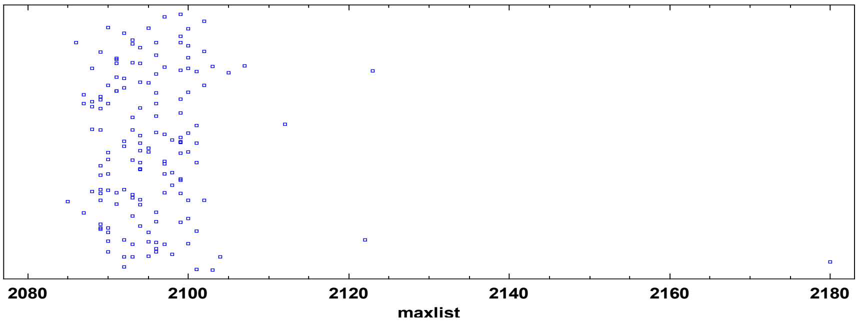

Figure 6. Over 20 users simultaneously measuring, sample time response in milliseconds; 5 minutes in continuous mode.

The more complex is a circuit, the more slots it will need at the relay switching matrix. Obviously, these components and short-circuits can be reused for other experiments but they will be always connected to the nodes wired at the relay switching matrix; e.g. a 3.01 kΩ resistor wired to nodes E and F, and a 10 kΩ resistor wired to nodes E and F as well, can be connected in parallel (nodes E and F) but clearly it is impossible to connect them in series. So, the number of feasible circuits is a strong limitation for an isolated system. Furthermore, even a federation will have problems in offering all possible constructible circuits based on a relatively large set of components. However, most of these constructible circuits are worthless learning circuits or hazardous circuits for components and/or electronic equipment/instruments. A federation of VISIR systems will not only provide a substantial circuit repository and variations based on their components but also an optimization of component and time resources at each node.

4 Conclusions and future work

PILAR partnership will enhance the learning, teaching and practical training at university and high school levels, by allowing to develop many different electronic practices through a newer and richer level of digital integration. The possibility of real practices for many different student profiles will help to develop basic and transversal skills all through the involved countries and, as a second step, all through any interested country. This new VISIR labs federation will also help to address low achievement in basic skills through more effective teaching methods, in a totally new dimension. Only with a federation of existing VISIR nodes will be possible to serve the large student population that may benefit from this technology-enhanced educational tool. This larger impact will also increase the efficiency of public expenditure and the investment in education and training, which could be identified as yet another horizontal or sectoral priority addressed by PILAR. STEM needs of improvement and practical competencies that must be addressed in schools, high schools and colleges, as well as might be used in industry for the capacitance and relocation of personnel might be obtained through the proposed federation of remote laboratories resources allowing a self-sustainable environment and incrementing the synergies as well as empowering the level of sharing open resources for the whole community.

It is palpable that partners feel the need to develop experiments concerning topics which are already available on other partners systems. The main finding underlines, even more, the need for a VISIR federation and the idea of sharing experiments.
Any of the approaches suggested for the experiments federation in PILAR will improve the efficiency of each VISIR system already built and will allow partners to share their learnings and capabilities of their respective VISIR systems and experiences with the rest of the academic community.
As future work, the architecture of the Federation will be established soon, as it is being technically planned nowadays. Once it will be defined, a pilot experience will be released as part of Work Package 2. The main challenge is derived from the different architectures implemented at each node. BTH and ISEP use OpenLabs platform, CUAS have iLabs as RLMS, whereas WebLab-Deusto is the RLMS at UNED and UDEUSTO. This pilot federation and the results obtained from it will be applied in a "Plan-Do-Check-Act" Deming cycle.

5 Acknowledgment

The authors acknowledge the support of the PR-VISIR, PIE-13, "Prácticas Remotas de Electrónica en la UNED, Europa y Latinoamérica con Visir", Escuela de Doctorado de la UNED, eMadrid project (Investigación y Desarrollo de Tecnologías Educativas en la Comunidad de Madrid) - S2013/ICE-2715, VISIR+ project (Educational Modules for Electric and Electronic Circuits Theory and Practice following an Enquiry-based Teaching and Learning Methodology supported by VISIR) Erasmus+ Capacity Building in Higher Education 2015 nº 561735-EPP-1-2015-1-PT-EPPKA2-CBHE-JP and PILAR project (Platform Integration of Laboratories based on the Architecture of visiR), Erasmus+ Strategic Partnership nº 2016-1-ES01-KA203-025327,. MECA - MicroElectronics Cloud Alliance - Erasmus+ Knowledge Alliances 2015 nº 562206-EPP-1-2015-1-BG-EPPKA2-KA.

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How can we improve our distance teacher education program? Voices of students and school administrators

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Abstract
At the University of Iceland, School of Education (UISE), a group of faculty members has been examining its teacher education programme, which has been offered online with face-to-face sessions since the early 90's as well as being offered as campus-based. One of the group's aims was to suggest ways to improve the quality of the UISE programmes. To that end views of current students and school administrators were explored. About 12% of all school administrators at the primary and lower secondary level in Iceland were contacted. Also 30 students at the School of Education were invited to participate in phone interviews (random sample) about their experiences and views on how the UISE distance education should evolve. Data collection was completed in April and May 2018. The results are outlined in this paper and discussed how they may be applied in the UISE work group recommendations for the development of distance education at the university.

Keywords: Distance education, teacher education, campus sessions, school administrators, teacher students

1. Introduction

Access to teacher education via distance was opened at the Iceland University of Education (IUE) [1] in the early 90's and the programme has been online with campus sessions from that time (Jakobsdóttir, 2008; Jakobsdóttir & Jóhannsdóttir, 2010; Jakobsdóttir, Jónsdóttir, Valsdóttir, Frímannsdóttir, & Jóhannsdóttir, 2008; Jóhannsdóttir & Jakobsdóttir, 2011; Jóhannsdóttir, 2010; Jóhannsdóttir & Jakobsdóttir, 2014). A major reason for this development was a need for rural districts' unlicensed teaching staff to get their degree without having to leave their communities (Stefánsdóttir & Mýrdal, 1993). In the beginning, prospective students applied to become distance learners and had a specially tailored programme whereas graduate studies (M.Ed. and diplomas), which also started in the early 90's, were provided only via distance and included for example school administration as a special track. About a decade later flexibility was increased. In the undergraduate programme, students did not have to apply for the distance programme; all registered students could sign up at any time during their studies for courses, which most were available in two separate formats (both on-campus with weekly attendance or online with two to three campus sessions).

However, soon after the IUE merged with University of Iceland (UI) a model was developed involving co-teaching of distance and campus-based learners in most courses (Jakobsdóttir & Jóhannsdóttir, 2010; Jóhannsdóttir & Jakobsdóttir, 2011). A study of this model after about a year of experience revealed that both teacher educators and students tended to deem the quality of the courses higher when they were not co-taught for both groups (Jóhannsdóttir & Jakobsdóttir, 2011). Many teachers felt it was easier to focus on and accommodate the needs of one group when the courses were taught separately; and students tended to feel that there was too much focus on "the other" group when the courses were merged. But they thought it was

[1] Iceland University of Eduation merged with University of Iceland (UI) in 2008 and to become the School of Education within the UI.

possible to run more courses when the co-teaching of courses was applied (to operate courses in spite of fewer students and safe costs) and therefore the majority thought that model should be continued.

This model was therefore continued but without much concrete evidence it was known that teachers were adapting their teaching in a variety of ways which often was not very explicitly explained in curriculum guides for students. Little hard evidence was available on who was doing what and how it was functioning. In 2017 a work group was formed with the purpose of developing distance education at the UISE and suggest clear models that worked well in different circumstances and could be more widely applied.

The work group has been gathering various types of data with surveys and interviews. In this paper the results of interviews with two groups are outlined. Two groups - students at UISE and principals of schools at the primary and lower secondary level - were interviewed via phone and asked to reflect on the experiences they had of distance education, and in case of the principals also the experiences of their staff. Their views were collected regarding whether and how distance education mattered at different levels and principals were asked to reflect on its effects on their institutes. They were also asked about how they thought the teacher education distance programme should develop.

2. Method

Four members from the work group[2] collaborated with and guided five graduate students from a course on distance education[3] to design the study and prepare the interview questions. Two graduate students gathered data among the principals and three among their fellow students. Each group wrote a report on the results of each part of the study (Skúladóttir & Óskarsdóttir, 2018; Víðisdóttir, Þorvaldsdóttir, & Einarsdóttir, 2018).[4] An online form was made for each group on the university server with a survey tool called K2. Only the graduate students and the work group members involved had access to the data.

2.1 School administrators

About 12% sample of schools in Iceland at the primary and lower secondary levels (mandatory school level with students age 6 to 16) were selected randomly (21 out of 171); 15 were located outside the capital area of Reykjavík[5] (71%) and 6 within the capital area (29%). Invitation letters to participate in the study were sent via e-mail to the principals involved; 16 agreed (76%) on behalf of 5 schools in the capital area (83% participation rate) and 11 from the others (73% participation rate). However, due to busy time schedule two principals could not be reached for a phone interview, so answers were gathered from 14 principals at 4 schools in the capital area (3 female, 1 male) and 10 outside the capital (7 female, 3 male). The data collected came from 67% of the sample or 8% of the total number of schools at the primary to lower secondary level in Iceland. The number of instructors reported to teach at each schools ranged from 15 to 51 at the capital area schools) but 8 to 70 at the schools outside the capital.

2.2 Teacher students

Originally 100 potential participants (ca. 5%) of the 1969 registered at the UISE were randomly selected. Sixteen of that group were dropped from the selection for the main reason that they were registered on a

[2] Sólveig Jakobsdóttir (who led the work), Karen Rut Gísladóttir, Sigríður Pétursdóttir, and Thurídur Jóhannesdóttir.
[3] Taught by the author of this paper. The graduate students volunteered to participate in the project, knowing that the data and the results would be used by the work group and potentially presented in various ways by members of the work group. They got their contribution evaluated as part of their final project in the course.
[4] This paper is mainly based on original work of the author and the independent analysis of the raw data gathered by the student groups.
[5] In smaller towns or rural areas.

study track that did not provide distance education (health and sports education studies).[6] The remaining group included 71 women and 13 men; 39 undergraduate students, 42 graduate students, and 3 who were practicing teachers taking single courses. These people were divided into three groups assigned to each of the three graduate students involved. The graduate students sent invitation letters via e-mail to each individual stating that if they did not decline to participate in the study within the next days they would receive a phone call from the student overseeing each group who would then invite them to do participate in a phone interview. Sixteen students declined the offer to participate before any phone calls were made. Others were called up to three times which resulted in 46 interviews with 42 women and 4 men. During the interviews it was found out that 30 had distance education experience and did the whole interview: 26 women and 4 men. Two thirds (67%) lived in the capital region, 9 in Iceland outside the capital (30%), and 1 abroad (3%). Table 1 provides a comparison of the final participants to all the registered students. It appears that the participants reflect the whole student population fairly well although perhaps somewhat slanted towards graduate students.

Table 1: Information about teacher students and participants in the study

	Registered students	Random sample	Study Participants	Participants with DE experience
N	1969	84	46	30
Females %	82	78	91	87
Graduate level (M.Ed.) %	44	49	43	57
Age, mean	34	37	36	37

3. Results

3.1 School principals

In the schools outside the capital area the percentage of licensed teachers varied considerably from ca. 61 to 100%. In 40% of those schools the rate was high, 94-100%, in 30% of those schools it was 79-88% but in 30% only 61-70%. On the other hand, in the capital area schools, three out of four schools had all or almost all of their teaching staff with a license (98-100%). But one of the capital area schools was a small private school which ran a special curriculum. In that school only 2 out of the 15 teachers (13%) had license to teach recognised by the Icelandic Teachers' Association.

In the 14 schools there were 49 teaching staff members reported to be distance learners, from 1 to 11 per school or 3.5 on average. This corresponded to 2 to 33% of the teaching staff that were reported to be distance learners. Mostly they were registered in teacher studies at universities but other types of studies mentioned were masters' studies or teachers' aids diplomas. In 86% of the cases these studies were reported to be at the UI (some mentioned UISE specifically, in 43% of the cases). Other Icelandic universities or colleges were mentioned in some cases. In the case of the private school mentioned earlier a Swedish university was the distance education provider because it offered education related to the pedagogy applied at the school. Most of the principals reported that a considerable number of their staff had been registered in distance learning programmes in the past and a principal of one of the out-of-capital schools said that dozens of their teaching staff had been distance learners. Two principals from capital area schools mentioned that currently there

[6] One student was a foreign exchange student taking campus-based courses.

tended to be fewer than in earlier years. Most of the principals had a personal experience of distance education (12 participants, 86%) and 71% said they had completed a degree from the UISE (or its predecessor IUE), about 43% mentioned the school administration track. All but one of the 12 said that the distance education had been of use in their jobs as principals (the only one that did not think so was new on the job). Things that were mentioned in this regard in more detail included better insights into policy and overview, making positive changes, taking interviews, counselling, and professional knowledge.

Principals had a positive view about their staff members' distance learning alongside their work. They agreed that distance education resulted in higher education level of their staff. About half had nothing negative to say and mentioned for example inspiration and positive effects on teaching. About half of the principals expressed some reservations and had minor or some concerns about the ability of their staff to organise their time and that combining work and studies could cause a lot of pressure. One mentioned the campus sessions in that regard. However, the general sentiment appeared to be that the schools were profiting from their staff distance learning in spite of some or considerable strain on the teaching staff involved and/or the school operation, for example due to time staff needed to take off work for campus sessions. When asked especially about how distance learning were of use to their staff an emphasis was on empowerment, increased professionalism, competence and deeper knowledge regarding subjects, pedagogy and learners' development. Also some mentioned the opportunities to link theory and practice, access to professional development in fast changing times as well as licensing and increased salary.

When asked about the development of distance education for teaching staff and whether some things needed to change most mentioned campus sessions. Some talked about their importance (e.g. interaction, teaching in real time and getting to meet teachers and fellow students) but six mentioned that the sessions should be fewer and recordings more used instead or online teaching. Four thought they should be more linked to weekends or days schools were off. Two suggested that campus sessions should be in August before schools started and/or in June after schools ended; two suggested summer courses and three that campus sessions should last a shorter time or be limited.

3.2 Teacher students

The majority of the students (19, or 63%) had experienced distance learning while they were in high school/junior college or in earlier studies and half of those (10) said that experience had been helpful in their current studies. About half (14) had completed all of their courses via distance, many had completed most of their studies but for some it varied. For example, two students had completed all of their master's studies via distance and part of their undergraduate program, two reported a mix (half and half), and two had taken only one course via distance.

Only four (13%) did not work with their studies. In almost all cases (24 out of 26) the work was related to their studies (e.g., teaching, pedagogy, leisure studies, school administration). The reasons the group had for choosing distance education was mainly work or location. Fifteen (50%) mentioned work as the only (9) or a major reason (6) and 10 that they lived too far from the school (33%). In one of those cases avoidance of taking student loans was the reason given for the work and in another to test the waters – not ready to give up her job and check if this was suitable. Five (17%) gave family reasons. One person wanted to learn about distance education, another said her learning could be applied directly in her job. Two said it was convenient and flexible (in one case because of illness). Three people (10%) said that there was not an alternative option available or reported that there was a scheduling conflict between courses. When asked how or whether distance education mattered to them several said that the opportunity to study at a distance was important or very important for them and many emphasised that the flexibility it afforded was vital. One example of a reply:

> It matters a lot for me and it is convenient. Distance learners are just as important as the campus-students and one is not forgotten. As one as heard that sometimes has happened in other departments at the University of Iceland. Everything is recorded and project description are good and well organised. (25 year old female M.Ed. student in mathematics education).

Students were asked to describe the distance education at the UISE. Overview of the results are shown in Figure 1. Most mentioned the use of Moodle (63%) and/or recorded lectures (63%). About one third reported some experience of online synchronous meetings (33%) via Adobe Connect or Skype. About one fifth mentioned the campus sessions (20%) or email with teachers (17%), and some projects online/in Moodle (13%) or Facebook or Messenger mostly with fellow students (13%). A few students (10%) mentioned discussion groups in Moodle or using the UI intranet UGLA and one or two GoogleDocs, Open classes/workshops and one talked about that the final test was arranged in a rural town.

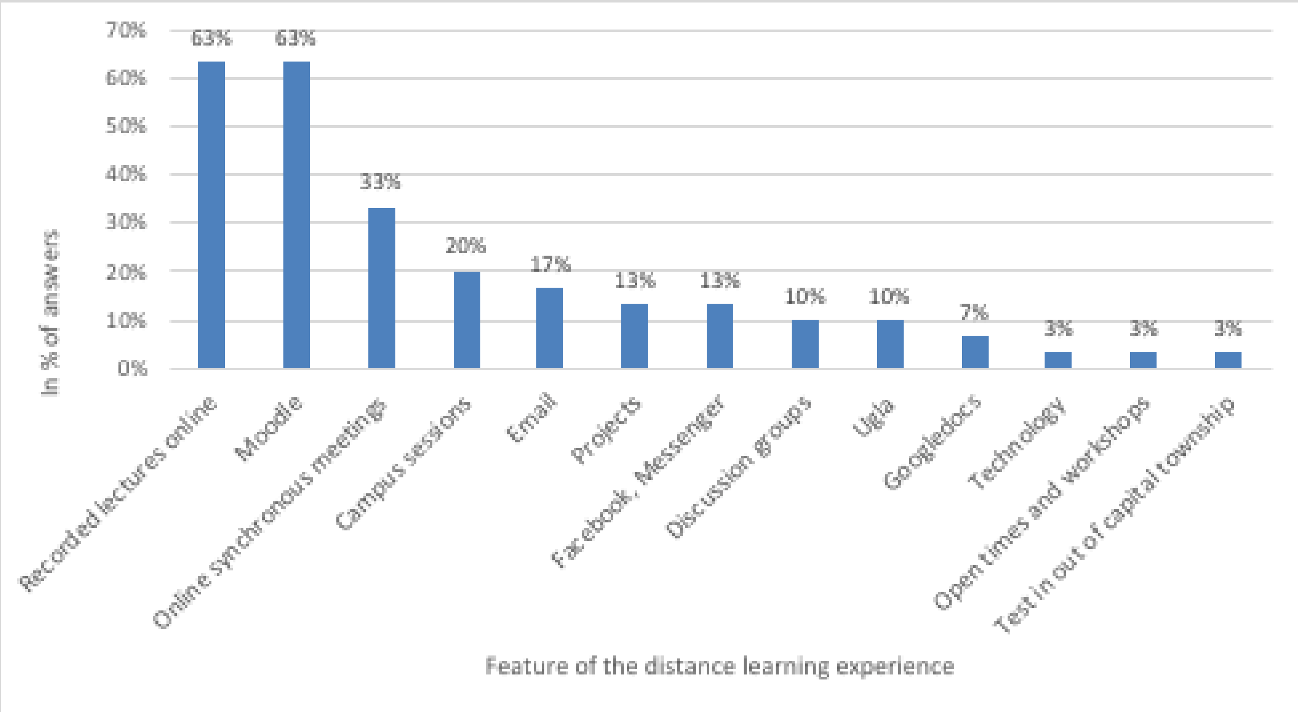

Figure 1: Features of the distance education students described at the UISE

A few students included in their descriptions that they were happy with the distance education at the UISE. An example of such an answer:

> Moodle, Ugla then the teacher has been putting in lectures, all reading materials, emails, incredibly happy with this! She is always reminding us about this and that and puts all kinds of information and knowledge in. I am just very happy with this course I am in. (46 year old woman taking a single course).

When asked what they thought about the distance program ca. 63% of the students said it was very good and even wonderful. An example of reactions: „Wonderful and I do not understand why there are not more who use this option and that this is not accepted in all universities.“ About one third (33%) thought it was fine, OK or perhaps a bit varied by courses. An example of reaction from this group:

> All right, you get a lot of information that you can take home with you. But still one often gets the experience that video or sound is not very good, one does not hear questions from the lecture hall, one does not get the whole story if the teacher is answering questions but does not repeat the questions from students. But I think the teachers are really good at accommodating the students. Mainly technology needs to be improved.

However, one student, who had an earlier experience as a distance learner at a different university/college where the emphasis had been on flipped learning was very unhappy about the UISE distance program. She thought the distance program poorly organised. Lectures in the courses she was taking were recorded during classes with campus students and there was often a lot of background talk and noise.

When asked about examples of success and/or something that was going well in the distance programme about one third mentioned flexibility related to learning and/or the teachers. An example „My teacher, I have had the same teacher in both courses. She is flexible and easy-going with communication and turning in projects." Another said „Yes this flexibility that I can use my time as is suitable for me based on both illness and family needs." A similar number of students mentioned good organisation and/or online recordings, which in some cases was also linked to flexibility as in this answer: „For example to be able to listen to the recordings. That is pure genius! Then she also records the class sessions so one can get the answers from the class just like one is present." Another reply was: „The teachers are good about recording the materials and sending it out. Most of them are quick to answer emails." One person mentioned that it was best when the teachers were not too formal and appreciated if they were seen to treat distance and campus students in the same way. One mentioned the campus sessions and thought they were wonderful, another students liked when there was good advance notice about turning in projects, one appreciated the synchronous sessions and one student emphasised the possibilities to collaborate with others across the country. About five students (17%) did not mention anything specific in this regard.

When asked about challenges and problems related to the distance programme 6 students (20%) identified none. Most commonly, mentioned by 8 students (27%), was lack of communication or connection with teachers and fellow students. Examples include:

> I am now taking a course where the information flow is flawed. One just follows the teaching plan, does the projects and gets grades. There is very little communication between teachers and students but still the course is largely well organised. There are discussion threads but little participation.
>
> One does get a bit isolated, one does not form as much connections with students as in f2f courses. One is perhaps in a group of 3 to 4 and that are the only individuals that you get to know.
>
> Sometimes the teachers forgot the distance learner and I had to put in a lot of effort to seek information for myself. There was a lack of cooperation between distance and campus students.

Other things were mentioned by one to four students. This included recordings of insufficient quality (4), teachers who did not record or were recording in the classroom. Also, bad or complicated organisation in Moodle (2), campus sessions (2), technology (1), lack of flexibility (1), extra work required instead of showing up in f2f sessions (1), better coordination/more similarities in the organisation of courses. In addition, mentioned by one student in each case were issues like self-discipline, synchronous discussions at the end of the day, that teachers were a bit invisible, the final project was too big, or the distance teaching involved had not suited the topic (creative thinking and philosophy).

Comparing advantages and disadvantages of distance versus f2f learning, people most commonly associated flexibility or better time control with distance education (mentioned by 40%), there was better opportunity to combine work and study (13%) and connection with the field (3%). Also, studying from home (7%) was mentioned, and being able to listen to recordings (3%). On the other hand thirteen (43%) thought there was less connection with teachers and fellow students in the distance program, less involvement in discussions (13%), danger of overload (7%), less personal (7%) or more need for self-control (7%). Other things mentioned by only one student included that distance students were busy people tending to have different priorities that campus students, there was less chance of group work, support from others and there was less guidance from the teachers. One person emphasised that advantages outweighed the disadvantages.

Most students (77%) thought they were doing well or very well organising their studies even if it might be hard especially in the beginning. One mentioned that group work helped to keep him on track. About 20% had more mixed experience and mentioned that it might depend on the semester and how well organised the courses were. Some mentioned lack of time or energy. One said:

> It goes well in my head, but it does not go very well in practice. I often do things at the last minute. Less motivation to study when one cannot discuss things with fellow students.

Students were asked about the usefulness of the campus sessions. Eighteen students (60%) thought they had been of good or very good use. One example was

> Yes very well, all kinds of projects and discussions. My employer has understanding about the campus sessions and I was employed keeping in mind that I could attend those. I am not at odds with my employer about attending those sessions. They are very interesting most of the time and one is more hands on with the learning materials.

Four students (13%) described the sessions more neutrally and did not assess their usefulness but the eight other students (27%) were more negative or thought it varied, some mentioned too much emphasis on lectures or that they should not include time gaps to safe time or money.

When asked about examples of good or successful campus sessions about one fifth said that in general all of them were good/well organised. About 20% mentioned project work, about 17% discussion, 13% work stations, 10% group work, and 10% thought longer sessions were better than shorter. One or two students mentioned other features. These included getting a good overview of what was ahead/the course, having good guest lecturers, working to improve group dynamics, games, learning something useful for their job, getting ideas listening to other students presenting their projects, meeting the teacher, acting or hands on experience.

On the other hand when asked to describe the features of an unsuccessful campus session, 11 could not think of any (37%) but most commonly people mentioned too much emphasis on lecturing (10 or 33%). Two mentioned bad organisation in general. Other things mentioned (by only one in each case) included insufficient care for each group of students (distance vs. campus), technology not functioning, discussions about earlier projects too long, not student attendance log, students introductions that could have been submitted PowerPoints with audio. One student said that the online component of the course had been so well organised that the campus session had been super fluent.

When asked how they thought the distance programme should develop nine people (30%) did not have any specific ideas about that. Several people emphasised the campus sessions (23%). The things mentioned included less emphasis on lectures but have more discussions, have them more concentrated with fewer gaps and even longer, better organised. Three (10%) suggested more use of synchronous discussions or meetings online, other three (10%) improved technology or use of Moodle and two (7%) better coordination and similarity between courses. Other suggestions were to quit recording lectures in class, have better distribution of workload, provide more demos on hands-on skills, have better connection with practice, tailor the studies more for the needs of working teachers who need to learn how to teach online. In addition one suggested providing lessons in time management at the beginning of the study and another one more opportunities for discussion applying social media.

At the end of the phone interviews participants were asked to indicate how happy/unhappy overall they were with the distance education programme and the campus sessions. About 90% of the students were happy with the program (either very happy, 40% or happy 50%). Seven percent were neutral but 1 student (3%) very unhappy. The campus sessions were evaluated less favourably but still 63% said they were happy with them (20% very happy and 43% happy). Thirteen percent were neutral whereas 20% were unhappy and 3% very unhappy.

4. Conclusions

The results of this study among principals at the primary or lower secondary school level in Iceland and among current teacher students at the UISE are that on the whole the distance education programme is reviewed favourably and thought to be important at personal level for the students and for the Icelandic school system and the teaching profession in the country.

Students tend to rate the programme highly and in a similar way to the student group surveyed more than a decade ago. A study by a work group in 2007 among distance students at the IUE (Jakobsdóttir, 2008; Jakobsdóttir et al., 2008) revealed that a large majority tended to be happy with the distance education programme (87%) but only 64% were happy with the campus sessions. The work group recommendations then included higher emphasis on lecture recordings and more emphasis on the use of campus sessions in a variety of ways.

The voices of students and principals in this study tell us that there is still a need to improve the timing and organisation of campus sessions but most appear fairly happy with the situation as it is now. At this point in time the work group is still looking at these results and considering other data from different sources (e.g. from teacher educators describing how they organise their courses) as well as recent international reports about the changing pedagogical landscape regarding blended and distance learning (Henderikx & Jansen, 2018).

4.1 Acknowledgements

Without the help of the graduate students in the course Distance Education this study could not have been made. Agnes Skúladóttir and Eva Óskarsdóttir interviewed the school principals and Bella Víðisdóttir, Jóhanna Thorvaldsdóttir, and Regína Einarsdóttir interviewed teacher students. They worked with me and my colleagues, Karen Rut Gísladóttir, Þuríður Jóhannsdóttir, and Sigríður Pétursdóttir to design the study and the interview questions. I thank all of these women for their contribution as well as our busy study participants who gave us their views.

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Impact of assessment strategies on blended learning

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Abstract
This work aims to characterize the impact of assessment strategies on blended learning. Describes the assessment methods most used in Blended Learning and identifies their impact on the teaching and learning process. It also identifies the feedback mechanisms of teachers in this evaluation. This study concerns bibliographic research in Brazilian institutions working with blended learning. The theoretical framework was based on: HOFFMANN (1998); LUCKESI (1999); GARRISON (2004); SCNHEIDER (2014). It was built a spreadsheet to analyze the assessment proposals used. It was possible to conclude that the formative evaluation breaks down the idea that to evaluate is to examine. For this to happen, the teacher must have permanent access to analytical data about the student's learning process, and feedback strategies must be identified to every training need.

1. Introduction
The paths taken by postmodern society inevitably lead the field of education to rethink its way of doing. The traditional classes in which the teacher is the main actor have lost space for new educational methodologies that incorporate the student as being also responsible for the teaching and learning process. But how do you make these new paradigms work? What forms of evaluation will be applied? In view of such context, the objective of the present study is to identify and characterize forms of evaluation of applied learning in courses in the Blended Learning (BL) model and the reflexes they may have when making choices regarding the teaching process - learning. The motivation for the research comes after the legislative opportunity that has been given to Higher Education Institutions (HEIs) to implement BL proposals and that these, taking advantage of the conditions opportunized by technology, have been increasingly adopted. Within this context, the evaluation of learning arises with particular relevance, because in BL the evaluation of learning acquires other nuances that should be studied with particular depth. The problem that the study seeks to answer comes from the questions: what forms of appraisal of learning can be applied to BL courses; What feedback mechanisms can be used? What are the consequences of these forms of evaluation for the teaching-learning process? The answer to these problematizing questions are: - describe the evaluation proposals most used in BL; - identify feedback mechanisms; - characterize reflexes of these forms of evaluation in the teaching-learning process. The study is based on theoretical positions within the scope of the evaluation of formative learning, taking into account the proposal to change the evaluation references that the author of the present study considers should be adopted when working the BL, such as: HOFFMANN (1998); LUCKESI (1999); GARRISON (2004); SCNHEIDER (2014). The work is organized in four parts: - Evaluation proposals in BL; -

Feedback mechanisms in BL; - Contribution to the learning process; - Impacts on the teaching-learning process from the teacher's point of view.

2. **Justification**

One of the transformations experienced in education in the last decades is the appropriation of the technologies normally used in Distance Education in face-to-face contexts (MORAN, 2014). Symbol of this process of change is the appearance of the methodological proposal of BL that allows the teacher to associate distance learning with face-to-face learning. It is possible to identify three models of the BL methodology: Alternation: determined by the teacher within a given course or topic, between the modalities of face-to-face and distance learning; Flex: students study in the course according to a personalized individual program, alternating between the modalities of face-to-face and distance learning. Auto-blend: students within each face-to-face course share their time between attending face-to-face classes and also learning through online activities and classes selected to complement their face-to-face course (ASH, 2012) According to BL, of working in the classroom, the contents, provides learning, debate and evaluation resources for students in a virtual learning environment (AVA). In this way, the intentionality of the release of the face-to-face lecture based on the theoretical content and the communicational profile with a focus on the teacher and the centralization of the work in practical activities of study of problems, in a dynamic of communication shared between the students and the teacher is potentialized (SCHNEIDER et al., 2014) (BETTIO et al., 2013) (BARBOSA, 2005). The BL format provides the conditions for a change in Higher Education (ES) at several levels, such as: the praxis of the teacher by stimulating the combination of theory and practice in the learning process that according to Pimenta (1995) supports the relation between the dimensions of knowledge (theoretical activity) and intervention and transformation (practical activity); to assume for the student the protagonism of the process of teaching and learning (MATTAR, 2013); students' motivation for learning (MORAN, 2008). In the context of BL, the proposal for appraisal of learning also needs to be changed, because before starting the study course, even in the virtual moment, the student characteristics are diagnosed and proposals for procedural evaluation are worked out in the study of the contents made available. The face-to-face moment arises as a space in which activities refer to tasks of observation and work between peers. The possibility of learning analytics (SIEMENS, 2011) refers to learning to another level, since characteristics of the student can be identified and the pedagogical work adjusted permanently. For students, the relevance associated with BL is associated to its usefulness, as a support to face-to-face teaching, contemplating, for example: content repository (CARVALHO NETO, 2009). The relevance of the theme is associated with the growth of BL models and the need for these proposals to adopt innovative evaluation dynamics, especially those associated with formative evaluation. The selection through formative and non-summative evaluation is due to the fact that it is desired to evaluate the quality of the student's learning and not only to classify the same. In contrast to summative assessment projects, which occur at the end of learning to determine what students have achieved, formative assessment in BL projects occurs throughout the learning process to adjust instruction and detect any gaps.

2.1. Goals

The general objective of this work is:

- To characterize forms of evaluation of learning applied to BL courses and the reflexes they have for the choices in the teaching-learning process. To this end, the following specific objectives were formulated:

• Describe which evaluation methods are most used in BL;
• Identify the feedback mechanisms of teachers in the formative evaluation of BL courses;
• Characterize reflexes of these forms of evaluation in the teaching-learning process.

2.2. Work Organization

This work provides a bibliographical research in which the term BL is conceptualized, exposing the models of such an approach and the reasons of its choice. A brief overview of BL in Brazil is presented, discussing the implications of using such methodology. Then, the formative evaluation is presented as one of the forms of evaluation in BL and in what form the feedback is used. Finally, the final considerations and the bibliographic reference are presented.

3. Theoretical assumptions

- The concept of BL - BL is a methodological proposal of teaching that involves the joint exploration by the teacher and student of the potentialities of face - to - face education and technology - mediated education (FERNANDES, 2015, POMBO and MOREIRA, 2012). This proposal seeks to merge the two different methodological proposals in a strategic way, in order to stimulate in the student the desire to learn. BL is considered as a hybrid or mixed model of online learning components combined with face-to-face sessions (GRAHAM and ROBISON, 2007). It can be interpreted as an association of: i) pedagogical strategies, combining problem-solving activities with debates; ii) interaction technologies, using different tools such as forums, podcasts, wikis, blogs; iii) teaching strategies, where face-to-face sessions and online activities are organized in order to take full advantage of both strategies (STACEY and GERBIC, 2008). BL has its origin from a phenomenon of convergence in education between virtual and face-to-face, originating from the application of teaching and learning processes of distance education, in an attempt to add value to face-to-face education processes (TORI, 2010) (MORAN, 2014). It presumes that the student should prepare for the face-to-face classes, previously studying the distance. During the virtual study it assumes the autonomy in relation to the time and to the way in which it will manage its work, as well as in relation to how, when and where it will apprehend the contents distributed by the teacher of individualized form attending its characteristics. The actual moment happens after the student already has contact with the contents. Thus, there is an opportunity for debates, for the deepening or contextualization of virtually maintained discussions, for the development of collaborative projects, for problem solving and practice of virtually worked content (BETTIO et al., 2013). Such a model is characterized by the flexibility it gives to virtually using the tools provided by the technology, or in person, the student under the guidance of the teacher and together with their peers: - learn at any time, without feeling the pressure of learning in a space temporal and spatial structure rigidly determined by HEI; - share information; work in pairs; solve problems; access the teacher's comments as a specialist; rotate individually or share the learning spaces they build throughout the learning process; - Integrate theory and practice during online and face-to-face education. BL's integration strategy in courses will vary according to factors such as: content, academic grade, student characteristics and needs, learning objectives, as well as the confidence and experience of students and teachers in the use of technology.

- Possible models of BL and the reason for their choice - Considering the Ash reference (2102), it is possible to identify three models of the BL methodology: Alternation determined by the teacher within a given course or topic, between the in-person learning modalities and the distance. The caster model presents the BL with predetermined fixed or alternate moments of presence and online learning. In another variant of this model, students alternate between fixed practice time on campus and free online study, allowing students to choose where they receive content. Students can also alternate according to a fixed schedule of individual work, contemplating at least one moment of online learning; Flex in which students study in the course according to a personalized individual program, alternating between the modalities of face-to-face and distance learning. The flex model of teaching and learning contemplates the development of work mainly through the Internet, giving the student a face-to-face learning according to an individualized programming. Auto-blend that the students within each face-to-face course divide their time between attending face-to-face classes and also learn through activities and online classes, selected to complement their face-to-face course. (ASH, 2012).
- BL in Brazil - has been referring to its beginnings in Brazil for the possibility of HEIs offering up to 20% of the timetable of the course in a non-presential way (BARBOSA, 2005). The semipresencialidade is characterized as any didactic activities, modules or teaching-learning units focused on self-learning and with the mediation of didactic resources organized in different media that use remote communication technologies. Carvalho Neto (2009) and Martins et al (2011) point to the existence of an expectation of the Brazilian student regarding BL. As part of the contribution of the BL to the teaching and learning process, the researchers point out relevance and utility to the AVA as a support for face-to-face education, including, for example, the use of content repository.
- Implications of BL - For Ash (2012) it is important to build a cultural model that supports the use of BL in teaching and learning. This model should allow some element of student control over the time, place, path and / or rhythm of study. In this sense, the use of the methodology of the BL requires a reflection on the organization of the educational system, as well as pedagogical adaptations in the proposals of teaching and learning and the redesign of the courses, forcing a readjustment in the nature of the proposals of face-to-face work experienced by the students , its duration, regularity of the time of its occurrence in the physical campus or online content studies (ABBAD; ZERBINI; SOUZA, 2010).
- Assessment of learning in BL - Learning takes on the challenge of evaluating to improve the teaching and learning process. It focuses on the regulation of learning processes, studying and trying to perceive students' internal cognitive processes and intervene from there so that they themselves regulate their learning. The teacher concentrates on favoring the development of self-control and self-regulation of students (FERNANDES, 2009). The evaluation assumes a polysemic character, evaluating all the intervening factors and agents (ANDRADE, 2001). It understands the student as a being in constant development (LUCKESI, 2005) (CARVALHO & MARTINEZ, 2005). It allows interventions at any moment in search of improvements (LUCKESI, 2005). It promotes self-assessment by providing self-knowledge and discussion on how the learning progress is (LUCKESI, 2005). In this way, metacognitive

work is determinant so that students can appropriate the evaluation tools (STAINLE and SOUZA, 2007). The teacher should promote integrative evaluative practices as components of student learning. Your focus should be on both results and processes. The assessment must be sensitive to the individual situation of each student, respecting their plurality and diversity. As far as the teacher is concerned, the evaluation should help him to guide his / her teaching practice and to seek an awareness of his / her role in the teaching process (PINTO; SANTOS, 2006) (ALMEIDA, 2010). The development of technology has provided the conditions for an in-depth, continuous, accurate and consolidated monitoring of student activities. The exploitation of technologies allows them to be automatically saved in the online environment, both content and communication.

- The formative evaluation of learning in BL - The formative evaluation appears as an opportunity to break the idea that to evaluate is synonymous with exam (SANTOS, 2006). The practice of formative evaluation is an interactive act in which teachers and students permanently negotiate strategies of knowledge production, so that learning is actually achieved (SANTOS, 2006). The evaluation is carried out throughout the entire teaching and learning process, in a processual dynamic and not only the product, and may involve, for example: portfolios, discussion forums, self-assessment and logbook (MATTAR, 2013) (ALMEIDA, 2010). The formative evaluation involves the teacher to have permanent and consolidated access to the information about the course / discipline monitoring by the student and to adjust the assessment strategies. It assumes an inclusive character, as it seeks not to discard the student and invites him to improve (LUCKESI, 2005) (HAYDT, 2008). The use of formative evaluation requires that the teacher be given more time to devote himself to the planning, preparation and development of the classes. BL's good practices also require the implementation of appropriate assessment strategies and methods for face-to-face and on-line learning (LAURILLARD, 2014). The formative evaluation in the BL involves the teacher in clarifying and sharing the intentions and evaluation criteria with the students; in the development of discussions, tasks and activities that evidence learning; in feedback to students so that they motivate students to continue to learn; to continuous feedback from students about their work, so they can clearly see where they are and what they need to do to improve. Technology can be integrated into formative assessment to implement and stimulate student engagement with the learning experience. Leahy, Lyon, Thompson and William (2005) present five approaches for evaluation: - Clarification and sharing of learning intentions and success criteria; - Engineering of effective classroom discussions, questions and learning; - Performing tasks; - Provide feedback that encourages students to learn; - Motivate students to become participants in their own learning; - Enable students to be open to allowing themselves to be instructional resources for each other. The first step in designing an online learning environment is to identify learning objectives. Establishing exactly what students are expected to learn is critical. Once goals are established, all learning activities and assessments are derived from them. (SEWELL; FRITH; COLVIN, 2010).
- Feedback in the formative evaluation in BL - Feedback is an indispensable component to the redirection of the educative action by the teacher and the student in BL proposals of formative nature. The feedback in the formative evaluation processes is one of the determinants of the success of innovative learning assessment strategies (LEITE and FERNANDES, 2011) (GARCIA, 2013). Feedback allows the teacher to assess student progress, the organization to understand customer concerns, and management to understand the

needs of employees. (SIEMENS, 2006). The feedback process provides valuable assistance to students on areas they could develop and improve. Feedback should focus on students' strengths, rather than pointing to mere weakness, and help them build confidence in their learning (SIEMENS, 2006). It allows to perceive if the message that was transmitted was actually captured and if there is a need to carry out some transformation of strategies in the environment of BL's proposal (BLACK and WILIAM, 2013). According to Mazur (2012), the effective use of face-to-face time depends critically on: - the bi-directional communication available so that students can receive almost instant feedback on the answers they gave to formative evaluation questions. - the availability of the teacher to receive the doubts of the students before the class and use the feedback to these questions, as the focus of the classroom (MAZUR, 2012.) The faster a student receives accurate (and ideally supportive) feedback about the work The concept of feedback is an indispensable component to the redirection of the educational action by the teacher and the student, as a mechanism of retroactive regulation, accompanies permanently (WILLIAN, 2001, BLACK and WILLIAN, 2009). Retroactive regulation takes place at the end of the school year. a phase of teaching, with the objective of verifying how the learning is taking place and identifying if the objectives are achieved by the student. Perrenoud (1999) considers that an external intervention to succeed must be perceived, interpreted and assimilated by a subject. Interactive feedback consists of continuous monitoring of student development (ALLAL, 1986) (ALMEIDA, 2010). The design of the formative evaluation in BL should promote frequent opportunities for feedback and this includes, for example, pre-test with automated feedback, tests, opportunities for reflection and self-evaluation (BAJZEK et al., 2008). The IES has in the accompaniment of the process of orientation and feedback to the student, fundamental information to permanently adjust the course according to the needs identified. (MATTAR, 2013) (POPHAM, 2011, p 2). In order for formative evaluation to be possible in BL, the student must, based on a process of orientation and permanent feedback, map the learning that is performing, detect any gaps and overcome possible difficulties.

4. Conclusions

The present study aimed to characterize forms of evaluation of learning applied to BL courses and the reflexes they have for the choices in the teaching-learning process, especially regarding the identification of feedback mechanisms of teachers in the formative evaluation. OBL is a methodological proposal that seeks that the teacher leaves the center of the teaching and learning process and begins to participate in it in partnership with the student. Technology integrated with formative evaluation allows: clarifying and sharing learning intentions and criteria for success; discuss effectively in the classroom; perform tasks; provide feedback that encourages students to learn; motivate students to become participants in their own learning; to enable students to be open to allowing themselves to be instructional resources for each other; stimulate assessment as the student as a resource for instructing others and promote learning from classroom discussions. The feedbackse is an indispensable component to the redirection of the educative action by the teacher and the student in proposals of BLde formative nature. In order for curriculum courses to be effective, the student should be encouraged to use the feedback to permanently map the learning he is doing, detect any gaps and overcome the difficulties. In future studies, feedback reference frameworks can be transposed for course analysis.

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Inclusiveness of students with disabilities at UNED. Experiences and challenges

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Abstract
UNED was born in 1972 with a special commitment to facilitate access to higher education to all those people who required flexible to study, because of their geographical location, their employment, their family responsibilities, or their disability. In 1995, UNED was the first Spanish university that introduced free public fees for students with disabilities. In 2000, the Integration Unit for students with disabilities was created. In 2005, the Disability and Volunteering Unit was created. In 2008, the Centre for Attention to University Students with Disabilities (UNIDIS) was founded. The UNIDIS functions are information, advice and guidance for the university community. The teaching-learning and evaluation processes are adapted to the needs arising from disability or functional diversity. Sensitization and training actions are carried out aimed at the university community. Actions are coordinated to improve physical accessibility and ICT. Actions to improve the employability of students and graduates with disabilities are developed. Documentary management of disability information is also carried out in the university environment and accessible materials are edited. In UNED during the academic year 2017-2018, more than 8,000 students with disabilities have been enrolled. There have been 889 students in Access course, 6,809 students in bachelor's degree, 341 students in master's degree, 423 students in Languages studies, and 39 students in Doctorate. According to their disability, there have been 4,156 students with physical disabilities, 2,114 students with mental disabilities, 509 students with hearing disabilities, 704 students with visual disabilities, and 1,882 students without specifying.

Keywords: Disabilities, inclusion, adaptation, diversity, teachers' competences.

1. Introduction
The real keys to understand the inclusiveness in Distance Education could be summarize in seven focuses:

1.1. The adaptations
To assure equity, usual resources – designed for general purposes – are adapted to special needs. To get equity, equivalence must be guaranteed. That means that the individualization according to contingencies and contextual requirements is discriminatory nor for people with disabilities, nor for everybody. Several catalogues of adaptations were published for this purpose (Andreu, Pereira Calvo, & Rodríguez, 2010).

1.2. The universal design

The design could make easier uses. This principle applies accessibility to physical spaces, technological means, contents, and all kinds of tools and means. The universal design must be flexible, simple and intuitive, easy to perceive information by diverse ways, fault tolerant, and scarce physical effort (Keengwe, 2018).

1.3. The assistive technology

Nowadays the assistive technology provides access to information, specially through the computer, but not only. Assistive means include also communication and mobility resources. They allow the manipulation and control of the environment (Shukhman *et al.,* 2018).

1.4. The rules

The rules are determined at European, national, and local levels. However, the interesting analysis implies the operational levels, that means, at university or faculty levels. The rules should determine people behaviour trying to develop institution cultures. However, they are not ever effective (Varenne, 1998).

1.5. The resources

Each institution needs its direct resources; however, they also use community means. The stable funding allows the specialized services, supporting means, and technical helps. Complementarily, donations, membership fees, volunteering, and subsidies could provide resources. However, these means do not guarantee permanent support specially in crisis times (Fabricant, Burghardt, and Epstein, 1992).

1.6. The empowerment

The equity of the institutions, the state, and the community is necessary, but not sufficient. People with disabilities must believe in themselves. That explains the decrease of students from secondary schools to higher education (Fundación Universia, 2017). That implies that institutions must empower people with disabilities developing programs to convince them that they are able, and they should access to university.

1.7. The human support

The human support is a way to solve the problems in their context. The social support is usually present also in Distance Education, as in non-presence situations, as in face-to-face ones. The teachers, students, and other workers could help students with disabilities. In addition, many strategies could be implemented as accompaniment, personal assistant, personal support, volunteering, interpreters for sign language, tutoring, or mentoring. Social action is always a relevant variable in disabilities inclusion (Fleming *et al.,* 2018).

2. Distance university and inclusiveness

In a previous paper at this conference, Feliz-Murias and Ricoy (2016) analysed main reasons why Students with Disabilities in Higher Education prefer Distance Education. They identified the obstacles that Distance Education avoids and the means that it provides for them.

2.1. Avoidances:

- Physical obstacles: as there are no daily classrooms, students must get around less frequently to campus. That makes easier the attendance for students with physical disabilities.
- Distance communication: as there is less face-to-face interaction, there is less physical or social contact. That makes easier the participation for students with psychological disabilities.
- Privacy: there is much more personal privacy. That decreases the occasions for discrimination for students with disabilities.

2.2. Providences:

- Flexible organization: students have greater autonomy to merge learning with their needs and activities.
- Communication technology: students could use accessible means for communication, facilitating a better and greater connection with managers, teachers, and other students.
- Means availability: the previously planned processes offer many more possibilities to get earlier and easily the learning means, to organise easier the learning process, and to adapt them when it is needed.
- Specialized services: the distance universities have provided explicit services in earlier time of their development.
- Technical procedures: protocols and procedures were designed to receive, diagnose, and orient students with disabilities.

The relevant presence and increasing demand of students with disabilities at distance universities cause a collective engagement as at institution level designing a facilitator framework, as at practical one to carry out day-to-day activities (Jaeger, 2018).

3. Inclusiveness at UNED: UNIDIS

3.1. Some history notes

The main dates related to inclusion of students with disabilities are:

- 1995: Free fees for students with disabilities (first university in Spain);
- 2000: Creation of the Integration Unit for students with disabilities;
- 2005: Establishment of the Disability and Volunteer Unit;
- 2008: Foundation of the Centre for People with Disabilities at University (UNIDIS);

3.2. Definition

UNIDIS is the Centre for People with Disabilities at University. UNIDIS is a service for the university community, without legal personality, dependent on the Students' Vice-Rectorate. "UNIDIS will aim to ensure equal opportunities for people with disability and / or specific needs for educational support in UNED. To do this, it will adopt an organizational and functional structure that guarantees the principles of universal accessibility and design for everyone in the university environment" (UNED, 2015, p. 4).

The current configuration of the technical team has three departments:

- Psychopedagogical Department (4 technicians);
- Technological and Documentary Support Department (2 technicians);
- Administrative Department (2 technicians);

3.3. Functions

According to the regulation of the centre (op. cit., 2015, p. 4), its functions are:

- Providing students, depending on their disability and / or needs, specific educational support, specialized attendance, academic and professional development, providing the appropriate methods, specific means of information, orientation, tutoring, and support for labour insertion.
- Sensitizing, training and advising the university community.

- Establishing action protocols to be used in the decision-making processes and implementation of the adaptations for students with disabilities.
- Improving information processes for university students in support of its full inclusion in university life.
- Improving the accessibility to physical spaces, information, and communication technologies.
- Executing a volunteer plan in faculties, schools and centres for the welcome, accompaniment and assistance to students with disabilities.
- Designing and executing a plan for the employment of students and graduates with disabilities.
- Cooperating with universities to look for tools that improve the quality of the provided services.
- Collaborating with other entities, associations and social organizations whose objectives are related to equal opportunities and the inclusion of people with disabilities in society.
- Fostering university associationism among students with disabilities.
- Proposing agreements with entities and experts in the field of disability for the incorporation of new actions and aids in the development of the process of learning and incorporation to the labour world.
- Promoting attention to disability among the lines of action of the strategy of corporate social responsibility.
- Disseminating the objectives, functions and tasks of UNIDIS in the university community, the related entities and society in general.

4. The stories: numbers and bodies

According to the Report of the Academic Course 2017-2018 (UNED, 2018), 8,018 students with disabilities have been enrolled on 2017-2018. A total of 8,282 enrolments of students with disabilities have been registered in official studies. 1,413 requests of adaptation and services have been received at UNIDIS service, of which 1,103 students have been granted.

Although some students do not expressly declare their disability condition (21.54%) and a person can indicate more than one kind of disability, most of the students with disabilities have a physical one (50.72%) and the psychic one (25.65%) (table 1).

Table 1: Students with disabilities according to the type of disability in course 2017/2018 (UNED, op. cit, p. 5).

Type of Disability	Number	Percentage
Physical	4,067	50.72
Psychic	2,057	25.65
Hearing	507	6.32
Visual	731	9.12
Total specified	6,291	78.46
Unspecified	1,727	21.54
Overall total	8,018	100.00

According to the type of study, most of students with disabilities are enrolled in grades (79.39%) (table 2).

Table 2: Students with disabilities according to the type of studies in course 2017/2018 (UNED, op. cit, p. 6).

Studies	Number	Percentage
Access	947	11.43
Grade	6,575	79.39
Master	329	3.97

Language courses	368	4.44
Doctorate	63	0.76
Total	**8,282**	**100.00**

According to the faculty, most of students with disabilities are enrolled in Faculty of Psychology (16.45%) and Law School (24.41%) (table 3).

Table 3: Students with disabilities according to the faculty in course 2017/2018 (UNED, op. cit, p. 7).

Faculties	Number	Percentage
Science Faculty	378	4.56
Faculty of Psychology	1,362	16.45
Education Faculty	434	5.24
Faculty of Philology	383	4.62
Faculty of Economics and Business	518	6.25
Law School	2,022	24.41
Faculty of Geography and History	869	10.49
E.T.S. Of Industrial Engineers	128	1.55
Faculty of Political Science and Sociology	316	3.82
Faculty of Philosophy	403	4.87
E.T.S. Computer Engineering	191	2.31
Access	909	10.98
Language courses	369	4.46
Total	**8,282**	**100.00**

The evolution in last ten years reflects the constant increasing of students with disabilities enrolled at UNED (table 4). In 2018, UNED had 170,282 students; then, students with disabilities represent 4,86% of enrolment.

Table 4: Students with disabilities enrolled during the period 2009-2018 (UNED, op. cit, p. 8).

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Students	4,808	6,294	6,104	6,906	6,812	7,126	7,000	6,571	6,714	7,419
Enrolments	4,597	5,773	5,861	7,320	7,249	7,698	7,625	7,159	7,395	8,282

The evolution in last ten years reveals the constant increasing of students with disabilities graduated at UNED (table 5). In 2017, UNED had graduated 7,671 students; then, students with disabilities represent 3.01% of graduates. There is still a great effort to achieve the equity.

Table 5: Graduated students with disabilities during the period 2009-2017 (UNED, op. cit, p. 8).

Course	2009	2010	2011	2012	2013	2014	2015	2016	2017
Graduates	95	111	184	156	145	200	215	219	231

5. Adaptations and services

According to the Report of the Academic Course 2017-2018 (UNED, op. cit.), throughout the 2017/2018 academic year, 1,413 students have asked for adaptations or services, a slightly larger number than in the previous year (1,254). However, only 1,103 obtained them. 266 were rejected (figure 1). In these cases, either the service or the students themselves have considered them avoidable or inadequate to their specific needs. This filter function is very important as the university must provide facilities and adaptations to students who need them, however it has to avoid them for students who do not need them.

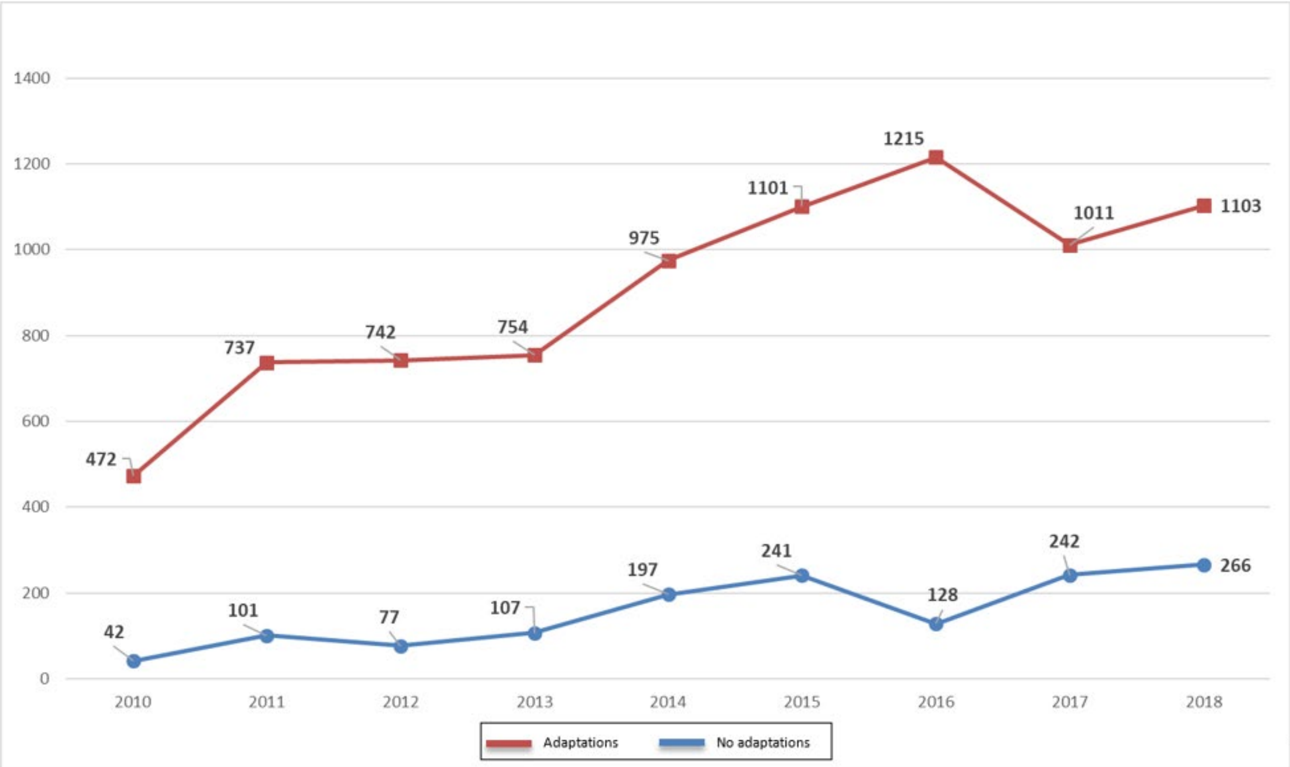

Figure 1: Adaptations and services authorized or rejected (UNED, op. cit, p. 11).

There are 19 different main categories of adaptations and services available. The most frequently conceded have been the following (table 6):

- Different location for exams;
- Personal support or assistance by teachers to carry out the exams;
- Furniture or adapted material provided by the centre;
- Computer support provided by the centre;
- Exams adapted on time or to other modalities;
- Technical aids or adapted material provided by the student;
- Student's answers to the exam in other supports;
- Enlarged font exams;
- Accessibility to the centre;
- Exams on other supports;

Table 6: Number of students and subjects with adaptations and services (UNED, op. cit, p. 12).

Types of adaptations	Students	Subjects
Braille exams	23	65
Exams on other supports	129	268
Exams with enlarged font	198	419
Exams with adaptation of graphical representations	95	178
Exams adapted on time or to other modalities	253	383
Student's answers to the exam in other supports	288	357
Personal support during the exam	71	180
Technical aids or adapted material provided by the student	253	411
Accessibility to the centre	119	295
Furniture and / or adapted material provided by the centre	200	475
Different location for exams	422	668
Computer support provided by the centre	252	412
Personal support or assistance by teachers	629	512
Adaptation of didactic material	97	138
Technical aids and support resources for learning activities	3	12
Personal support for learning activities	10	20
Adjustments to correct the exam	76	134
Adaptation in the oral evaluation	20	12
Adaptation in the wording of the questions	12	13
Total	**3,150**	**4,952**

As observable in the table 7, the number of subjects with adaptations and services has increased constantly from 2010 to 2018. As known, each student is enrolled in several subjects. The adaptations and services could be carried out for each subject as permanent supports (e.g. personal support, computer or interpreter). However, the adaptations for exams should be prepared for each exam session and each student could have 2 exam opportunities in each enrolment. As each period of exams offers two alternatives to make easier the participation, the teachers could have to prepare till four adapted exams for each student whether they do not pass it at once. That means an important implication and effort also for teachers.

Table 7: Number of subjects with adaptations and services from 2010 to 2018 (UNED, op. cit, p. 12).

Year	Total subjects	1st. Semester	2nd Semester	Annual
2010/2011	3,764	1,274	1,286	1,264
2011/2012	4,272	1,657	1,643	1,067
2012/2013	3,906	1,804	1,589	686
2013/2014	4,341	1,833	1,863	825
2014/2015	4,409	2,077	1,968	641
2015/2016	5,331	2,355	2,254	781
2016/2017	4,786	4,345	2,127	606
2017/2018	4,952	2,221	2,099	636

Finally, in the 2017/2018 academic year, 498 hours of interpretation in sign language were carried out in tutorials, face-to-face exams, and other activities, and paid by UNED.

6. Communication activities

According to the Report of the Academic Course 2017-2018 (UNED, op. cit.), UNIDIS also disseminates news and information related to university and disability through several channels:

6.1. UNIDIS website

UNIDIS collects all the relevant news about university and disability and cures it, selecting which one is for technicians, which one for people with disabilities, and which one is open for everybody. The website is designed for anyone who wants information about the academic services offered by UNED for people with disabilities, as well as general information about university and disability.

6.2. Digital bulletin

Since 2010, the UNIDIS Digital Bulletin has been published it is an informative publication managed by the Department of Technological and Documentary Support that every month echoes the latest news, publications, events, and calls about university and disability.

6.3. Fora and communities

Likewise, the relevant information has been disseminated in two fora and communities with students with disabilities, technicians, or interested people. The community of attention to the disability is a space of communication and collaboration where students with functional diversity can share concerns, experiences, resources, and solutions with other students and specialists of our university. There is also a Diversity Services Community for communication and collaboration among technicians who support students with disabilities in Spanish universities, where they can share experiences, resources, consultations, etc.

6.4. Distribution lists

There are several moderated lists prepared for the different recipients: some of them are internal ones, and others are external, as the distribution list of the UNIDIS newsletter, the list of students with disabilities enrolled at UNED, or the communication list.

6.5. Audiovisual dissemination

UNIDIS also uses the audiovisual production media at UNED to broadcast the information in the different communication channels as Canal UNED, TVE2 (second national TV channel) and RNE 3 (third national radio channel). During this last year, 17 recordings have been added to our repertoire related to university and disability.

6.6. Social media

From March 16th, 2016, UNIDIS has implemented the main social networks as Facebook, Twitter, and LinkedIn. The contents to be published through these channels have been submitted according to their own characteristics according to each network. Our results on June 2018, were:

- Facebook: https://www.facebook.com/unidisuned/
    - Publications: 77
- Twitter: https://twitter.com/unidisuned
    - Tweets: 723
    - Followings: 1,089
    - Followers: 1,106
- LinkedIn: https://www.linkedin.com/company/unidis---uned
    - Publications: 30

- Followers: 1,106

6.7. Dissemination in meetings and conferences

The centre also participates in a lot of events and activities related to university and disabilities as:

- Meetings with disabilities associations and foundations.
- Technicians fora and meetings.
- Expert course for technicians about the attendance of university students with disabilities.
- Presentations of guides, materials, reports, and books about disabilities.
- Publications and reports about disabilities at university
- Participation in conferences, workshops, and other meetings.
- Participation in courses and training to improve technician competences.

7. The exhibition "UNED to meet everyone"

On May 4th, 2018 was inaugurated the exhibition "UNED to meet everyone", a collaboration between the Library of UNED and UNIDIS, with the vocation of touring the different centres of our university, as well as other institutions that could host it.

The exhibition summarizes synthetically the activities and actions that UNED offers for people with disabilities, both students and workers at all levels, and explains in a graphic and comprehensible way what mechanisms and strategies they are to facilitate inclusion and normalize the life of people with disabilities within UNED community and also promote, encourage their participation that is still very scarce with respect to the general terms of the population.

The exhibition and the news related to it are on the website: https://sites.google.com/site/bibliotecaunediscapacidad/

The exhibition is organized on three axes:

7.1. Twelve panels mounted on rollups:

The contents reflect the main topics of disabilities at UNED:

- A University near everyone: general introduction on disability at UNED.
- A shared network: distribution of attention to disability in UNED.
- Everything starts when you want: the process of adaptations of the teaching-learning process and evaluation in UNED.
- Other ways of seeing: example of care for a student with visual impairment.
- Other ways of moving: example of care for a student with physical disability.
- Other ways of hearing: example of attention to a student with hearing impairment.
- Opening doors to the world: the challenges of accessibility in UNED.
- We teach and continue to learn: disability in training, research and dissemination.
- Wherever you are: the library at the service of inclusion.
- Personal synergies: the participation of volunteers.
- These are your awards: recognitions to the attention of the disability received by UNED.
- Institutional rollup of UNIDIS.

7.2. Various showcases with books on the subject area of disability:

In several showcases, there are books of interest on University and Disability and specialized magazines in the university environment related to functional diversity.

7.3. Video about the experience of students with disabilities at UNED

There is a TV with videos about the experiences of students with disabilities of UNED.

8. Conclusions and challenges

As conclusions, some challenges could be identified:

- The digital means must be improved to facilitate easy ways of access for everybody. The adaptive technology is available for most students. However, it will work only if it is combined with accessible contents. This focuses specially the virtual sites and the video contents.
- Most topics are still based on paper books. Either if means remain on paper format, all of them have to be provided in digital formats. By the way, the resources must evolve to new formats based on new didactic strategies.
- The evolution of the general framework has to reach the universal accessibility. Most adaptations could be avoided if contents were designed with universal accessibility approach. It could be more expensive at the beginning, however no more adaptations should be needed.
- The procedures must be distributed. Every service must be responsible on his field to carry out the tasks related to inclusion. The specialised services as UNIDIS are to monitor, to ask, to control, and to motivate. However, every service has to carry out its own task.
- The experiences and solutions must be shared to improve the knowledge among all the university community: students, teachers, and other workers. This knowledge must be based on the practical experience, not o theoretical one.
- The public institutions must increase means and funds. As observed, the demands and number of students is increasing, and the available means must be improved. That means more financing, greater staffing and more material resources.
- The positive discrimination measures must be evaluated. Although the fees are free for students with disabilities, the percentage of students is lower as in the general data of access to higher educations, as in graduates at the end of the training.
- New measures must be designed to motivate people with disabilities to participate in non-formal programs. There is a part of them who have no aspirations to get a job because they have a pension or subsidy. They could study by a more profitable and less tense way in non-formal programs.

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Innovative Learning: Students in the Process of Exam Quizzes Building

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Abstract

"Exam Quizes Building" is an innovative method of learning and examination based on empowering students to create questions, putting them in a role of a teacher and role of the researcher. During "Quizes Building" exercise, students created questions and teacher's role was to select good questions for later use. Creating good questions required good mastery of the material. Also it provided motivation boost by creating content which was used later by other students.

The authors will describe practical aspects of educational pilot study with "Exam Quizes Building", including tips on how to create "Exam Quizes Building" using Moodle platform and pedagogical, organizational and technical SWOT-like analysis of this method.

The scale of this method at pilot study was four groups, 300 students, over three thousand questions. Procedure: Students create questions using Moodle quiz with local teacher role. Students create questions along with bibliographical information. Questions are shown to students for public debate and selection.

Keywords: Exam Quizes Building, Flipped Assessment, learning by asking the right questions, practical conclusions from the implementation, collaborative learning, critical thinking

1. Introduction

Creating quiz question by students is a method that brings benefits to both students and teachers.

Students engaged in such an activity usually need to work more and, according to multiple theories discussed later, they can learn better than through reading alone. Also, by creating content for community, they are usually more motivated than writing essays which in most cases goes into a trash can after grading.

For teachers, the main advantage is the size of question bank, available for future use. This method can lead to creation of hundreds of questions per year (depending on class size and students' activity), which can be used during tests (both self-assessment and graded) and exams.

Although this kind of assignment is nothing new, since it can be done using pen and paper, modern IT tools like Moodle make the question creation process and question delivery much smoother and less time-consuming.

2. Theory behind student-generated quiz questions

The subject of quiz questions generated by students is studied since 1970s. There are multiple theories claiming that the process of generating questions might have positive impact on students' results.

The active text process theory claims [1] that creating quiz questions enhances students' reading comprehension by constructing relations between the text and prior knowledge, because the process of generating questions forces students to think about relations among different aspects of the text. Early study by Andre and Anderson [2] investigated effects of rereading versus student-generated questions and showed some positive impact on students' performance of the latter.

The review and elaboration theory points out that creating questions may increase student's motivation for reviewing [3] and also requires more intensive review than in case of rereading, because students need to identify important information when they want to create a good question [4].

Another approach is proposed by metacognition theory. According to Flavell [5] metacognition is "one's knowledge concerning one's own cognitive processes or anything related to them". Creating questions by students may help students to "monitor their understanding and encourages students to get to know what they know and what they don't know" [6].

Generating questions by students was also studied from socio-cognitive perspective. The process of question generation, including discussion about questions, encourages students to collaboratively build knowledge and obtain deeper understanding [7,8].

According to some research, student-generated questions promote higher-order thinking [9]. Students during question creation need to generate explanations to justify their questions, which requires students to use higher-order thinking abilities [3].

3. Description of the process

Student generated quiz questions assignments were launched multiple times by several different teachers, but generally as described below, with changes to schedules and detailed grading rules.

3.1 Preparation

When the project started in late 2013 with student generated quiz questions assignment, we were using built-in Moodle platform functions. Now, there is a dedicated plugin available, which will be described later, but before it was introduced, all of our assignments were done 'manually' by the teacher.

The teacher had to prepare workspace for his students. He created, for each student, a separate Moodle quiz module with locally assigned teacher role for that student. The quiz was hidden, so the other students were not able to access it – the access was restricted for student with local teacher role and a teacher.

The problem was in teacher's workload, because most groups consisted of over 100 students, which meant creating (or rather duplicating) one quiz for each person and then assigning local role for each student. Now, with new plugin, teacher's workload is significantly reduced.

3.2 Teacher's instructions

Students were instructed to create 10 questions as obligatory part of an assignment and they could create 10 more questions for bonus points.

Teachers usually briefly instructed students how to use Moodle quiz module and students had no technical difficulties during the question creation process.

3.3 Question creation

When the assignment has started, each student received his own Moodle quiz module with locally assigned teacher role. The quiz was invisible to other students and students were instructed not to use common quiz question data base of the Moodle course, because in that case they would see (and could edit) each other questions, so they put questions into quiz category (Moodle allows for separate category for each quiz module, which isn't shared across the course).

Students had access to variety of Moodle question types, including multiple choice and multiple answer, matching, fill-in missing words, show on picture, ordering, etc. It made quizzes more engaging and it also helped to unleash students' creativity.

Students were obliged to provide proper references for each question, including photo of the book page on which the question was based. This made checking far easier for the teacher, because he could check the question even without having that book at hand.

References were placed in the 'general feedback' text field in Moodle question. This field displays when students submits his answer (and can be hidden during the exam). This allowed students who are taking non-exam quiz to check the source of the question and get information about some book that they have missed.

Usually the question creation period lasted for several weeks. After it has ended, students were deprived of locally assigned teacher roles. They couldn't create question anymore and lost access to common quiz question database.

3.4 Peer assessment of created questions

In the next phase teacher took all the questions created by students and put them into public quiz module. All the questions were made available for review and students could discuss them on the forum.

Thanks to the references, students who omitted some books or other materials, could identify what they have missed. The knowledge of sources and questions significantly reduces stress, because students were not surprised by some less common topics.

3.5 Question selection process

Basing on the students' feedback from the peer assessment phase and his own judgement, teacher eliminated wrong questions or questions of low quality. All the accepted questions were divided between thematic categories for future use and stored in Moodle course question database (which can be easily copied to other courses).

3.6 Computer based exams

When it came to the exams, we have been using free examination tool called *Safe Exam Browser*. Combined with Moodle quiz function it makes any cheating attempt virtually impossible. There are multiple SEB and Moodle tools to limit cheating, which can be used in any combination:

- Students cannot access the internet.
- Student cannot close the browser. If they turn the computer off, they can continue after the restart from the place they have finish.
- Access to the exam can be restricted to selected computers (by individual IP addresses or IP range).
- When exam has started, students cannot go back to Moodle materials – they have to complete the quiz.
- Students cannot go back to previous questions.
- Questions are randomized by drawing pre-set number of questions from thematic categories.
- Question order is randomised.
- Answers and distractors are randomised.

The result is that every student receives slightly different questions (but on the same subjects), in mixed order, with mixed distractors and without the ability to go back. With proper teacher's supervision, cheating is close to impossible.

With automatic grading students know their score just after finishing the exam. There is no need for manual grading and this alone can save a lot of teacher's time.

3.7 Possible technical improvements

When we have started with student-generated quiz questions, there were no specific tool to support the process. We were using built-in Moodle quiz module in conjunction with locally assigned teacher's role. The problem with that method was that it took a lot of time on part of the teacher.

But now we have *StudentQuiz* plugin for Moodle, which was developed by University of Applied Sciences Rapperswil, Switzerland. This new plugin makes the whole process much easier, especially by reducing teacher's workload. Instead of creating new quiz with locally assigned role for each student and then close quizzes for students when the question creation period ends, with this plugin teacher can create one student quiz in which all the students can publish, test and evaluate their questions. We strongly advise to move to the new plugin.

4. Data and feedback

Student-generated question bank was done by teachers of several faculties, e.g. Faculty of International and Political Studies, Faculty of History and Jagiellonian Language Centre.

One instance of course with student-generated quiz questions from the Faculty of International and Political Studies was closely monitored. We have collected data and feedback about the whole process, results and students' opinions. There were 100 students in this group.

4.1 Difficulty level

There is common apprehension that showing the questions to the students before final exam may cause the exam to be too easy.

The average final exam score among all the course subgroups was 62.90%. The maximum score was 84,17% and minimal score was 28,0%.

One subgroup of 42 students in our course had to do the exam quiz with 55 points maximum. Figure 1 shows how the grades were spread.

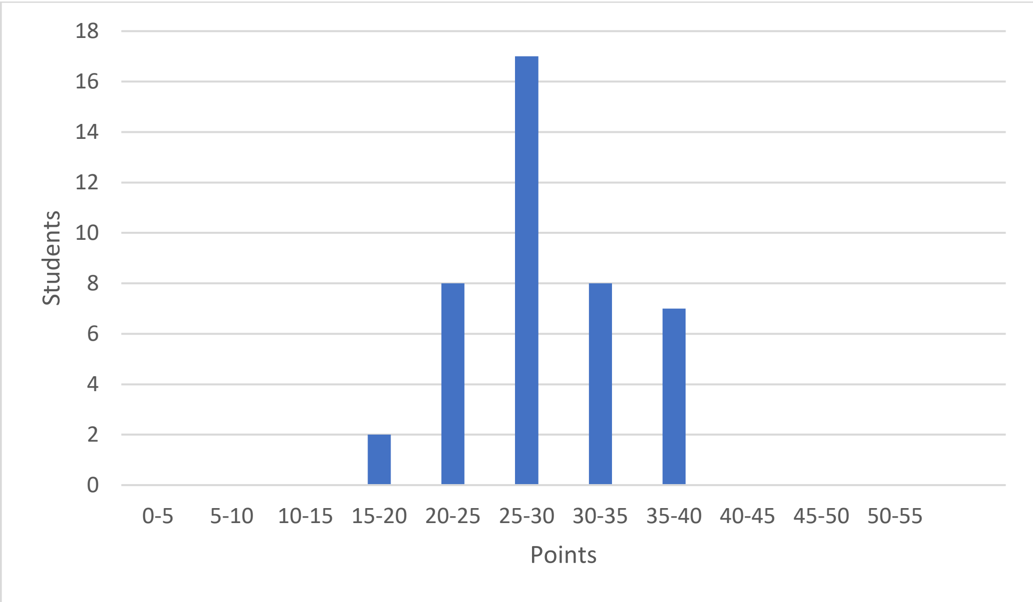

Figure 1: Spread of points (for 42 students).

Despite students were shown most of the questions before exam, there are no maximum or even near-maximum grades, proving that exam was far from being too easy.

Even if students copied all the questions from the whole database and try to memorise them, there were over 2800 questions, which make the whole effort very time consuming and basically pointless.

4.2 Activity impact on exam results

Students' activity during question creation and peer assessment had significant impact on their results. There was a correlation between actions (by action we mean any operation on Moodle platform that is recorded in logs) and final exam grade. The Pearson's correlation coefficient was 0,466 (significant at the 0,05 level). Figure 2 shows the details.

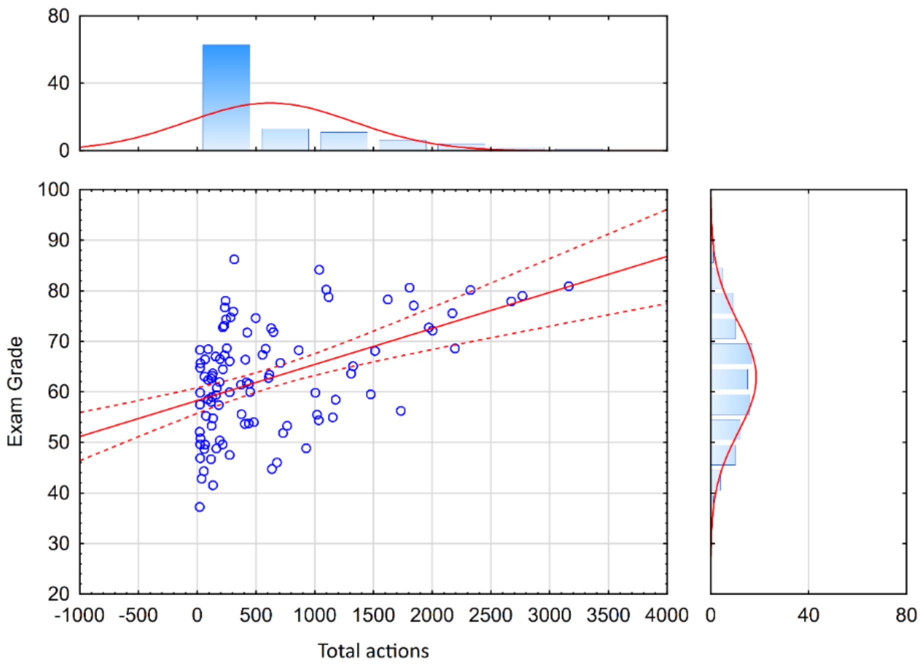

Figure 2: Correlation between exam grades and students' activity (for 100 students).

4.3 Students' feedback

After the assignment was over, students were given short anonymous survey. Their responses were as follows:

Would you like to create more quiz questions in other subjects?

- Definitely yes – 35%
- Rather yes – 45%
- Difficult to say – 20%
- Rather no – 0%
- Definitely no – 0%

Is question creation method a good method of learning?

- Yes, but is too time consuming – 20%
- Yes, it allows for deeper understanding – 80%
- No, reading books is enough – 0%
- No, it's a complete waste of time – 0%

Was creating questions difficult from technical perspective (using Moodle)?

- Easy and without problems – 60%
- Mediocre, it could be better – 40%
- Difficult and cumbersome – 0%

What form of test do you prefer – computer-based exam knowing a part of the questions or pen and paper exam but without knowing a part of the questions?

- Computer based – 65%
- Pen and paper – 10%
- Makes no difference to me – 25%

Which form of test do you prefer without knowing a part of the questions?

- Computer based – 25%
- Pen and paper – 35%
- Makes no difference to me – 40%

We have also concluded interviews with the students and they have clearly stated, that they were far more motivated by creating content that will be used by their group and others, than write essays that will probably land in the trash can after grading.

Students also stated, that this kind of assignment requires much effort, which was considered good by more ambitious students.

Some students stated, that knowing the range of course material (thanks to references in Moodle questions) significantly reduced stress, because the probability of being surprised by some questions was significantly lower.

4.4 Number of questions created

The main advantage for the teachers is the ability to obtain large question base with much less effort than creating questions themselves. They spend time for evaluating the questions and preparing the whole assignment, but with new plugin available, the time spend is limited only to question evaluation, which is significantly faster than creating questions from scratch. There is also another benefit when it comes to question diversity, because students often surprise teachers with their creativity with available multiple question types.

For one of our courses, number of students and number of questions created is shown in Table 1.

Table 1: Number of students and new questions in each course edition at the Faculty of International and Political Studies.

Edition	Students	New questions
2013/2014	108	ca. 1300
2014/2015	100	ca. 1540
2015/2016	126	ca. 240
2016/2017	101	ca. 460

The activity decreased in later years because teacher had enough questions for his purposes and because creating new, original questions were much more difficult to create given large question base.

5. Conclusion

We have launched multiple instances of student-generated questions assignment. They were used both for preparing exam questions and as an additional activity during a course.

The assignment has some slight impact on students' results, but greater impact can be seen when it comes to motivation. Students are used to write essays that are not used anymore after grading, so the students have the notion that they write essays only to themselves. In case of creating quiz questions, they are aware that questions will be used by their group and in the future years and such notion of creating something for the community motivates many students far more than writing the essays.

Knowing the questions before the exam and the ability to review references published for each question greatly reduces stress, while keeping difficulty level quite high, because it is virtually impossible to memorize such large question base.

Students have no technical problems while creating questions using the Moodle platform and taking photos to put into references.

Teachers acquired large question data bases for future use, not only for final exam but also for self-assessment tests for each subject. Although with built-in Moodle functions it required a lot of effort (still significantly less than creating questions by themselves), but with new plugin available, the whole process if far less time-consuming.

The additional benefit of using Moodle quiz module is an ability to launch computer-based safe exam with far more limited cheating than on standard pen and paper exam.

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Open Educational Resources in Microelectronics framed in the MicroElectronics Cloud Alliance Project

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Abstract

Nowadays, the use of Information Technology (IT) infrastructure in the learning environment is a demanding challenge. Few times the needs of the work place and its changing environment are mentioned. These changes are not met with changes in education. Curricula have to be updated and universities need to collaborate to share course materials, intellectual property blocks and ideas.

To answer these requirements of labor markets and academic institutions, the MicroElectronics Cloud Alliance (MECA) was set to develop Cloud-based European infrastructure for providing education in micro- and nanoelectronics.

The Spanish University for Distance Education (UNED) - as a partner of the project – has developed two MSc courses in Microelectronics as open educational resources (OERs) over mClouds architecture for the rest of partners to access and share them.

This article presents the results of the two new courses developed by UNED, as well as the new lines of exploitation of these OERs within the academic community and the SMEs that want free and open courses to guarantee the highest quality in the training programs addressed to their staff.

Keywords: cloud-based e-learning environment, microelectronics courses, open educational resources.

1. Introduction

The educational model has evolved along with technology and the needs of people. Nowadays it offers hundreds of different courses, each of them with its own methodology. Thus, universities and training centers have renewed their courses and educational resources in order to be more competitive. Current courses have very specific characteristics; among them we can highlight open courses, easy hosting environments, dynamic and varied contents that allowing interaction between users without time limits or geographical restrictions as well as virtual and remote activities.

The Spanish University for Distance Education (UNED) has developed a varied number of open courses, MOOCs for the students interested in, and curious about engineering, people entering in the work field or who would like to improve their knowledge beyond their local boundaries and people who want to acquire new knowledge.

This document describes in Section 2 the different courses in UNED. Section 3 explains in detail the courses part of the MECA project. Section 4 presents the learning outcomes and the results of the pilot test. Section 5 details the conclusions that were reached after the work developed in the MECA project. In Section 6 we acknowledge those who make possible this research. Finally, the last section is dedicated to the references cited in this article.

2. Description of the courses developed by UNED

An aforementioned, UNED has developed a series of courses in different formats adapted to the needs of the labor market and a new generation of students. The first model of courses is for pre-university students. To create them our university worked with 11 different secondary schools. The courses developed are available both in Spanish and in English. Three different courses on technology were developed for Secondary Education (compulsory in Spain) [1] [2]. They are offered to students of 12 to 16 years.

The second set of courses is devoted to increase knowledge of people entering in the work field, or wants to learn new things. They were intended to meet the demands of the labor market in microelectronics. Thus, two new open courses were designed as part of the European project Erasmus+ Knowledge Alliance MECA: “Microelectronics Literacy and Technologies” and “Integrated Circuits and Design”.

Finally, the last type of courses follows the UNED model where new educational resources for MOOCs are being developed to offer specialized knowledge in different areas to all people who are interested in learning and acquiring skills in new areas.

As part of the dissemination and final stage of the MECA project, in this paper we will focus on the second set of courses.

3. Courses on Microelectronics

The MicroElectronics Cloud Alliance provides a range of open educational resources (OERs) and virtual or remote access to practice-based learning facilities. In general no university is able to afford the necessary infrastructure, clean rooms, technology and experts in all fields of this multidisciplinary science. To share laboratory experiences, CAD tools, project ideas and a common infrastructure, the use a sort of "educational cloud" above the software/hardware infrastructure can be a solution. All the partners of MECA - Higher Education Institutions (HEIs) as well as Small and Medium Enterprises (SMEs) - developed e-learning materials for 22 courses in CAD systems, microelectronics technologies, test, characterization and application of integrated circuits and systems. These 22 new courses foster virtual mobility and each university allows partners to share a cloud-based teaching system, as well as remote access to its facilities and laboratory experiments or software systems, thus giving them access to new resources.

The two courses that UNED has developed are: 1) Microelectronics Literacy and Technologies, and 2) Integrated Circuits and Design. The first course (Microelectronics Literacy and Technologies, MLT) focuses on delivering basic knowledge in Microelectronics. The course is divided into two clearly differentiated blocks: 1) Fundamentals of Microelectronics; and 2) Main Technology Processes in Microelectronics. As well, the second course (Integrated Circuits and Design, ICD) deals with more advanced concepts in Microelectronics and it is designed for experimenting with remote laboratories, such as the *Virtual Instruments System in Reality, VISIR* lab. UNED has extensive knowledge in remote and virtual tools, given that a distance-learning model is its core feature. This course is also divided into two blocks, 1) Technologies of Integrated Circuits and 2) Design of Digital Integrated Circuits.

Figure 1 shows the website of these courses. All have been developed in Moodle and allow free access to all who is interested in Microelectronics. In addition to VISIR, each of these courses integrates several learning materials (see Figure 2).

Innovation in these courses lies on the integration of a remote laboratory (VISIR). It is a remote lab for experiments on electric and electronic circuits, developed at the Blekinge Institute of Technology (BTH) of Sweden, and is used in several universities worldwide [3]. The VISIR software is released under a GNU GPL license. "Web Interface" is the website of VISIR. When a client logs in, it generates a session cookie stored in the "Measurement Server" for authentication. The "Experiment Client" accesses through the Web Interface, being the entire laboratory workbench an embedded object through an HTML page. The roles of the Measurement Server are authentication at each request of the session cookie; validation of the construction of the circuit and values obtained with the instrumentation values (defined previously by the administrator/teacher); handling of time-sharing between simultaneous users; handling requests' queue. The "Equipment Server" is a stand-alone equipment controller written in LabVIEW, which manages all the hardware with the relay switching matrix.

Figure 1: Website of the Microelectronics and Renewable Energy Courses.

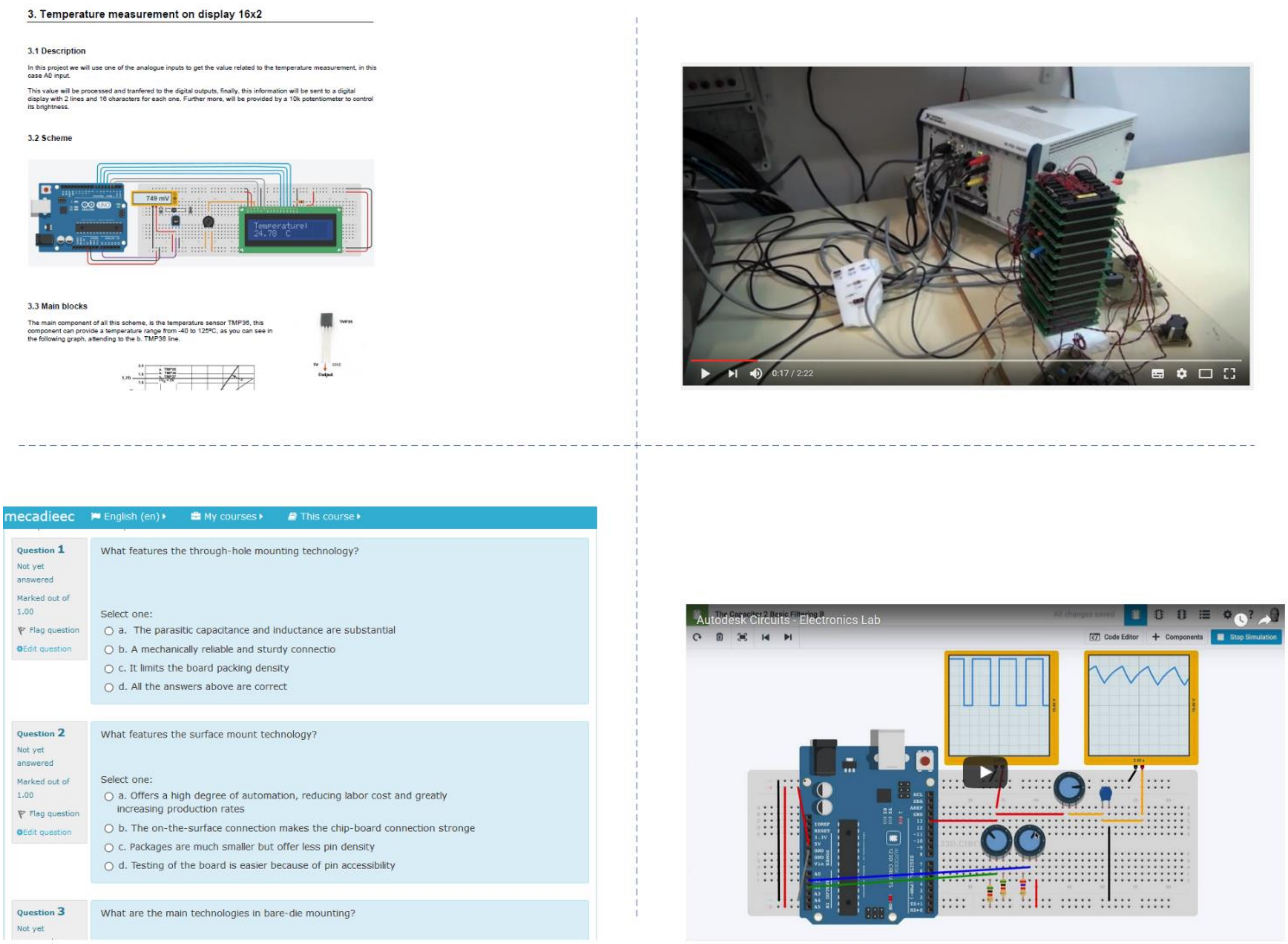


Figure 2: From upper left to bottom right: documentation; demonstration videos; mock practice and self-assessment exercises; access to virtual tools.

The main difference between remote laboratories and in-person laboratories lies on how the interaction between student and workbench is carried out. The main advantage of remote labs when compared with in-person ones is their availability, with no temporal or geographical restrictions.

Other improvements of remote laboratories are low maintenance cost and requirements; no need for assistance during experimentation of students and no associated risks for students and instrumentations. However, remote labs have obvious limitations not found in in-person laboratories such as the degree of freedom in the design of experiments.

In these courses the use of VISIR is introduced progressively with demo videos. Then, as series of activities are sorted and presented to students by level of difficulty. All activities designed for these courses have their own video with instructions, a document to guide students throughout the practices and access to VISIR using a booking system.

4. Learning Outcomes and Results of the Pilot Test

The usefulness of these courses is not limiting them to our country (Spain) but to expand them beyond our borders. The MicroElectronics Cloud Alliance allows us to distribute all our resources in the European Area. Table 1 summarizes the learning outcomes of the two MECA courses presented in this paper.

Table 1: Learning Outcomes of the Two Courses Developed By UNED.

Courses	Knowledge	Skills	Competences
Microelectronics Literacy and Technologies	Overview of fundamentals of microelectronics. Basic knowledge in the main technology processes in microelectronics.	Skills in classification materials, definition of semiconductor substrates and crystals. Ability of understanding the crystal growth processes, all the main manufacturing processes and thin film processes and choosing which is the best process to use for a specific design	Ability to use different types of large scale integrated circuits Being able to design the oxidation and deposition layers and the diffusion and ion implantation in microelectronics
Integrated Circuits and Design	Advanced knowledge in Technologies of integrated circuits and methods for designing digital integrated circuits	Advanced skills in choosing which is the best technology to use for specific requirements in the production of an integrated circuit and advanced ability of choosing more suitable method for designing a specific integrated circuit	Being able to use Lithography technology in the design of integrated circuits. Ability to use CMOS technology sequence and BiCMOS integrated circuits. Being able to manage and design custom circuits and logical matrices.

As part of the MECA project, the School of Industrial Engineering of UNED carried out a pilot test to get feedback from the experience of the students, thus allowing us to improve its design or content (f needed) always keeping in mind the dissemination and international scope of the courses.

Two questionnaires were created to fulfill this purpose, intended to gather data of the small but significant set of participants in the courses. Hereunder we present and detail each questionnaire and the results obtained.

4.1. Questionnaires and results: Course on Microelectronics Literacy and Technologies (MLT)

Twenty-five participants answered this questionnaire. The first set of results related to demographic data such as gender, age, education and occupation are detailed in Figure 3. This first set of data is common to both questionnaires.

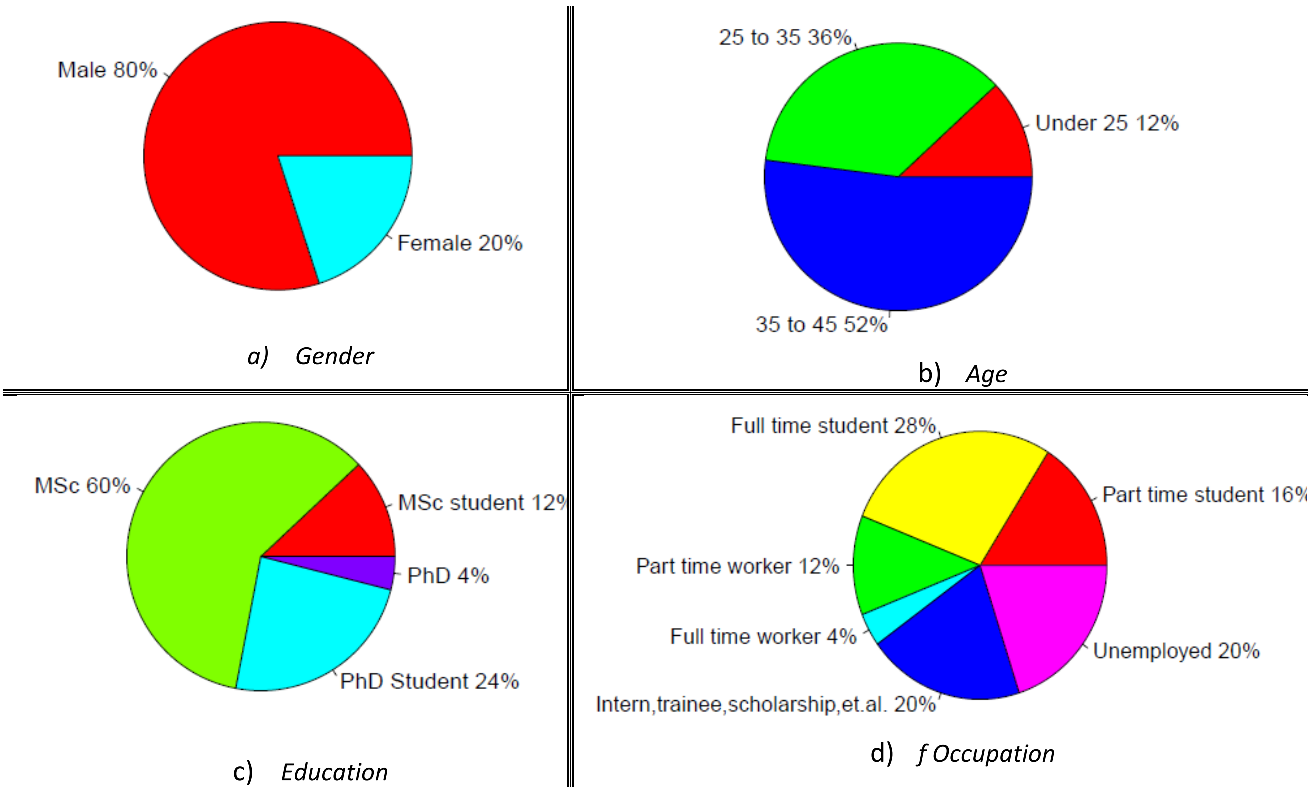


Figure 3: Demographic data of participants: Gender; Age; Education; Occupation.

Data shows that the majority of respondents are male, aged between 35 and 45 years, graduate students pursing a masters degree or doctorate, and working full o part time.

The next series of questions are related to general aspects of the MTL course (Figure 4).

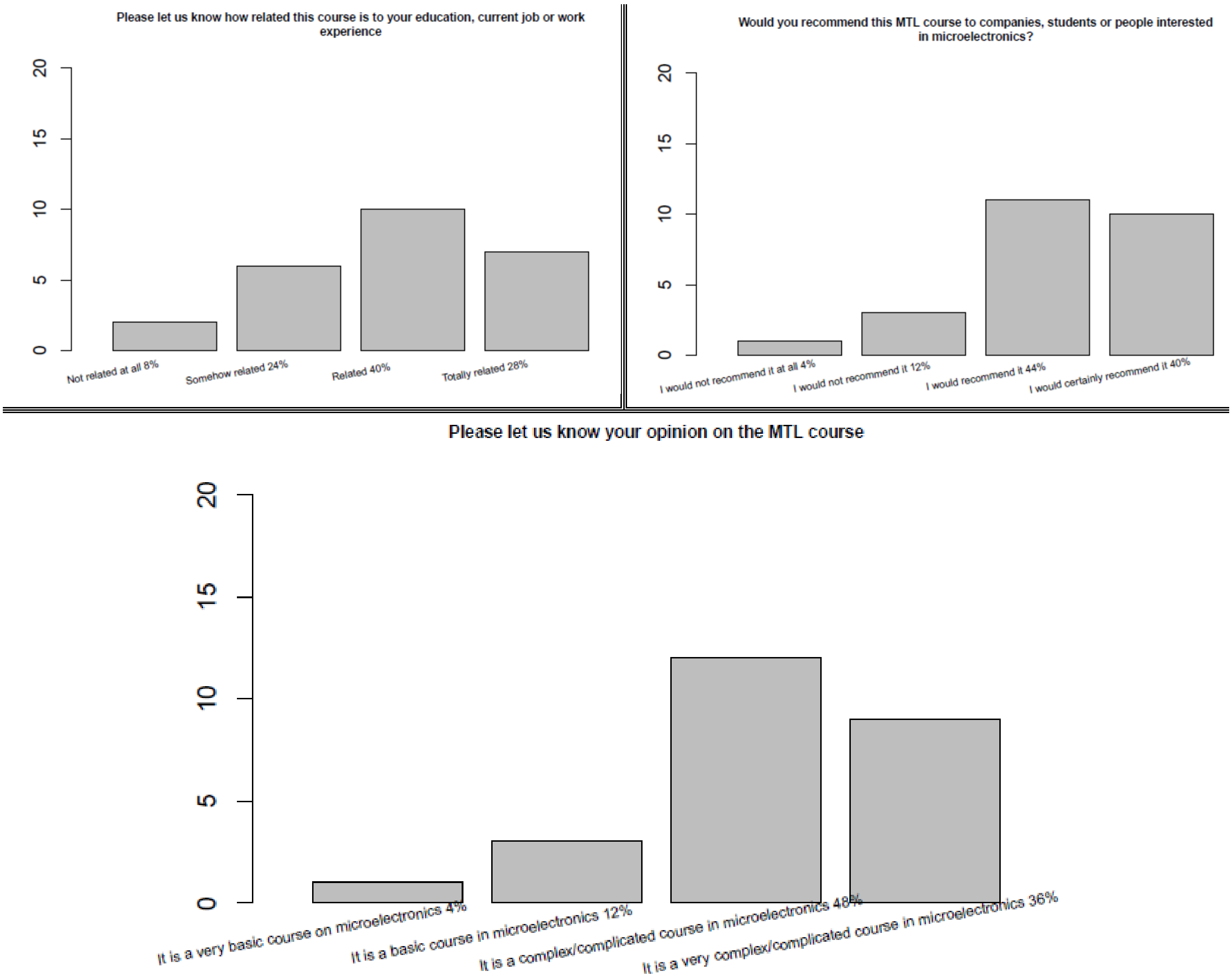


Figure 4: Set of questions related to general aspects of the MTL course.

As per data, 40% of students were pursuing this course because it was related to their work or previous education. The final evaluation of the course has been very positive, as 84% of participants would recommend it to other users. The last question revolved around the global opinion of the course, and its results show that the respondents consider that it counts with complex contents on microelectronics.

The last series of questions focused on methodology, design, content and degree of satisfaction of the users (Figure 5), as well as on the platform used, the technological means and a final evaluation of the course (Figure 6).

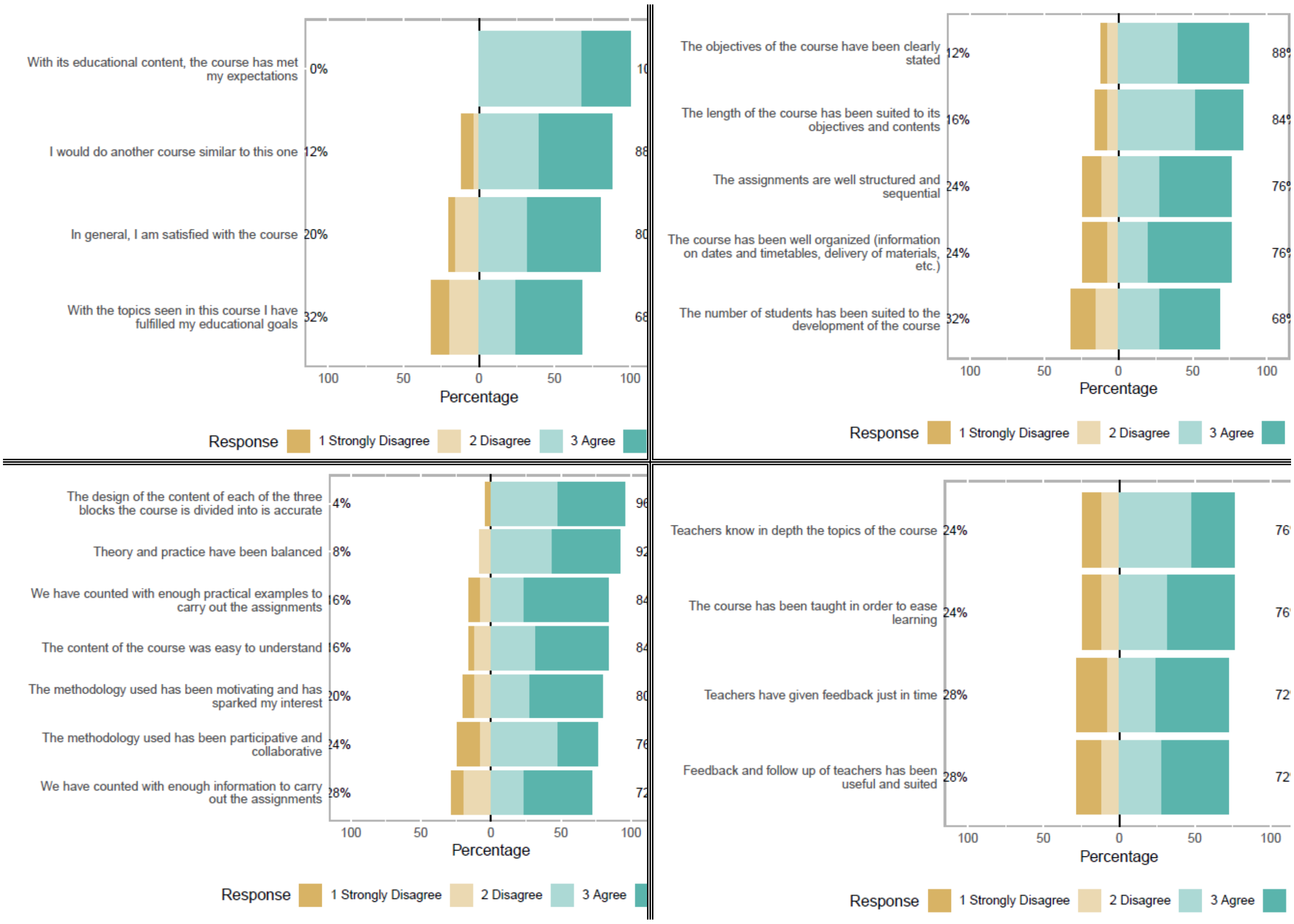


Figure 5: Methodology, design, content and degree of satisfaction of the users of the MLT course.

The results of the elements measured are very good, as 100% of participants agree that their expectations have been fulfilled. As well, 84% of respondents consider that the duration of the course is adequate to cover all the contents and 88% think that the objectives have been clearly defined since the beginning of the course. 96% of respondents consider that the design of the content in the different blocks is correct and precise, and 92% think that theory and practice are well balanced. Finally, 76% of students consider that teachers are expert in their fields and the course is taught to be easily understood.

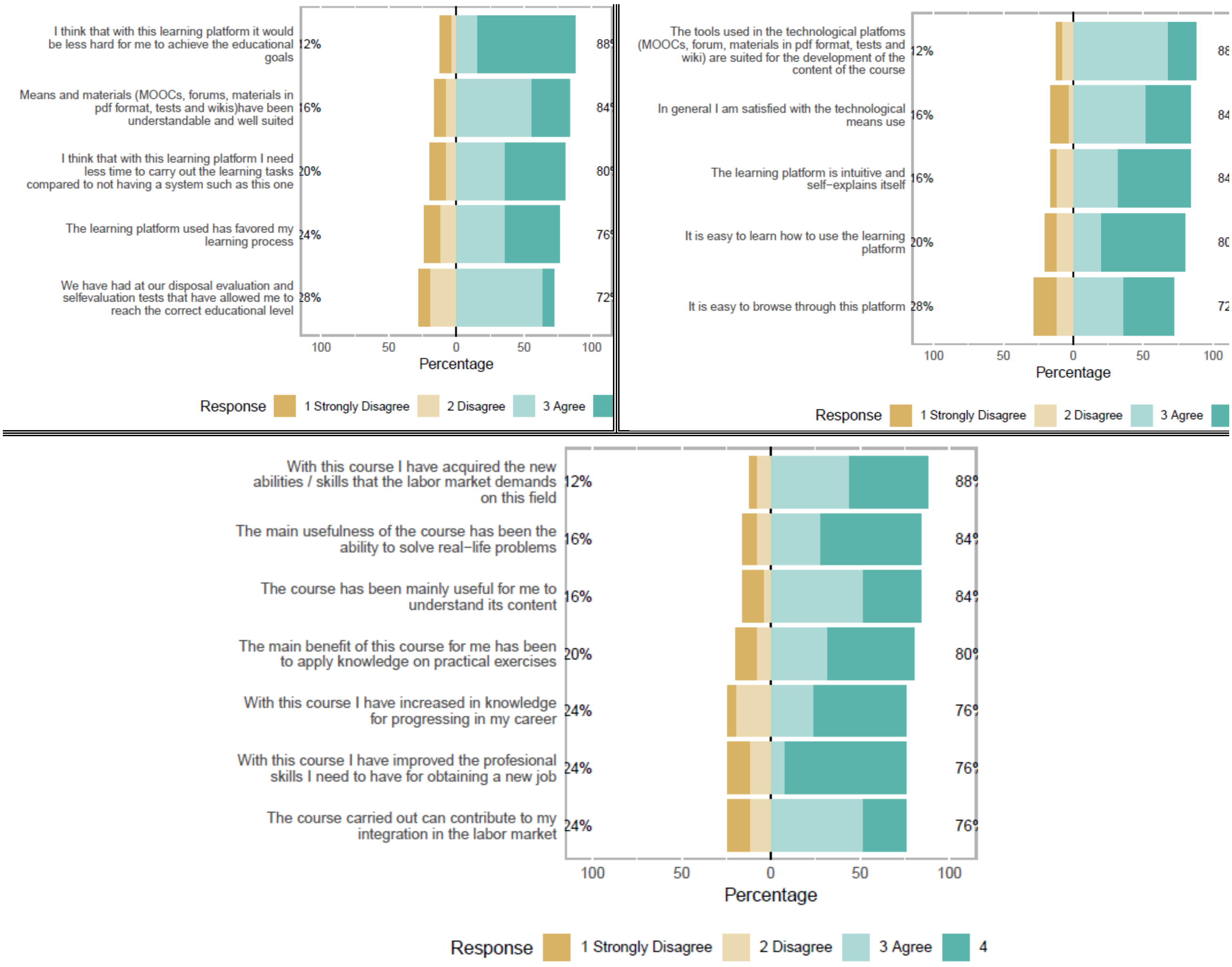


Figure 6: Platform, technological means and final evaluation of the MTL course.

The platform and technological means used as well as the final evaluation of the MTL course also obtained very good results. 88% of respondents consider that the educational platform used for the course favors learning. As per responses of 84% of participants, the technological means used (forums, materials, tests and wikis) are easily understood and adequate. Thus, in general 84% of respondents are satisfied with the means used.

Finally, in the global evaluation of the course 88% of respondents said that they acquired the new skills in microelectronics that the labor market demands. In addition, 84% considered the course very useful to solve real life problems.

4.2. Questionnaire and results: Course on Integrated Circuits and Designs (ICD)

As aforementioned, the sample is 25 students who took part in the pilot test of the MECA project. As in the previous questionnaire, respondents are 80% male, 35 to 45 years of age, pursuing a masters degree or a doctorate and working either full or part time.

The first three questions are related to the general aspects of the ICD and MLT (Microelectronics Literacy and Technologies) courses (Figure 7).

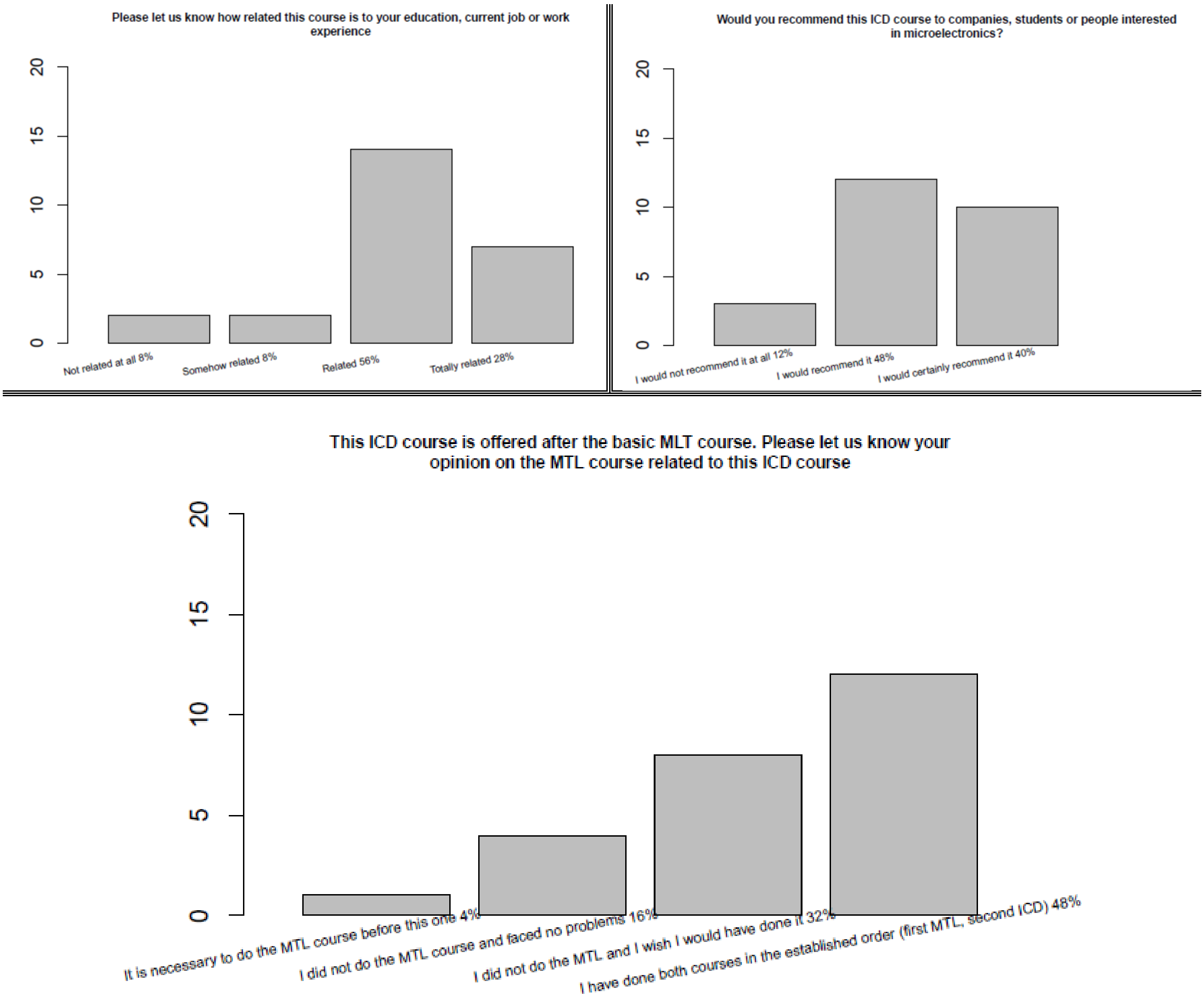


Figure 7: General aspects of the ICD course.

Data shows that over 56% of the respondents took the course as it was related to their field of work and / or their previous studies. Likewise, the final evaluation of the course was very positive since 88% would recommend it to other users. Finally, participants were asked if they did the previous MLT course to take this advanced level course. With their responses it was possible to see that students considered necessary to carry out both courses in the established order.

As with the previous course, a set of questions on methodology, design and contents of the course, as well as the degree of satisfaction of users, were asked in the last part of the questionnaire (Figure 8). Another set of questions revolve around the platform, resources and technological means, as well as a final evaluation of the course (Figure 9).

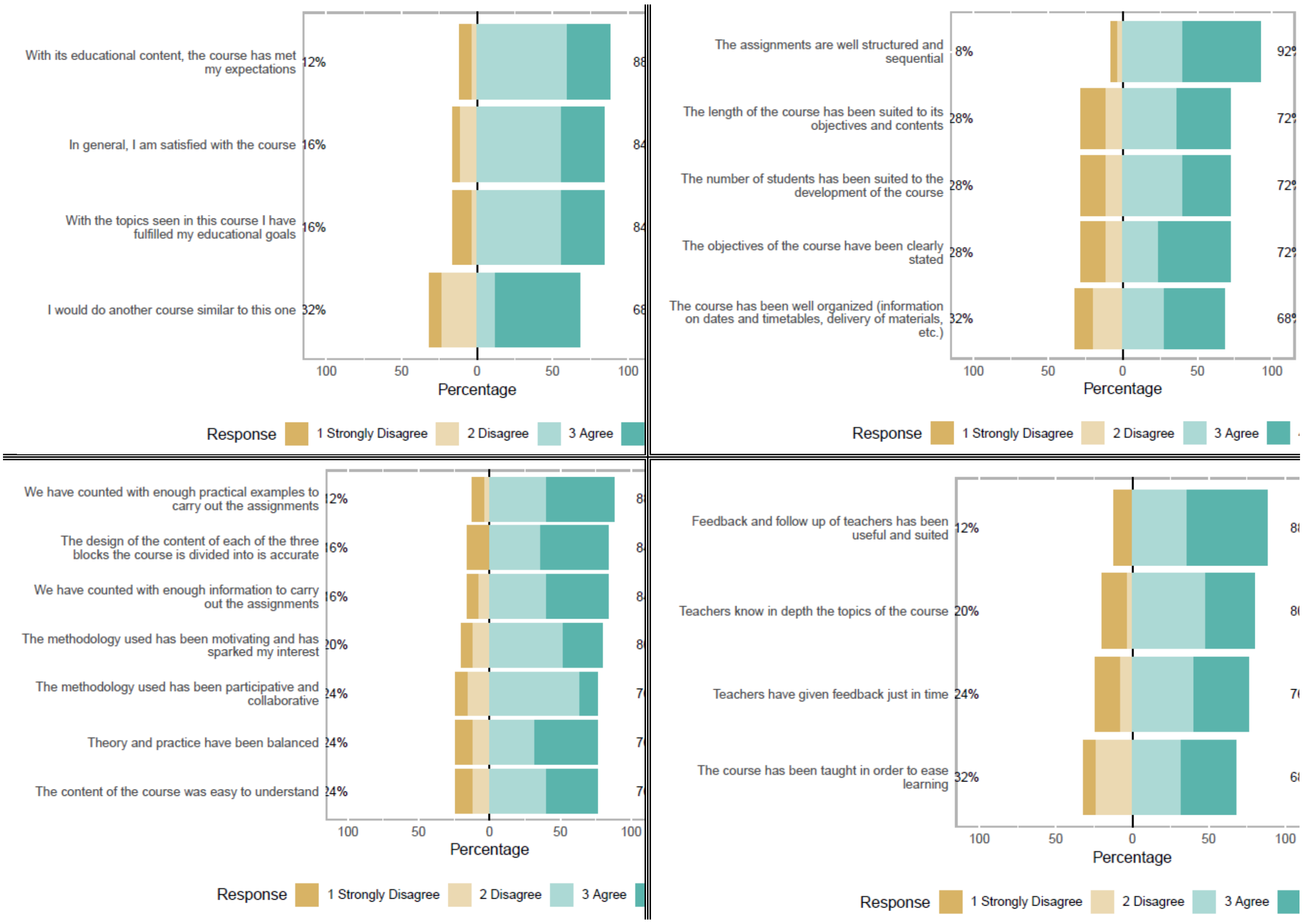
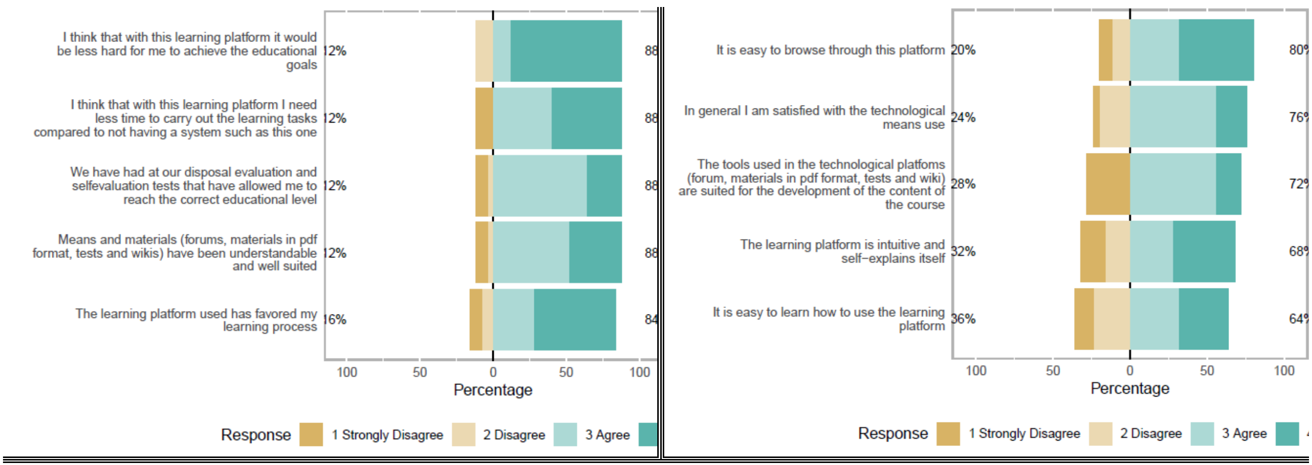


Figure 8: Methodology, design and content of the ICD course.

Methodology, design and content obtained very good results. 88% of respondents believe that content has fully met their expectations and 92% think that the tasks are sequential and well organized in the course. 88% of students answered that the course counted with sufficient practical exercises to carry out all the tasks posed. On the other hand, the methodology used was motivating for 80% and raised their interest in the course. Finally, we can conclude that the follow up by the teaching team was perfect and very useful for 88% of respondents.



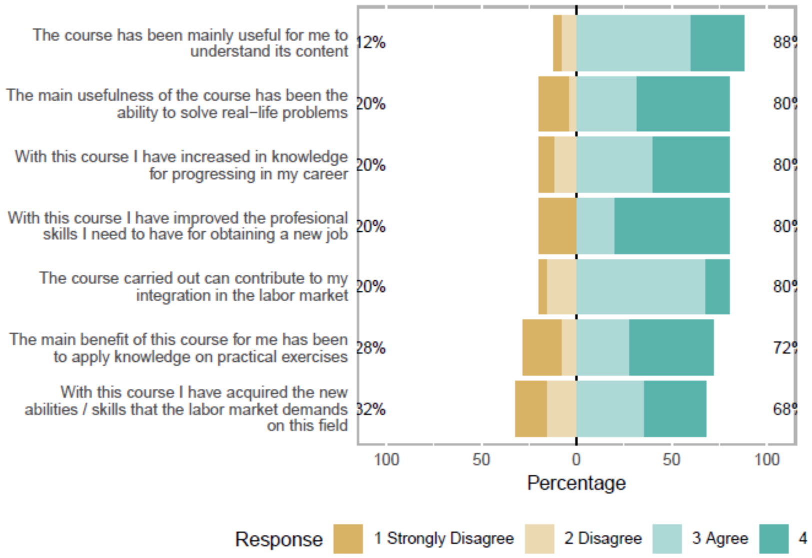


Figure 9: Platform, technological means and final evaluation of the ICD course

Data shows that this set of questions have obtained very good results as well, with 88% of respondents considering that the educational platform hosting the course favors learning. For 88% of students the means and materials of the platform (forums, tests, and wikis et al.) were fully understandable and adequate for the course. Thus, 76% are satisfied with the technological means used.

Finally, in the global evaluation of the course 80% of respondents said that they expanded their knowledge and could apply for a better job. As well, 80% of students considered that this course could help them on their integration in the labor market as the course improved their skills in this highly demanding field.

5. Conclusions

This article describes the work carried out in the three years of the MECA project, being these courses one of its key elements. The two courses on microelectronics have been designed as part of the scope of the MECA project: the research on the current demands of the labor market as well as the educational evolution that has taken place in higher education.

The courses have been hosted in an open platform to allow accessing and sharing resources and contents by all the participants in the project as well as every person interested in microelectronics. These courses have been developed with the distance education methodology of UNED.

The results of the survey carried out to evaluate the courses show that the contents were presented in an orderly and sequential manner according to the progress of students in their learning. The importance of tools and practical contents is highlighted as well, and this design has allowed students to combine the theoretical contents learned with real distance practices.

These courses open up new possibilities of acquiring or complementing knowledge, free of charge, and to improve the ability of educational institutions to integrate better-educated people into the workforce. Our challenge will be to keep on researching in this field to integrate more practical courses with remote labs as well as implementing the MOOC model in order to provide high quality education to every person interested in microelectronics.

6. Acknowledgments

We would like to acknowledge the Electrical and Computer Engineering Department of UNED for their support in the project “Knowledge Alliance 562206-EPP-1-2015-1-BG-EPPKA2-KA MicroElectronics Cloud Alliance (MECA)”. As well we thank the eMadrid excellence network “Investigación y desarrollo de tecnologías educativas en la Comunidad de Madrid – S2013/ICE-2715” and the support of the Industrial Engineering School of UNED in the project “2017-IEEC14 Prácticas de laboratorio y publicaciones en congresos”.

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Open Networking Lab: online practical learning of computer networking

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Abstract

Learning to configure computer networks is a topic requiring a substantial practical component and suggesting a pedagogic approach that foregrounds experiential learning. However, providing appropriate computer networking hardware is expensive for classroom labs, and is not viable for individual distance learners.

Simulation offers an alternative basis for practical learning and supports a range of modes, from individual distance learning to in-class blended learning. Sophisticated network simulation packages, such as Cisco's Packet Tracer, have high fidelity to networking devices and can simulate complex network scenarios. Unfortunately their complex interfaces make it difficult for a novice student to engage productively.

The Open Networking Lab (ONL) will provide online resources for students of introductory computer networking. It will take an activity-centred approach, supported with video and screencasts, in preference to lengthy text. Practical activity is based on *PT Anywhere*, a network simulator that provides students with an easy-to-use, browser-based interface over Cisco's Packet Tracer. *PT Anywhere* thus provides fully authentic simulation but, by only revealing a subset of features, supports a carefully scaffolded approach to teaching and learning.

We report at an early stage in the development of the ONL. Material is being piloted with students at UK Further Education colleges. Evaluation will include observation, surveys and interviews with students and staff; PT Anywhere also provides learning analytics. A further stage of development will culminate in a badged open course on the Open University's OpenLearn platform.

The ONL will provide vocational learning at scale in educational institutions, employment contexts and for individual learners.

Keywords: simulation, vocational learning, OER, evaluation, blended learning

1. Introduction

Skills development in computer networking has typically been based on practical experience in laboratories using real networking equipment. However, providing and maintaining appropriate computer networking hardware is expensive for educational institutions, and access to hardware is not viable for independent learners. There is therefore a need for a simulated network experience, to allow teachers to reinforce classroom learning and students to practice their developing skills (Corter at al. 2007). The Open Networking Lab project (https://onl.kmi.open.ac.uk/) addresses this need, by providing a user-friendly network simulator, integrated within an open online course, to enable anyone to learn the basics of computer networking, regardless of prior knowledge. The project is creating a free online 'badged open course' which can be used either in-class with support from a teacher or for independent learning, at home or in the workplace. The project is hosted at The UK Open University and is supported by funding from Ufl (http://www.ufi.co.uk) as part of their 'VocTech Impact 2017' funding initiative for vocational learning using digital technologies. The ultimate aim is to enable as many people as possible to access learning, and eventually employment, in computer networking – an area which is in high demand from industry.

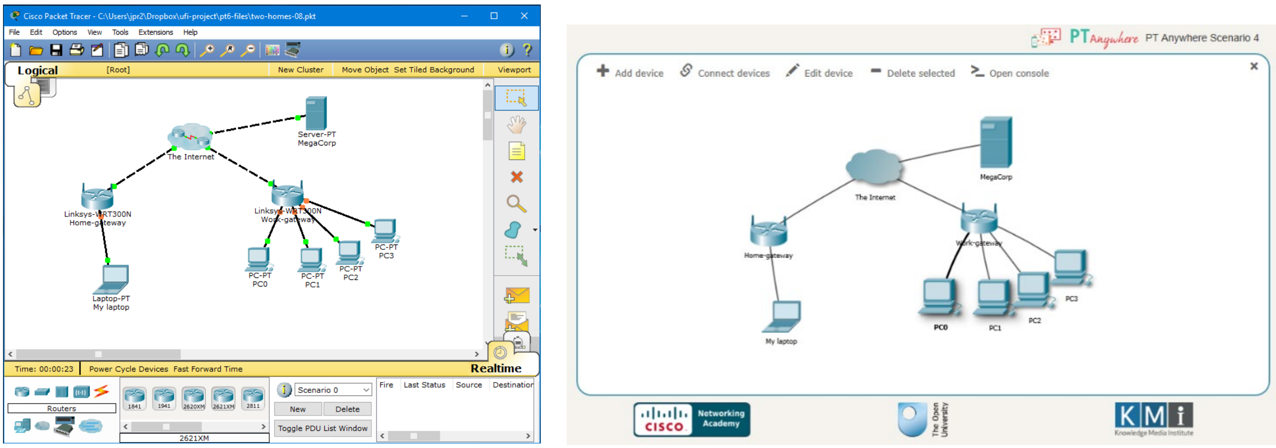

Figure 1: (a) Packet Tracer; (b) PT Anywhere

To address the educational need for a network simulator, the computer networking company Cisco developed the powerful *Packet Tracer* simulation software (DiCerbo et al., 2010), which is used globally to support learning within the Cisco Networking Academy educational community, and beyond. Packet Tracer is a highly authentic simulator, with a correspondingly complex set of features and user interface (Figure 1 (a)). In response to the need for a simpler version, more suited to novices, the *PT Anywhere* (short for Packet Tracer Anywhere) software was developed (Mikroyannidis et al. 2017). PT Anywhere was developed in the context of the FORGE project (http://ict-forge.eu/), a European initiative for online learning and experimentation via interactive learning resources (Mikroyannidis et al. 2015). PT Anywhere provides students with an easy-to-use, browser-based interface over Cisco's *Packet Tracer*; it offers fully authentic simulation but uses a simplified interface, revealing only a subset of features (Figure 1 (b)). Using PT Anywhere enables a scaffolded, experiential and authentic approach to learning (Vygotsky, 1978; Kolb, 1984; Brown et al., 1989). Embedded learning analytics facilities provide valuable data which educators can use to explore learning patterns (Gibson & de Freitas, 2016), looking at individual learners' paths through the simulation activities or at aggregated data from a set of learners.

The Open Networking Lab project is further developing the *PT Anywhere* web-based network simulation software. The course incorporates hands-on practical activities using PT Anywhere, supported by primarily audio-visual learning materials. The student's study throughout the course is firmly based on screencast demonstrations using Packet Tracer, followed by practical activities using PT Anywhere, and self-assessment quizzes. Integrated Learning Analytics tools provide insights into how learners engage with the software and activities.

The Open Networking Lab course will be hosted on the Open University's *OpenLearn* platform for Open Educational Resources and open courseware (http://www.open.edu/openlearn/) where it will be accessible without cost to any learner or educator worldwide. Initial development is being carried out using the 'sister' platform *OpenLearn Create* (http://www.open.edu/openlearncreate/) so that the learning resources can be iteratively developed, piloted and improved prior to launch on OpenLearn itself.

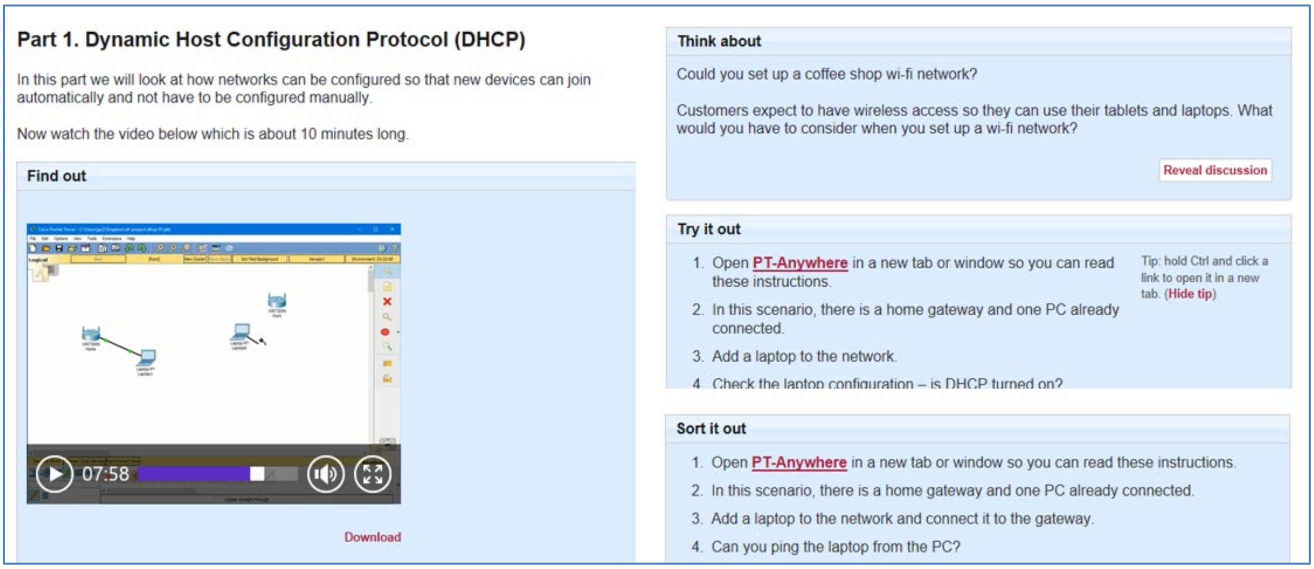

Figure 2: Screenshots from the Open Networking Lab online course showing screencast video (left) and activities (right)

In the Open Networking Lab course (Figure 2), learners are shown, primarily via screencasts, how computer networks are set up and configured. They then try out these ideas for themselves using the PT Anywhere simulator. Quizzes and other forms of formative assessment further support the learning, and enable learners to be confident that they have gained appropriate skills and knowledge. This package of activity-based learning should help learners feel motivated and engaged, and enable them to gain a sense of achievement as they progress through the online course. After completing the course, including passing two summative quizzes, learners will be able to claim a digital badge in computer networking.

On completion of the course, learners will be able to:

- identify and understand computer networking technology and concepts
- use a simulator to set up a simple network (e.g. for a home or small office)
- using a simulator, undertake preliminary troubleshooting and fault identification.

The Open Networking Lab course will be accessible to a wide range of vocational learners (particularly at post-16 Further Education (FE) and apprenticeship level) who seek technical qualifications and employment in computer networking. Learners will be able to move from having no knowledge in this area to a level of confidence and competence. Educators and industry can use the Open Networking Lab materials to support their learners.

The software and resources are being evaluated in collaboration within the Cisco network of FE colleges, engaging hundreds of learners, in two stages of evaluation. Participating FE colleges for the project are all part of the Cisco Academy network (https://www.netacad.com/). The first pilot included half of the planned material and these resources were used by the college students as part of their normal studies. Project team members provided both remote and face-to-face support to the colleges, and observed how the learning resources were used by students and teachers. College teachers were also supported via a comprehensive *Lecturer's Handbook*. Data is being gathered from learners using surveys and observation, and from teachers via interviews. PT Anywhere and OpenLearn also provide various kinds of learning analytics. This data, with appropriate ethical considerations, forms part of the evaluation.

The aim of the first pilot evaluation was to identify how the software and course material could be further improved, and to judge the impact on student learning and engagement. These aspects were considered using both quantitative and qualitative data; preliminary results are reported in this paper.

This evaluation will feed into work to complete the Open Networking Lab course. A further round of evaluation and improvement is planned before final publishing as a badged open online course.

2. Evaluation methods

Evaluation of pilot presentations of Open Networking Lab material in further education colleges was carried out during May-July 2018. Quantitative approaches (student survey questions, activity logs) were used to address the following questions:

- How usable was the online resource?
- How well does the content fit the needs of the students?
- How effective is the learning from the online resource?
- How engaged were the learners?
- What patterns of engagement are shown?

Qualitative approaches (student open comments, classroom observation and interviews with teaching staff) were used to address the following questions:

- What improvements are required to the software and learning resources?
- What improvements are required to the support for delivery in college?

The evaluation plan, data collection instruments, information and consent forms were approved by the Open University's Research Ethics Committee. For students under the age of 18 years, parental consent was sought.

Evaluations were carried out in eight colleges with a total of 177 enrolled students; a variety of teaching methods was used, including self-study and guided study (see Table 1 for details). Survey forms were completed by students at the end of the pilot in all colleges, and in some cases also during the pilot. A total of 150 responses from 80 students were collected. A total of 146 online Open Networking Lab student accounts were created during the pilot, and from these 82 students gave permission to use their logged data. Interviews were held with 5 teaching staff.

Table 1: Further education colleges in pilot evaluation

College	Level and context	Age range	Number of students on course
A	Adult education evening class using ONL as self-study	Adults	10
B	Apprentices Level 3 & 4 using ONL in whole day session	17-37	22
C	BTEC Level 3 in two 3-hour sessions over 2 weeks	16+	15
D	BTEC Level 3 in two 3-hour sessions over 2 weeks	16+	39
E	Computer Science Level 4 in two 3-hour revision sessions over 2 weeks	18-30	27
F	A-level Computer Science in three 1-hour lessons	16-18	6
G	CCNA Level 4 in two 4-hour sessions over 2 weeks	16+	13
H	BTEC Level 3 in four 1-hour sessions over 4 weeks	16-18	45
Total			**177**

The target audience of the Open Networking Lab is complete beginners, but the timing of the pilot at the end of the academic year meant that many students had some experience of networking. For them, the Open Networking Lab was a revision opportunity with a different approach.

3. Results and discussion of evaluation

In this section we will address the evaluation questions posed above, using both quantitative and qualitative data. Illustrative student comments are shown.

3.1. How usable was the online resource?

Students and staff generally found the online resource easy to use, and it worked well (Figure 3 (a) & (b)). Some initial difficulties were resolved by using the recommended browser versions.

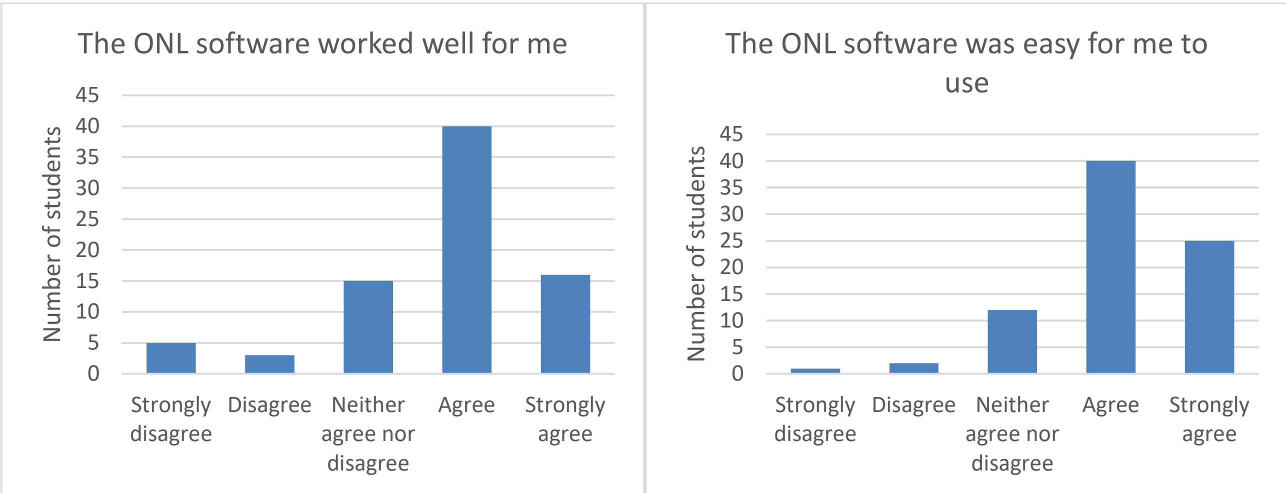

Figure 3: (a) ‘The ONL software worked well for me’ (Student survey, Likert scale, N=79)
(b) ‘The ONL software was easy for me to use’ (Student survey, Likert scale, N=79)

3.2. How well does the content fit the needs of the students?

The Open Networking Lab content was designed for complete beginners although, due to the timing of the pilot, students mainly used it for revision. Figure 4 (a) & (b) show that most students already had experience of networking, but still felt they had learned from using the Open Networking Lab materials.

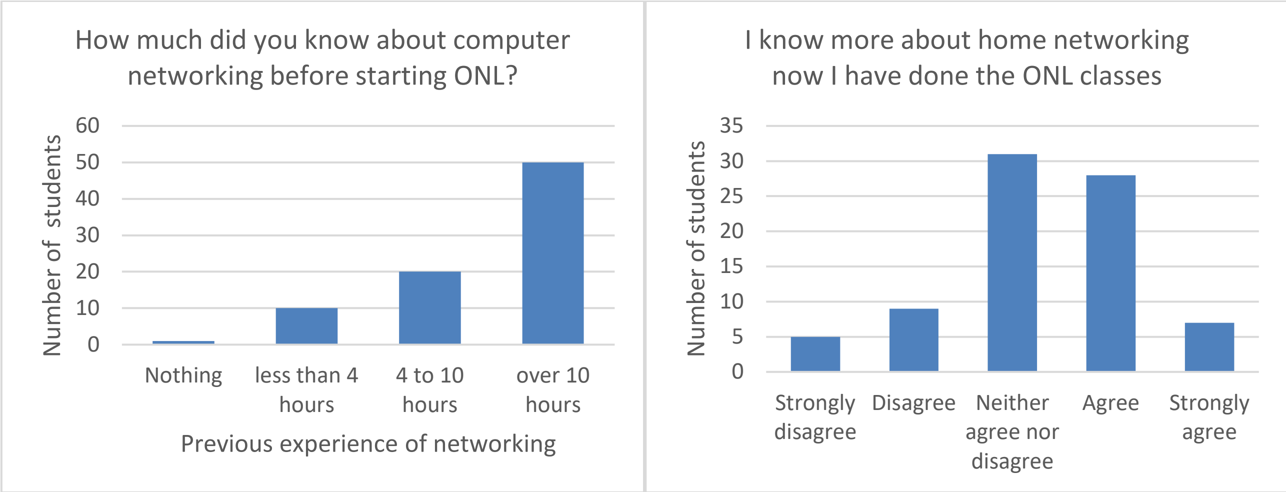

Figure 4: (a) 'How much did you know about computer networking before starting ONL?' (Student survey in **first** ONL session, Likert scale, N=81);
(b) 'I know more about home networking now I have done the ONL classes' (Student survey in **final** ONL session, Likert scale, N=80)

The following quotes from students indicate that the topics were felt to be at the appropriate level.

> "I found it very welcoming for someone of my experience"
>
> "The information would be helpful for someone that has little or no networking knowledge"
>
> "The included PT activities were really useful. The content was relevant for pure beginners."
>
> "it's a good course for the level of students it's aimed at."

3.3. How effective is the learning from the online resource?

As noted in the previous section, 35 out of 80 students agreed or strongly agreed that they knew more about networking after the Open Networking Lab class (Figure 4 (b)), even though the majority had already studied the topic (Figure 4(a)).

To account for the wide variation in previous experience, the following graphs (Figures 5 and 6) show data from students categorized as follows: no previous experience, less than 4 hours, 4 to 10 hours, over 10 hours of networking experience before the Open Networking Lab class. (Some students were surveyed more than once during the pilot; this data includes all responses. All students who responded more than once recorded their previous experience consistently.)

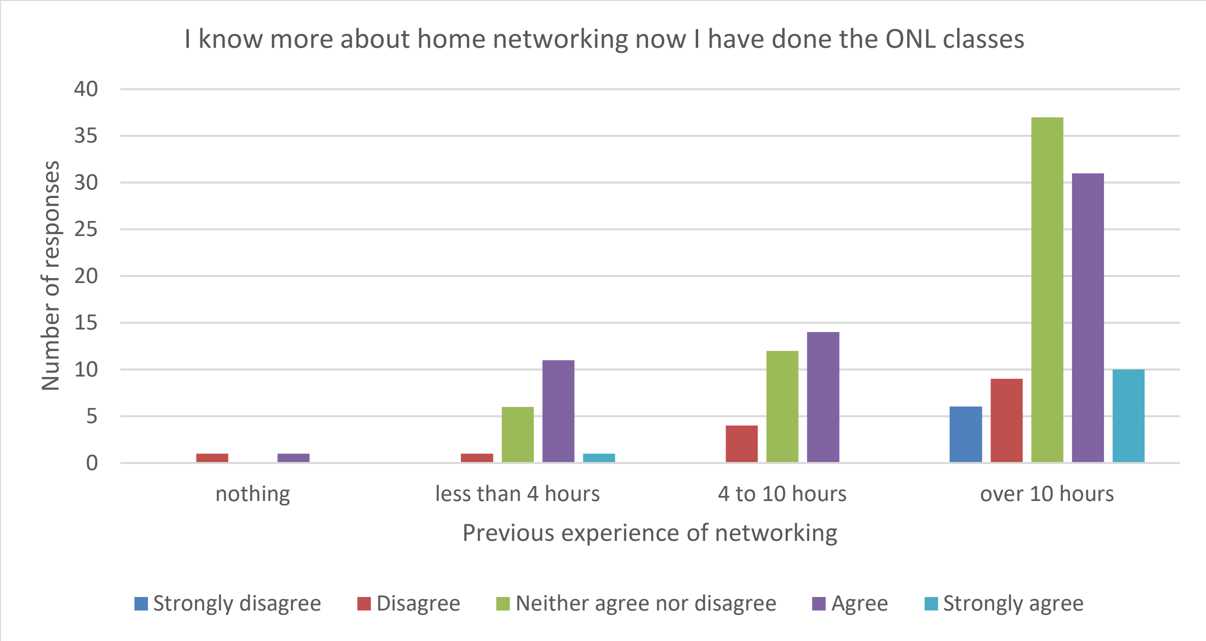

Figure 5: 'I know more about home networking now I have done the ONL classes'
(Student survey, Likert scale, N=150)

Figure 5 shows how learning from the Open Networking Lab varies with previous experience. This indicates that students with little previous experience tend to know more after studying Open Networking Lab materials. Although this is less so for students with greater previous experience, a good proportion still indicate that they know more about networking after using the Open Networking Lab (41 of 93 replies agreed or strongly agreed).

> "I feel this goes into the perfect amount of detail. Enough to give context to everything else but no needless information, definitely the ideal 'brief overview'"
>
> "As the topics become more advanced the explanations become more concise which is helpful to someone like me who is new to networking."

One tutor commented that more experienced students tend to forget the basics, so the Open Networking Lab has a role as a refresher course.

3.4. How engaged were the learners?

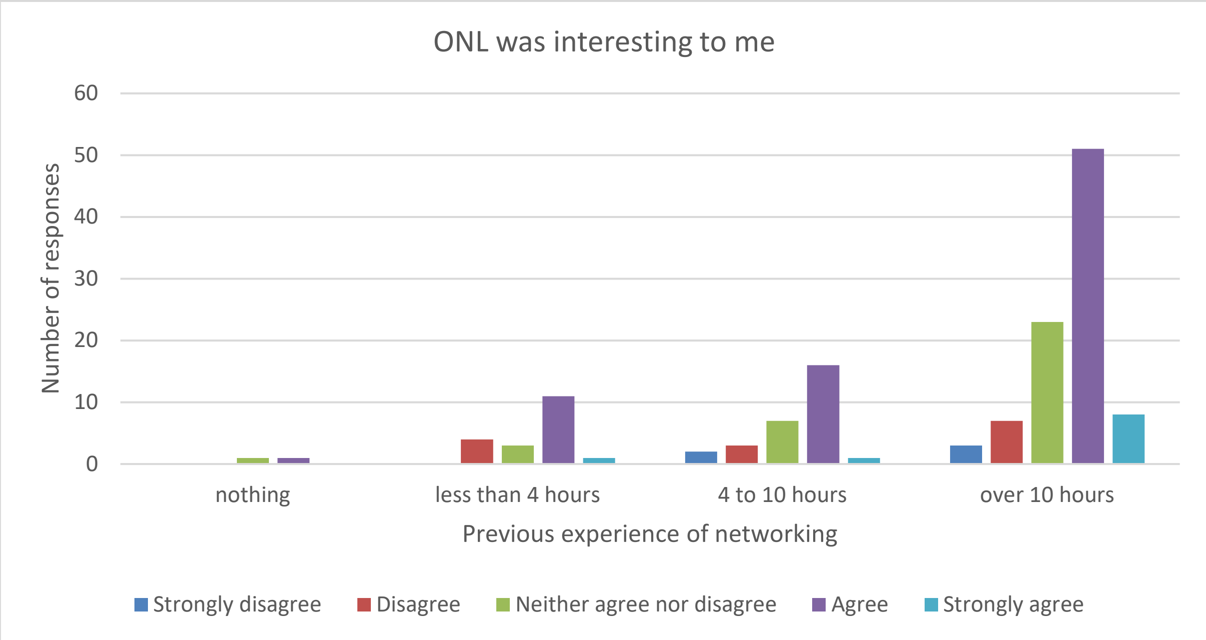

Figure 6: 'The ONL was interesting to me' (Student survey, Likert scale, N=150)

Most students agreed that the Open Networking Lab was interesting, regardless of their previous experience (Figure 6). The PT Anywhere activities were interesting to the students. Students appreciated the knowledge and authority of the Open University lecturers on the videos, and liked being taught by experts.

> "I liked the open university video as they went through a lot of things in depth"
>
> "The videos has lots of potential to teach you lots."

Classroom observation noted that in some classes students worked individually at their own pace, mainly paying attention to the screen. In other classes, there was some discussion in pairs about the content. Students were more engaged by practical activities (PT Anywhere and the quizzes) than by the text and videos.

> "I prefer the combination of shorter videos and more practical activities in this session. It keeps you engaged as opposed to shutting off 5 minutes into a 17 minute long video."

35 out of 80 of students agreed that they would do more Open Networking Lab instead of their usual classes if they had the chance (Figure 7).

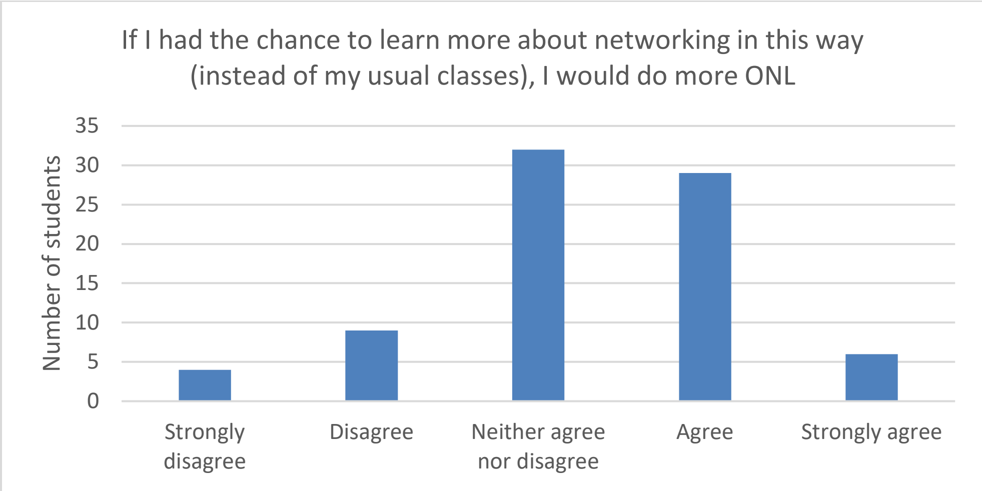

Figure 7: 'If I had the chance to learn more about networking in this way (instead of my usual classes), I would do more ONL' (Student survey, Likert scale, N=80)

3.5. What patterns of engagement are shown?

An insight into patterns of student participation can be gleaned from logged activity data. The following data is drawn from an initial sample of students (N=27) who had given consent. Figure 8 shows the number who viewed sessions online, showing some drop out with later sessions.

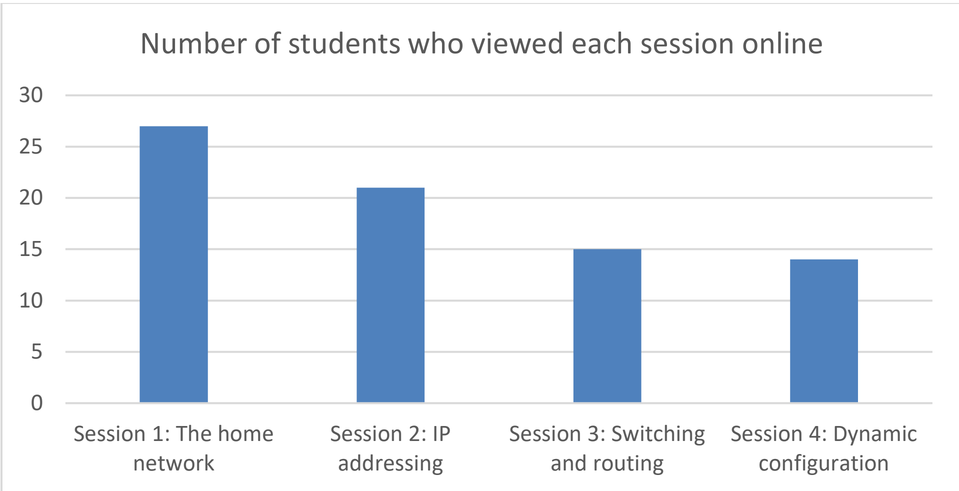

Figure 8: Number of students who viewed each session online (ONL logs, N=27)

In this pilot, sessions were not designed to be of equal length (Session 4 *Dynamic Configuration* in particular was much shorter). Figure 9 shows that those students who do view a session spend a reasonable amount of time with it.

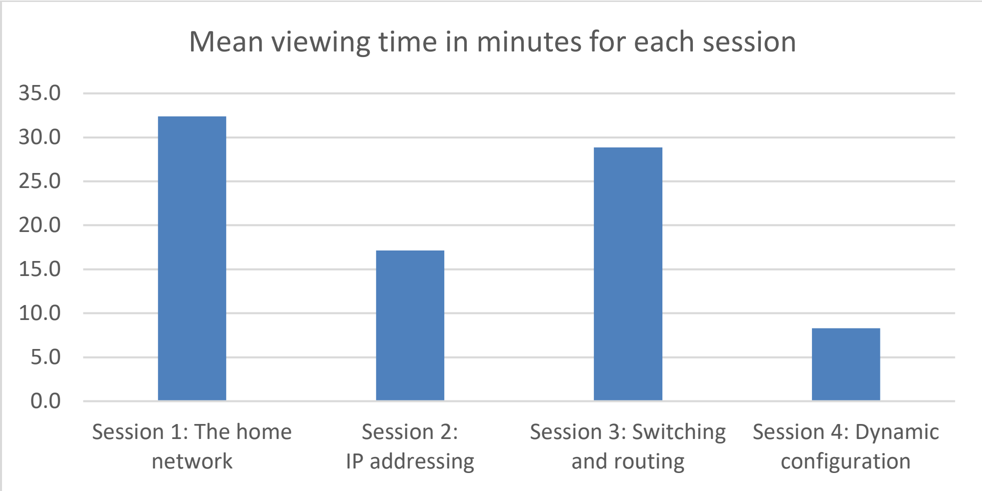

Figure 9: Mean viewing time in minutes for each session (ONL logs, N=27)

Within this overall pattern of usage, considerable individual variation can be seen; for example, classroom observers noted that some students downloaded videos onto their phones to watch later. In Figure 10, individual students (N=27) are shown and characterised on three scores:

- The percentage of time spent online compared to the designed time for the course (240 minutes for the pilot).
- The percentage of video resources accessed (viewed online or downloaded).
- The percentage of epub, pdf or other alternative offline formats downloaded.

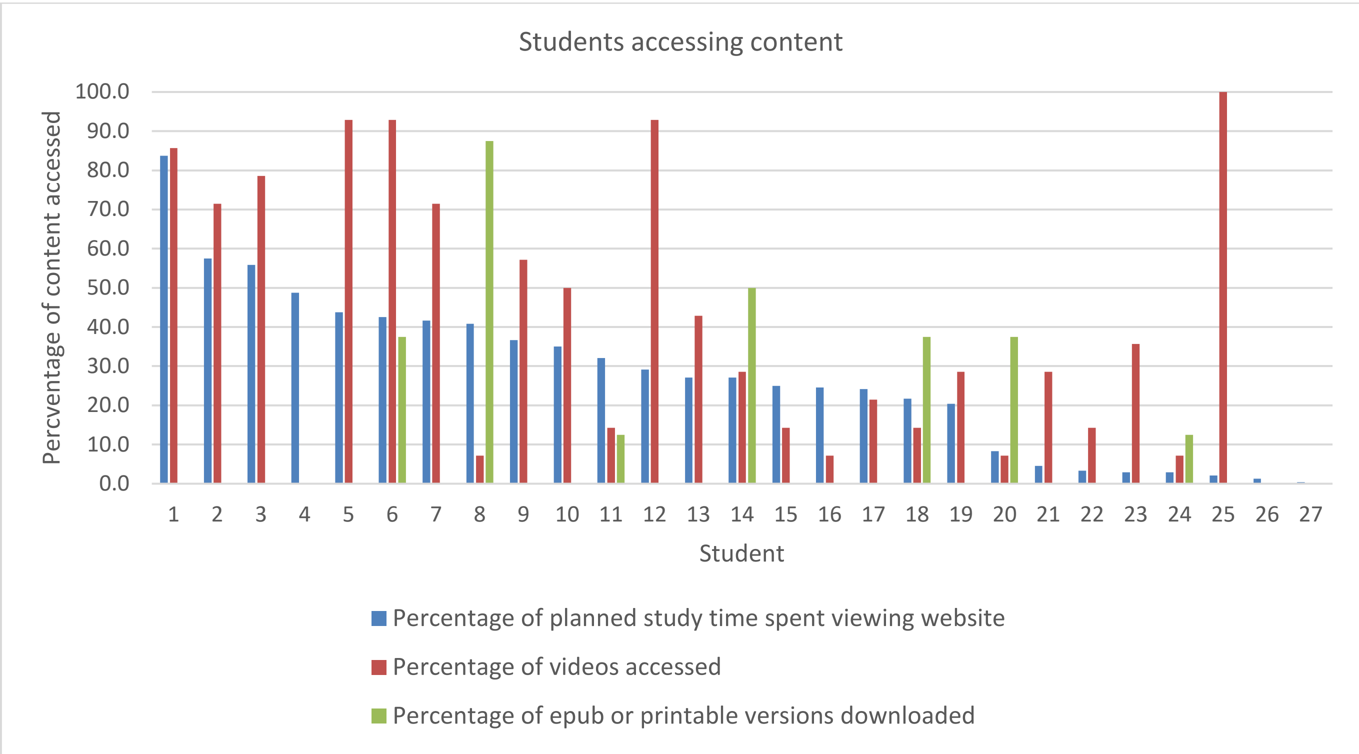

Figure 10: Patterns of individual student access to content (ONL logs, N=27)

As can be seen, students varied considerably in their behaviour. The data have been ranked by time spent online, so that Student 1 spent the most time viewing the website, Student 27 the least. The majority of students in the pilot spent less than half the designed time on the website. Some, however, downloaded a significant proportion of the material for use offline.

Picking out four specific examples in Figure 10 illustrates different strategies at play:

- Student 1 spent a lot of time on the website and accessed most of the content including video.
- Student 8 spent less time on the website, but downloaded most of the content as offline versions.
- Student 14 shows a mix of time on website and downloading offline versions.
- Student 25 spent hardly any time on the website, but viewed or downloaded all videos.

At this stage in our analysis we have not connected the ONL logs to classroom observation, so it is not clear whether this differing student behaviour is the result of different classroom pedagogies or the free choice of individual learners. It is evident however that the final version of the Open Networking Lab should support as wide a range of learner strategies as possible.

3.6. What improvements are required to the software and learning resources?

Staff interviews and classroom observation showed that the Open Networking Lab website and PT Anywhere were straightforward to use, although some PT Anywhere activities were not fully developed in this pilot. A specific issue is the need to open PT Anywhere in a new browser tab or window so that the instructions can be viewed alongside the simulation.

Student comments show they value the interactive aspects of the material, particularly PT Anywhere activities and the quizzes, and would like more. They also wanted more explanation of acronyms and of why wrong answers in quizzes were incorrect.

There were many comments about the length, content and pace of the videos, and on technical problems such as audio quality and level.

> "there should be improvement on the mic quality as the quality jumps from one video to another"
>
> "Video could be split into two videos. This video is very long, at 17 minutes, and needs to be split into shorter segments of a few minutes each."
>
> "This video is very informative, with a lot of info packed into a short amount of time. It could possibly be beneficial to make two videos, that go into a little more depth, and allow the learner more time to understand what is happening."

The videos in the pilot were initial drafts. As new versions are produced, the course team are restructuring them into shorter segments, and endeavouring to achieve a slightly faster and more upbeat delivery. Authors face a challenge in balancing the desire for short videos with the need to include enough context and content to provide valuable learning. Final recordings will be made in a studio to achieve better technical quality.

The pilot contained interactive quiz questions embedded within a session and a final quiz question at the end of each session. These were valued by students and staff but they felt there could be a greater number and variety of questions. In the final badged open course form, additional mid-course and final sets of quizzes will be used to award the course badge.

"Would be helpful to have a short quiz after each video, to check understanding, make it more interactive" (Staff comment)

3.7. What improvements are required to the support for delivery in college?

The Open Networking Lab material is intended for several modes from teacher-supported use in a classroom to individual learning at a distance. The context of the pilot evaluation was teacher-supported classroom use and staff were asked how the OU team could support wider use of the Open Networking Lab in the FE sector.

Their suggestions included: describing the ONL audience clearly, showing how materials fit or augment existing curricula, providing a detailed index of content, providing case studies showing how the Open Networking Lab can be used. These comments have been used to shape the *Lecturer's Handbook* for the Open Networking Lab.

Staff also offered a number of detailed practical suggestions which have been incorporated into the *Lecturer's Handbook*. These included: use recommended browsers, check configuration of classroom PCs, provide headphones or ear buds, consider a whole-class introduction using projector or whiteboard, create user accounts in advance.

4. Conclusions

The data from the initial pilot of the course indicated that learners and their teachers found the Open Networking Lab course materials valuable. Students were engaged by the resources, and reported that they learned from them. We can conclude that the approach – experiential online learning through screencasts, practical activities using a simulation package, and automated assessment – is a good one for these (mainly young) vocational learners.

Based on this evaluation, the PT Anywhere software and the learning resources have been modified and improved. For example, the screencasts were split into shorter segments, and more practical activities and self-assessment opportunities were included. The improved resources will be made available to FE colleges for use and evaluation with a second cohort of students in late Autumn 2018. Colleges which were not involved in the initial pilot will been approached in order to broaden the user base, and enable testing with teachers who are new to the resources. User feedback from this second evaluation will be taken into account for the final stages of the course development.

The Open Networking Lab will then be launched on OpenLearn in 2019 as an open-access free online course. It will be available to students, apprentices and lifelong learners, either as part of training offered by colleges/employers or as self-directed learning. The final product will be an OpenLearn Badged Open Course (BOC), enabling learners to develop and evidence their skills in a self-supported learning environment, or with support from teachers as blended learning.

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Acknowledgment

We gratefully acknowledge funding and support from the Ufi Charitable Trust, together with ongoing support and collaboration from Cisco.

Privacy Issues in Learning Analytics

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Abstract
Today's technological advances have led to tremendous advances in collecting, storing and analyzing data that come from diverse sources of information and may be represented in a wide variety of different formats (texts, photos, videos and many more). The term which perfectly describes this milestone in the history of computing is called *big data* and the task of analyzing these enormous amounts of data is called *big data analytics*. Academic institutions which offer open and distance learning programs such as the Hellenic Open University can profit from big data and the use of big data analytics by integrating it in their organizational support systems thus reflecting on their overall performance and planning competitive and attractive educational programs as well as improving in the delivery of their services. In the individual level, the modern lifestyle with the numerous networked devices and applications implies that all activities we are engaged in leave behind an imprint or a digital footprint. Combining thoroughly this variety of information creates a unique social genome (Kum et. al., 2014) for each and every one of us and understanding how to interpret it will bring major breakthroughs in many areas of our society such as improvements in social services, health and education. On the flip side, there are certain disadvantages concerning privacy issues arising from the inappropriate and illegitimate use of data containing personal information and ethical concerns about the basic right of individuals to have control over the amount and the extent of information they are willing to share. The systematic solution to this controversy is the design, application and evaluation of privacy-preserving data publishing methods in order to assure that the confidentiality of the subjects of projects is not compromised and a balance between the utility of the data and the privacy is accomplished.

Keywords: ethical issues, privacy, learning analytics, distance learning, data publishing, anonymization, statistical disclosure control.

1. Introduction
One of the main characteristics of our times is the progress made in technology that has consequently advanced processing power and data storage capabilities to such an extent that the amount of data collected from various sources is massive and multimodal. There are three main sources of generating data that come in different forms: people, machines, and organizations. Combining them altogether creates what is called the

big data. What is more important, nowadays we have the tools and skills to apply powerful data mining techniques and sophisticated data analyses processes in order to find the value that is within the data, make inferences on human populations and even discover new facts about the subjects of data. In computer terminology these vast amounts of divergent data that are produced in an impressive speed are best described using a number of dimensions or V's (see, for example (Firican, 2017)).

The most commonly used dimensions are: *volume* that describes the vast amounts of data that is constantly generated in our digitized world changing the storage unit from GB (10^9 bytes) to ZB (10^{21} bytes), *velocity* that corresponds to the creating speed of data especially in real-time applications and *variety* that describes the different forms of data such as text, images, voice, geospatial data etc. It our era which is characterized by the millions of users of social media, the variety of forms of big data is ever increasing. In addition to the first three dimensions, some more have been introduced in order to describe even more accurate the challenges of our times and these dimensions are: *veracity* signifying the quality of data, their validity and the reliability of the data sources and *valence* describing the connectedness of big data in the form of graphs just like atoms. Finally, there is the dimension of *value* to describe the opportunities lying in the big data analysis along with the practical use and the benefits of it.

Even though big data refers to a rather vague concept, there exists plenty of structured information in big database systems maintained by international organizations, offices, and funds which are eligible by their role or mission to conduct various surveys on a yearly basis or according to certain criteria of interest in topics such as demographics, economy education, health, and many other areas of social sciences (Organization for Economic Co-Operation and Development (OECD), The World Bank, the World Health Organization, the Eurostat, and many others). Moreover, these organizations provide openly a significant part of this information in the form of reports and publications also offering statistical tools such as indexes and graphs which help to make comparisons among different regions or countries, find the existent interrelations between them, build models and standardize certain metrics and criteria.

The analysis of big data helps enterprises and organizations to operate in a smarter and more efficient manner because it offers reliable results on actual problems by finding trends, patterns, correlations and many other features that exist among data. By integrating data science and big data analytics into the scopes of every commercial activity such as retail, financial services, manufacturing, etc., there are plenty of opportunities created, provided that this is performed with respect to the overall strategy and the organizational objectives. The same stands for the area of healthcare, social services and of course the sector of education. By combining information based on the data of students, patients and, in general, the data subjects, and by applying advanced computational tools along with great analytical skills, data science can provide predictive models and thus lead to better and faster decisions. In some cases, as in the life sciences, the impact of the data analytics is not only measured by economic benefits but by life-saving criteria, hence the influence of big data is much more important.

Nevertheless, there are ethical and legal issues concerning the privacy of individuals as there are questions on how the collection of big data is being made available, as in the case of social media where privacy seems to be more or less consciously sacrificed to the adoption of new trends in communication. The other most alarming matter is who and why may have access to the big data as in the case of "profiling" for the scopes of personalized marketing services, a notion that hides on the reverse side the total loss of anonymity. The fact that we could discover something new about a person by connecting the interrelationships among the available information means that we have to be very cautious in the analytic methods applied in the sense that they have to conform to certain rules and regulations that protect privacy rights. Helen Nissenbaum (2004) from the New York University introduced the term of "privacy as a contextual integrity" meaning that almost everything people do happens in a context that cannot easily be categorized as only private or only public and often these two may cross side. For that reason, data privacy should be considered with the respect to the context into which is being placed.

Data curators/analysts have the responsibility over the data and for that reason there exists an assurance that they use a large scale of data and certain methods to protect the privacy of individuals, the information contained and more specifically the unexpected correlations that may be produced by big data analytics. It is evident that all this information is a powerful resource that requires strict regulations, and most importantly, due to its sensitive nature, stringent laws to protect the individual and their civil rights. Currently some of the practices in force include HIPAA which relates to the protection of health related data, FERPA which is a privacy statute for the protection of data concerning educational rights, and the EU General Data Protection Regulation (GDPR), a complete regulatory framework applying on all EU citizens since May 25th of 2018.

GDPR has introduced Privacy by Design, a concept that aims in developing smart and safe information systems where privacy is integrated in the system's architecture design. Another strong point of the GDPR is that it brings key changes in the area of human rights and along with the existing rights of the "right to privacy" and the notion of consent it introduces the "right to access" and the "right to be forgotten". It is important to mention that in addition to the above advances the regulation applies to every EU citizen no matter where the headquarters of the enterprises that utilize personal data of the citizens of the EU may be and what is more, the non-compliance is penalized firmly by connecting the amount of penalty to the revenues of the companies which defy the rules and treat personal data in an untrustworthy manner.

By this analysis on educational data from the Hellenic Open University (HOU) that is the only university in Greece offering distance learning programs which completion leads to the acquisition of undergraduate and postgraduate diplomas, in this paper we expected to experimentally test the opportunities of learning analytics as well as the threats upon the utility of information. The rest of the paper is organized as follows: Section 2 gives a brief background insight on previous related work on leaning analytics and privacy-preserving methods, Section 3 refers to the Basic Concepts and Definitions, Section 4 describes step by step how privacy is achieved through the implementation of *k*-anonymity and *l*-diversity; the two methods that have been applied for the purposes of this study on actual data. That is further analyzed on Section 5 is a case study on educational data of HOU and finally Section 6 demonstrates and discusses the results of the study, considering how they could become applicable as well as how new studies could follow up to facilitate the learning process.

2. **Related work**

While the term big data analytics is used to describe all the methods applied to the analysis of big data, the term learning analytics (LA) is used to describe "the measurement, collection, analysis and reporting of data about learners and their contexts, for the purpose of understanding and optimizing learning and the environments in which it occurs" (Long & Siemens, 2011). LA is a field of research that builds upon ideas from other fields such as process mining, business intelligence, data processing, information retrieval, technology-enhanced learning, educational data mining and data visualization (Scheffel, 2015). It has been growing steadily in recent years as a systematic effort to understand and optimize the learning process. Learning analytics is also highly driven by the call to connect stakeholders' perspectives on the skills acquired from higher education programs to an optimum evaluation of academic institutions.

The utilization and assessment of Learning Analytics Dashboards (LADs) is the subject of a study by Gkontzis et al. (2017) that concentrates on three LADs: (i) the Forum Graph Report that depict the interactions between students and tutors in a forum activity in a course, (ii) the Course Dedication block that can be used by tutors to see the students' estimated dedication time to a course, and (iii) the Analytics Graphic block, a descriptive tool that provides graphs which facilitate the identification of students' profile. Through the analysis of these LADs, educators gain accumulated information and can provide feedback to the educational process in order to warn and encourage students who are at a critical point. Moreover, the administration of the institutions has direct access and is more capable to take the right decisions concerning the improvement of the whole educational process.

Research on data privacy has been developed upon two theoretical and methodological approaches or scenarios: (a) the scenario of sharing data with third parties without violating the privacy of those individuals whose (potentially) sensitive information is in the data (this is called *privacy-preserving data publishing*) and (b) the scenario of *privacy-preserving data mining* or disclosure control. More specifically, according to the way we approach the problem of preserving-privacy, there are two related research areas:

- Privacy-preserving data publishing, that is sharing data with third parties without violating the privacy of the individuals whose (potentially) sensitive information is in the data. This area is also referred to as non-interactive systems and it can enrich the open data initiatives for learning analytics (Gursoy, M. et al., 2016).
- Privacy-preserving data mining (PPDM) or disclosure control, which is mining data without abusing the individually identifiable and sensitive information within. This area is also called interactive anonymization systems (Davis & Osaba, 2016).

No doubt, one of the most recognized methods on statistical disclosure control is *differential privacy*, a method introduced by C. Dwork (2006) combining cryptography and database communication, initially presented as the mathematical/statistical background of generating noise to preserve-privacy and evolving into the state-of-the-art method in big data analytics. According to Dwork (2006), the formal definition of ε-differential privacy is:

> a randomized function F ensures ε-differential privacy if for all neighboring data sets T_1 and T_2 differing on at most one record (that are called adjacent data sets) and for all possible outcomes of the algorithm $S \in Range(F)$, $Pr[F(T_1) \in S \leq e^{\varepsilon} x\ Pr\ [F(T_2) \in S]$.

The method proposed by Dwork & Roth (2014) is not an algorithm but a definition and thus can be applied in various situations where the available datasets are very big eliminating the risk of re-identification of an individual. *Differential privacy* uses algorithmic computations to put certain boundaries on the information that can be extracted in the form of statistical queries from a big database on the grounds that the same results would be drawn up from an adjacent database (that differs on at most one record), so finally the conclusions are independent of the presence or the absence of any individual in the dataset. It has been constructed upon the basic concept that we are interested in the population and not in the individual and by that notion, the bigger the dataset the better the results we obtain from the queries.

Association rule hiding is another PPDM method that belongs to the subfield of Knowledge Hiding in Data Mining which purpose is to allow mining only the useful part of the information, while preserving the sensitive part or in other words hiding all the information that is considered sensitive from the mining operation. Knowledge hiding follows a process of knowledge that is called the *sanitization process* and the outcome of the procedure is that the sensitive information cannot longer be mined while in the same time the database maintains as much as possible of the original data utility. Kagklis et al. (2014), synthesized some taxonomy of frequent item set hiding techniques. Especially on the category of linear programming-based hiding techniques, they presented an analytical case study of the algorithms used in this category and according to the results of the above study; there is a trade-off between time complexity/scalability and the side effects that are created. As a consequence and according to the authors, there is still research to be completed in the area of linear programming-based techniques.

In their work, Gursoy et al. (2016), conducted experimental analysis on educational data to test both the existing techniques; privacy-preserving data publishing and privacy-preserving data mining on the same data. More analytically, they implemented: a. query processing and b. prediction of the Grade Point Average (GPA) by applying in the first case *k*-anonymity and *l*-diversity and then they tested the same tasks by applying *ε-differential privacy* both on real and synthetic data. From the results, the authors concluded that in the case of query processing, the amount of error on both methods (anonymization and statistical disclosure control) was increased as privacy requirements got stricter. However, *ε-differential privacy* clearly performed better than anonymization. Moreover, in the case of the GPA prediction, again the method of *ε-differential privacy* provided better results on the experiment leading to the conclusion that the accuracy of the prediction was increasing as the values of the *ε* parameter were getting higher and providing evidence of positive correlation between these two aspects. In the case of *k*-anonymity and *l*-diversity, high values of these parameters led to a significant drop in the classification accuracy and in the case of *l*-diversity, the results were even worse.

Following the call for open data, a team of researchers from Harvard University and MIT announced on May 2014 the release of an open data set containing student records from 16 courses conducted in the first year of the edX platform. The dataset was a de-identified version of the original data set and the goal of the release was first to allow other researchers to replicate the results of the analysis and secondly to conduct novel analyses beyond the original purpose of the collection, adding to the body of literature about open online courses. On their paper, Daries et. al. (2014) explore how the value of data is affected by privacy-preserving methods and as a means to measure the utility loss between the de-identified and the original data, they note the difference in the amount of correlation observed on the de-identified data compared to the initial correlation on the original data. For that purpose, two anonymization methods, the generalization, and the suppression were tested on the grounds of *k*-anonymity, the prerequisite method set by the U.S. Department of Education.

3. Key concepts and definitions

We have seen so far that there exist two approaches in the theory of data privacy: a. the privacy-preserving data publishing and b. the privacy-preserving data mining. Of course, certain things are common into these methods and we will begin by the definition of basic concepts so that the further analysis on the educational data is more understandable. First, we need to define the roles of various parties who interact with each other on the basis of their relationship with the data as:

- Data subjects are persons and entities whose data is collected and analyzed.
- The data owner/curator is the party that collects and stores data regarding the subjects. Also, the data owner decides whether data should be shared with third parties, in what manner and using which privacy measures. By definition, administrators have the role of the data curator in schools. In Universities, this role is in the hands of the Head of Departments, etc.
- Data analysts and recipients include all parties that are given access to the data, e.g., LA experts, data scientists, and more.

Secondly, it is useful to define the discrete characteristics that we find in every dataset and categorize them according to the distinct type of information that exists in these features as:

- The *Direct Identifiers* (DI) are those features and the data used to describe them, which can uniquely identify an individual case. Examples of direct identifiers in educational data are: a student's name and surname, the student's identification number, the student's e-mail address, etc.
- The *Quasi-Identifiers* (QI), are the attributes that when used alone do not necessarily disclose individuals' identity, but in combination with external databases can single out data subjects. In educational data, the attributes of gender, date of birth, the code number of courses taken and other attributes are considered as quasi-identifiers.
- *Sensitive attributes* (SA) are the attributes which contain private information that people, normally do not feel to share with others or reveal in public. Some examples of attributes containing sensitive

information are the income, some rare diseases, and the use of drugs/medicines. In educational data, we can consider as SAs the scores/grades which students do not always openly reveal.

- *Auxiliary information* is data that bears no privacy risk and does not fit into any of the above categories. In the example of educational records, auxiliary information could be the learning objectives of the course, the expected outcome and other similar information defined and described by the instructor and the participants in the course.

Thirdly,it is important to refer to the types of attack (Templ et al., 2014) that may happen which in the terminology of data privacy is also called disclosure and the quantitative aspect that is used to measure it is called risk of re-identification. More precisely, the following main types of disclosure are proposed:

- *Identity disclosure* that occurs when the intruder associates a known individual with a released data record by linking. For example, a released data with external information, or by identifying a respondent with extreme data values.
- *Attribute disclosure* that occurs when the intruder is able to determine some new characteristics of an individual based on the information available by the released data. For example, if a hospital publishes data showing that all female patients aged from 56 to 60 have a certain disease, then an intruder knows the medical condition of any female aged form 56 to 60 without having to identify the specific individual.
- Inferential disclosure that occurs when the intruder is able to determine the value of some characteristic of an individual more accurately with the released data than otherwise would have been possible. For example, with a highly accurate predictive regression model, an intruder may be able to infer a respondent's sensitive income information using attributes recorded in the data, leading to inferential disclosure.

Finally for the scopes of this paper, we need to define and distinguish de-identification from anonymization:

- The *de-identification* refers to the process of removing or masking direct identifiers (Elliot et al., 2016) such as a person's name, address and any other unique characteristic associated with a person. In the case of educational data, we could say that students' full name and surname, students' e-mail address and their registration numbers function as direct identifiers. It is worth mentioning that de-identification is close to the notion of privacy and more precisely, it refers to protecting data from direct re-identification.
- The *anonymization* refers to a process of ensuring that the risk of somebody being identified in the data is negligible (Elliot et al., 2016). This procedure invariably involves doing more than simply de-identifying the data, and often requires that data be furthered altered or masked in some way in order to prevent statistical linkage. In addition to that, the anonymization not only protects individuals from being directly re-identified but also ensures that re-identification may not occur indirectly too.

4. **Privacy through *k*-anonymity method and *l*-diversity**

In the non-interactive systems, the goal is to transform a dataset in order to enforce a certain definition of privacy. This approach is also known as syntactic anonymization and has been introduced by Samarati and Sweeney (1998) and Sweeney (2002). Assuming that sample uniques are more likely to be re-identified, one way to protect confidentiality is to ensure that each distinct pattern of key variables is possessed by at least k records in the sample (Templ et al., 2014). More analytically, the method of k-anonymity makes the assumption that if enough entries (rows) are indistinguishable, then the privacy of the subjects will be preserved since each subject's data would be associated with a group of persons (data subjects) as opposed to the individual in question.

The *k*-anonymity method refers only to categorical data, in other words, it can be applied to variables that take values over a finite set. On the contrary, continuous variables are numerical variables (not necessarily with the infinite range, as for example grades on educational data) and arithmetic operations can be performed to them. An example of a categorical variable is gender and an example of a continuous variable is income. Disclosure risk of categorical variables is based on the notion that records with unique combinations of key variables have higher risks of re-identification. We call a "key value" a certain not pre-defined combination of values that represent a pattern which is considered important to the scopes of each data analysis. Let f_k be the frequency or the count of records with pattern *k* in the sample. A record is called a sample unique if it has a pattern *k* of which the f_k =1. Let F_k denote the number of units in the population having the same pattern *k*. A record is called a population unique if F_k =1. In order to achieve *k*-anonymity, a typical practice is to set *k* =3, which ensures that the same patterns of the key variables is possessed by at least three records in the sample and by that notation *3*-anonymity is achieved; meaning $f_k \geq 3$ for all records.

For example, suppose we have a summary statistics table (Table 4.1.1) representing educational data from two basic courses of a university program. For the purpose of this example, let us assume that the key value is the set of all the attributes appearing on the table, respectively the "Code Number of the Course", the "Grade", the "Gender" and the "Age" of the student. Each row represents a distinct record in the dataset (or sample) and the last column named "Frequency" describes the frequency or the count of records with the same pattern of the key value in the dataset. In brief, we have the following summary statistics:

Table 4.1.1: Example of data containing sample uniques

	Code number of the Course	Grade	Gender	Age	Frequency (for the set of all the attributes)
1	PL10	4	Male	22	1/8
2	PL10	5	Female	24	1/8
3	PL10	5	Female	28	1/8
4	PL11	7	Female	28	1/8
5	PL11	8	Male	21	1/8
6	PL11	8	Male	23	1/8
7	PL11	6	Male	22	1/8
8	PL11	5	Female	23	1/8

We notice that:

- In the case of the course "PL10", we know that all female students (records 2 and 3 of the table) passed the course. We also know that the only male student failed to pass the course.
- In the case of the course "PL11", if someone knows the gender and the age he can find out the attribute of the grade as every record among the female students (records 4,8) is unique and the same stands for each one of the records of the male students (records 5,6,7).
- In the case that the grade and the course are known, then an intruder can link the unique values of grade to other attributes and discover the age/gender of a student from that table.
- For the four attributes of the above dataset: "Code Number of the Course", the "Grade", the "Gender" and the "Age", we notice that all records represent unique values or *sample uniques* which means that there is only one value in the given dataset with the exact combination of attributes. The vulnerability

or threat of having many sample uniques refers to the risk of re-identification and in our example this risk is very high.

To achieve *k*-anonymity we can either apply generalization or suppression or a combination of these two methods. Generalization is a method applied on categorical data in order to recode categories with few observations into a single category with larger frequency counts. If we apply generalization on continuous variables, it means to discretize the variable; for example, recoding a continuous income variable into a categorical variable of income levels. In our example, we first decide to apply generalization on the attribute of age by recoding it into two intervals according to the range of the original values, that is [21, 28] and the number of the observed records, that is 8 records in the dataset (or sample). Consequently, we come up with two (2) new intervals of the attribute of age, respectively: [21, 24] and [25, 28] and we continue by calculating once again the frequency with respect to the age and with respect to the set of all the attributes. We can see the results of the generalization in Table 4.1.2.

Table 4.1.2: Example of applying generalization to achieve k-anonymity

	Code number of the Course	Grade	Gender	Age interval	Frequency (for the attribute of age)	Frequency (for the set of all the attributes)
1	PL10	4	Male	21-24	6/8	1/8
2	PL10	5	Female	21-24	6/8	1/8
3	PL10	5	Female	25-28	2/8	1/8
4	PL11	7	Female	25-28	2/8	1/8
5	PL11	8	Male	21-24	6/8	2/8
6	PL11	8	Male	21-24	6/8	2/8
7	PL11	6	Male	21-24	6/8	1/8
8	PL11	5	Female	21-24	6/8	1/8

From the column "Frequency (for the attribute of age)", we can see that we have achieved the threshold of *2*-anonymity. Nevertheless, if we look at the last column "Frequency (for the set of all the attributes)" and look at the observed counts, we can understand that we could not release the above table as the *2*-anonymity is not achieved for the whole dataset. So we must decide to either stop at this point or continue with the anonymization process by applying further generalization or suppression. We have seen so far that generalization refers to the transformation or recoding of the values of a variable into higher frequency categories. Suppression is applied if unique values of the key variables remain after recoding. Using the suppression method, missing values are injected to replace these values of the key variables that are considered unsafe in the *k*-anonymity model. By implementing suppression in a dataset, we make the necessary suppressions as to increase the number of records with the same pattern of key variables and reduce the record-level disclosure risk.

In our example, we can see that whereas there are not sample uniques in the key variable "Code Number of the Course" and the key variable "Gender", there are sample unique in the key variable "Grade" and of course if we consider the combination of all these attributes or what we call the key value, there are 6 out of 8 records in the dataset that are unique (they have frequency count=1/8). Assuming that we decide to make the necessary suppressions by beginning from the attribute of "Gender", we calculate once again the frequency with respect to the combination of "Age" and "Gender" and take the results of Table 4.1.2a:

Table 4.1.2a: Example of applying suppression to achieve k-anonymity (before the suppression)

	Code number of the Course	Grade	Gender	Age interval	Frequency (for age and gender)	Frequency (for the set of all the attributes)
1	PL10	4	Male	21-24	4/8	1/8
2	PL10	5	Female	21-24	2/8	1/8
3	PL10	5	Female	25-28	2/8	1/8
4	PL11	7	Female	25-28	2/8	1/8
5	PL11	8	Male	21-24	4/8	2/8
6	PL11	8	Male	21-24	4/8	2/8
7	PL11	6	Male	21-24	4/8	1/8
8	PL11	5	Female	21-24	2/8	1/8

Then by applying the necessary suppressions, we take the results of Table 4.1.2b:

Table 4.1.2b: Example of applying suppression to achieve k-anonymity (after the suppression)

	Code number of the Course	Grade	Gender	Age interval	Frequency (for the set of all the attributes)
1	PL10	4	****	21-24	1/8
2	PL10	5	****	21-24	2/8
3	PL10	5	****	25-28	2/8
4	PL11	7	****	25-28	1/8
5	PL11	8	male	21-24	2/8
6	PL11	8	male	21-24	2/8
7	PL11	6	male	21-24	1/8
8	PL11	5	****	21-24	1/8

From the above described process of suppression, we notice that the dataset and is *2*-anonymous with respect to the "Age" and the "Gender" although it has partially lost the information upon the attribute of "Gender" in some records. With respect to the set of all the attributes, it still remains not anonymous and as we can see on the last column there are 4 records with frequency count 1/8. Consequently, we may decide: a. to stop at this point or b. to continue with the *k*-anonymity method. Let us assume that we decide to continue then we have two options: the first one is to apply suppression on the records with frequency count 1/8 and lose a significant part of the value of data or apply further generalization on the attribute of "Age" and on the attribute of "Grade". In the case of "Age" we can understand that more generalization would mean total loss of the information because the two intervals would have to be recoded into a single one. By the above example, we have attempted to show in a simple, yet representative way, how anonymization is implemented on every step of the process and always with respect to the data we have available, the scope of the analysis, the sensitive attributes and many other factors that we must take into consideration.

The *k*-anonymity method has the limitation that even if a group of observations fulfills *k*-anonymity, an intruder can still discover sensitive information if she/he has access to it (Templ et al., 2014). For addressing that problem, the notion of *l*-diversity has been developed as a means to diversify the specific sensitive attribute and achieve a stronger notion of privacy. According to Machanavajjhala et al. (2007) the purpose of *l*-diversity is to create an *l*-diverse group of observations, or in other words, a group of observations that contains *l* “well-represented” values for the sensitive variable. The simplest interpretation of “well-represented” is distinct *l*-diversity, meaning that the sensitive variable has at least *l* distinct values for each group of observations with the same pattern of key variables (for each *k*-anonymous group of observations).

To demonstrate the *l*-diversity method, suppose that in the example of the educational data, we consider the attribute of “Grade” as a sensitive variable and the set of values: “Code Number of the Course”, “Gender” and “Age” as the key value. Suppose that each of the records is *k*-anonymous with respect to the key variables but with respect to the sensitive variable, an intruder can discover new information. We can see our dataset and the sensitive attribute of “Grade” in Table 4.1.3a:

Table 4.1.3a: Example of applying *l*-diversity method on *k*-anonymous educational data

	Code number of the Course	Gender	Age interval	Frequency (for the set of all the attributes)	Sensitive attribute: Grade	Distinct *l*-diversity
1	PL10	****	21-24	3/8	4	1
2	PL10	female	21-24	2/8	5	2
3	PL10	female	****	2/8	5	2
4	****	female	****	4/8	7	1
5	PL11	male	21-24	3/8	8	2
6	PL11	male	21-24	3/8	8	2
7	PL11	male	21-24	3/8	6	1
8	****	female	21-24	4/8	5	2

The first, the fourth and the eight record of the table (records 1, 4, 8) are not distinct *l*-diverse and the options we have is either to remove (suppress) these records in order to achieve a minimum of *2*-distinct values in the *k*-anonymous group of observations or to make further transformations on the original data. We choose the first option and we take the following 2-anonymous and 2-diverse table (Table 3.1.3b):

Table 4.1.3b: Example of applying *l*-diversity method on *k*-anonymous educational data (after the method)

	Code number of the Course	Gender	Age interval	Frequency (for the set of all the attributes)	Sensitive attribute: Grade	Distinct *l*-diversity
1	PL10	female	21-24	2/5	5	2

2	PL10	female	****	2/5	5	2
3	PL11	male	21-24	2/5	8	2
4	PL11	male	21-24	2/5	8	2
5	****	female	21-24	2/5	5	2

From the above example, it is obvious that the utility loss of the data is considerably large as there has been a suppression of 3 out of 8 records of the dataset.

5. A Case Study on Educational Data

In order to measure the disclosure risk and the utility loss of data, we applied various data management and data anonymization techniques on several datasets of a module in the HOU. The raw datasets contained educational data and more specifically:

- all the forum activity throughout the academic year (almost 90.000 of logs for both the Module Forum, that is viewed by all the students of the course and the Tutor's Forum that is viewed by the tutor and the students of each group) generated from students and tutors of the course,
- data containing registration information (e.g. id number, e-mail address etc.) that is also called personally identifiable information (PPI) in the relevant terminology and
- the scores of students in written assignments, online quizzes, the final test and some other online evaluation projects (though with very few frequency counts).

The first step of the methodology, using the MS Excel, was to perform data cleaning and data integration techniques in order to produce a single database with all the above information. For that purpose, certain computations took place, such as computing the overall forum activity in number of logs for each student/tutor and applying specific transformations of data variables e.g. the "time" value which counted the exact time of the log entry was transformed into the "date" value counting the different day of the activity and finally the variable "number of days active" counting the total number of active days for each student/tutor. The final part of that step was to remove all variables containing PII values (e.g. id number, IP Address etc) of the user because they could lead to direct identification.

The second step of the methodology, using the SPSS Statistical Package, was to apply descriptive statistics in order to see whether and how each one of the forum activity is related to the performance and for that purpose we computed the correlation coefficients and used statistical tests. Hypothesis testing is a statistical tool that measures the probability of an assumption that is called the *null hypothesis* to be true or false according to a pre-decided level of probability that is called p-value and signifies our pre-decided tolerance on the Type I error (the null hypothesis is rejected when it is actually true) and on the Type II error (the null hypothesis is accepted when it is actually false). This process provided us with valuable knowledge and helped us decide upon their distinct role of the forum activities –according to their significance -as direct identifiers, quasi identifiers and sensitive attributes.

The third step of the methodology, using the ARX Data Anonymization Tool, was to perform privacy-preserving techniques and in particular *k*- anonymity in order to calculate the disclosure risk of the data set. The tool is set by default to implement suppression as well as generalization and the user sets the respective parameters. From the menu we created "generalization hierarchies" a data transformation method processed by ARX on categorical as well as continuous (scale) variables with the user setting the range of the intervals. Then the tool computes the disclosure risk under the assumption that the data (in the form of hierarchies) is published and presents the respective results (before and after the anonymization). In that step of the methodology, we also experimented on the recoding data with the use of the SPSS tool. More analytically, we transformed certain continuous variables (forum activity) into categorical variables on the grounds of the observed frequency statistics so that each category would represent an almost equivalent number of values. Then, we tested the results of the two anonymization models, the one that is done almost automatically by the ARX and the one that requires a more intuitive way by the data analyst by comparing the risk of re-identification and obtained almost similar results.

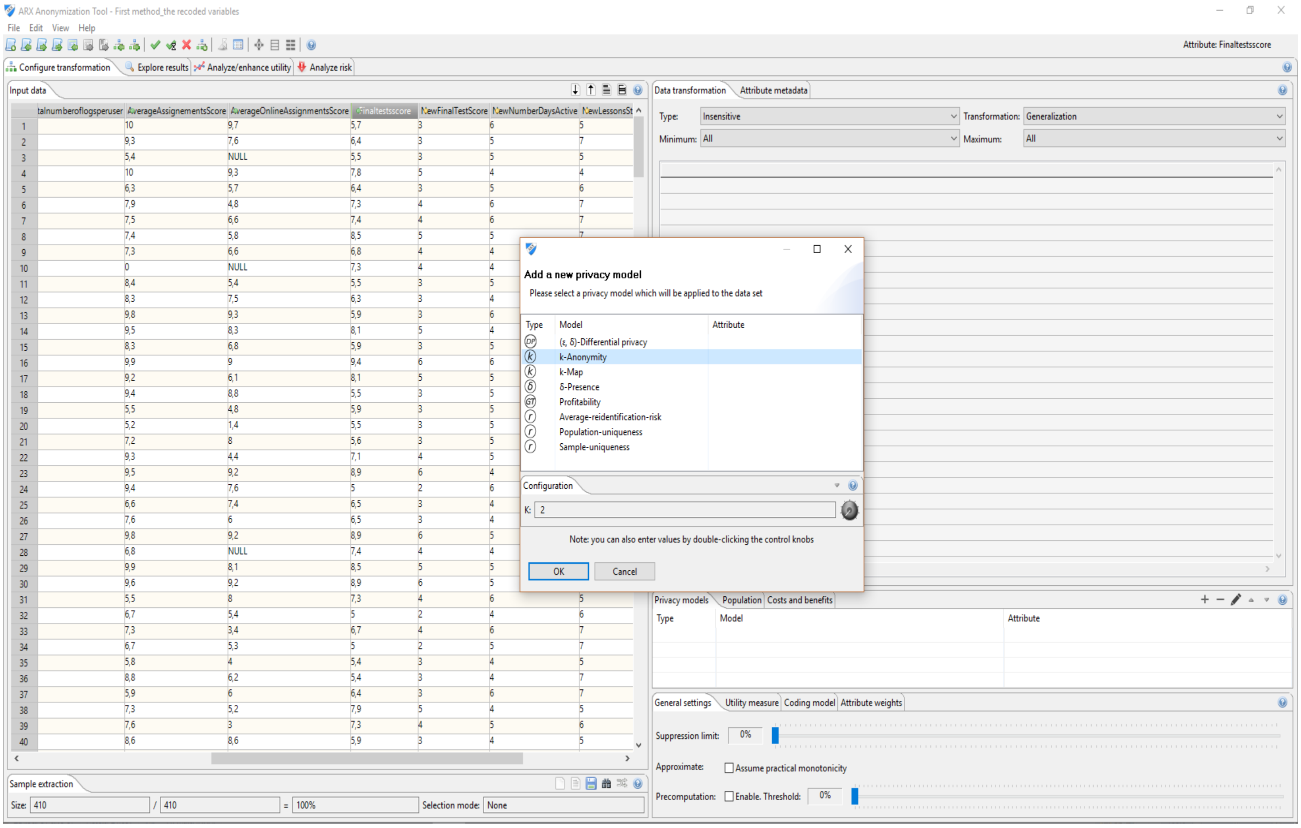
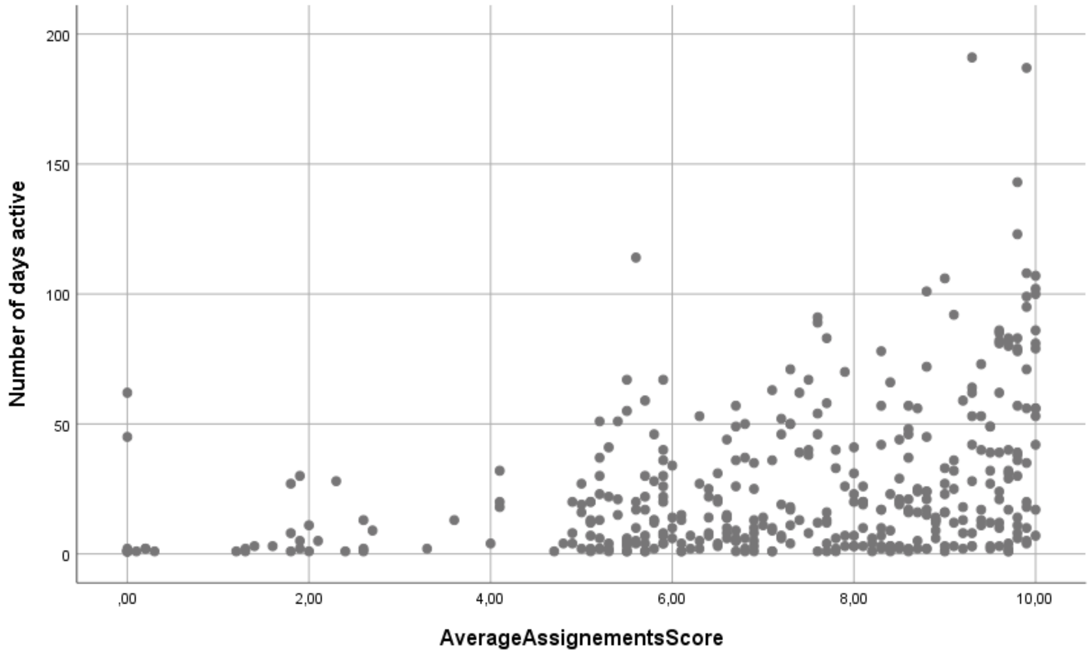


Figure 5.1: The ARX Anonymization Tool: the data (on the left) and the selection of privacy models (in the middle)

In addition, we applied several other privacy models which are included in the ARX Tool, such as the model of *ε-differential privacy* and others to see whether they provide better results on our analysis. Finally, we tested whether there is utility loss on the information after the anonymization process by computing several statistical measurements.

5.1 Tables and figures

In Figure 5.1, we see a representative graph (scatter plot) showing on the y-axis the activity of the forum ("Number of Days Active") and on the x-axis the performance of students ("Average Assignments' Score"). Even just observing this graph we can understand that for grades with the value of 6 or higher, most students have a forum activity of up to 50 days. We can also see that many students with good grades have forum activity of up to 100 days and finally there are the outliers or the extreme values (almost 200 days of activity) with very low frequency count (1 student).



5.1.1 Scatter plot of the “Number of Days Active” and the “Average Assignments’ Score”

We computed the correlation coefficients between each one of the main forum activities and the grades of students on written assignments, quizzes and the final test. In Table 5.1.2 we give the results of the computations in the column called “Pearson’ Correlation Coefficient” and we can see whether the several forum activities (on the left) are correlated to the average assignments’ score. This measurement can take positive or negative values in the [-1, +1] interval. In the case study, the coefficients take positive values that are rather small. In the respective columns under the name of “p-value” we have the results of the statistical test that provides evidence whether the coefficients are important (significant) or not to our analysis.

5.1.2 Table of the scores of the correlation coefficient between forum activities and the average assignment’s score

		Average Assignments’ Score			
		Pearson’s Correlation Coefficient	p-value		
			Significant correlation at the 0.01 level (*)	Significant correlation at the 0.05 level (**)	Not significant correlation
Forum activity	**Number of days active**	0.349	(0.001) *		
	Lesson’s structure viewed	0.309	(0.001) *		
	Discussion viewed	0.322	(0.001) *		
	Discussion Created	0.79			(0.123)
	Post Created	0.166	(0.001) *		
	Some content has been posted	0,157	(0.002) *		
	Total number of logs	0,335	(0.000) *		

If the p-value of the coefficients is higher than the pre-decided level of significance (0.01 or 0.05) then the coefficient is not statistically significant and the two variables are not correlated. On the other hand, if the p-value is lower than the level of significance there is enough evidence the coefficients are statistically significant and the two variables are correlated. In our case study, the p-values of almost every forum activity provide (very low but nevertheless enough) evidence that the forum activity is important to the average assignment's score.

6. Conclusions

From the case study on education data coming from the HOU, we have concluded that we have to follow certain steps in order to provide reliable results and that presumes defining the scopes of the analysis and the description of the problem that we expect to solve with the design and conduction of an analysis. This is a procedure which involves the participation of several groups of people that are directly or indirectly involved with the problem and its results must be applicable, that is they should be clear, measurable and should be easily integrated into the decision making process.

The first step of the analysis includes careful investigation of the data, compliance with the legal framework concerning their acquisition and implementation of analytical skills for the purpose to modify the data and to perform the necessary preparations, as for example dealing with the missing values. Provided that step is prepared cautiously then the results on the categorization of data on the anonymization process is done more smoothly; that is we can determine more accurately upon the direct-identifiers and the quasi-identifiers. This is very helpful because deciding especially on the quasi-identifiers is not often easy as it requires considering several factors, moreover, nowadays with the various sources of data is a dynamic process and not a static one.

By the next step that is best described with the use of scatter plots, descriptive statistics, regression etc we were able to explore the data and continue with the purpose of the analysis by measuring the importance or what is called in the terminology of data science the test of statistical significance. The different variables of the data play a diverse role and the discovering of their interrelations offers a new dimension or value in the information we want to find. In addition, we assume that we want to share the acquainted knowledge so that more research could be performed on the specific area of our primary study or experiment.

In the anonymization phase of the experiment, we noticed that the adding of more columns increased the disclosure risk of the whole data set because it means adding more activity and thus making the dataset more vulnerable to an external attack. On the contrary, by adding more records on the dataset was something that helped the analysis because the dataset became bigger and as a consequence the disclosure risk decreased. Also in that step we concluded that the combination of certain quasi-identifiers produced a higher disclosure risk than other combinations because they created more unique combinations and that produce a higher risk of re-identification. The "trade-off" between preserving-privacy and preserving the value of information or not having utility loss upon data is a challenge and in the case of syntactic anonymization it requires users with certain skills whereas in the interactive systems, privacy is better preserved but there is a limitation on the use of queries and certainly on the size of data (has to be very big).

Finally, in our study we proved that the use of forum actually helped students on the final test and the assignments. Even though forum activities are not very strongly correlated to the scores (the coefficients are not close to the value of +1), they still play an important role. Especially on the final test which is the most crucial for completing the module, the average score among students not using the forum was 2.94 whereas the average score of students using the forum was 6.23. It would be interesting to experiment more on the students' opinions and expectations upon the course and how these are connected to the way they communicate through their forums so that they become more applicable and support the overall learning process.

7. References

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Project: Voluntary student-driven peer feedback

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Abstract

Peergrade is typically used as an online tool for peer feedback, facilitated by the teacher. Thereby, still creating a teacher centred learning situation. This abstract will suggest using Peergade as part of a student peer feedback cycle with several iterations, before the student hands in the final paper for teacher evaluation and grading. Feedback does not have to be perfect to be useful as a source of reflection, but the biggest challenge is probably for the students to recognize their peers as a valid source of feedback, and furthermore recognize that it is a task worthy of their time. At the University of Southern Denmark's (SDU) Centre for Teaching and Learning (SDUUP) the Peergrade tool is currently being promoted as part of the online tools available for teachers. At OOFHEC 2018 I would like to discuss the possibility of using Peergrade as a tool for voluntary student-driven peer feedback and open up for actual student controlled and felicitated feedback. But how can you initiate and structure such a project with a group of people that you have so little control and interaction with outside the classroom? How much technical knowledge is needed for students to feel safe using the tool on their own? I would like to share my thoughts with you and hopefully gain some useful peer feedback through a professional dialog and debate.

Keywords: Peer feedback, peer assessment, Peergrade, student-driven, voluntary,

1. Introduction

The aim of this paper and presentation is to explore ways of approaching a complex development project. The main objective is to ask questions, not to present the ideal solution to these questions. Hopefully the input from the OOFHEC 2018 conference will help shape the outlines of this project. Initially this project was merely thought of as a development project with potentially practical and local implications, but I did not find a single example of voluntary student-driven peer feedback in my exploration of the academic literature on peer feedback and assessment. The teachers are the ones who must tell students to conduct peer feedback. It would seem that this particular area of voluntary student-driven peer feedback is lacking in both empirical examples and supporting research, and this project will therefore become two-folded. One objective is to get the students to be more active than passive in the way they engage in peer feedback, and the second objective is then to do the empirical research that can support further development.

Peergrade is an online software used at SDU that can handle the logistics of peer feedback with distribution of papers, anonymous feedback, flagging options, and create an overview for teachers. In a sense Peergrade has made the logistics of peer feedback manageable and therefore making written student-driven peer feedback a more achievable project. Peergrade was therefore the main source of inspiration for formulating a project that includes voluntary student-driven peer feedback, but it is not the main reason why universities should engage their student in feedback activities. This paper will therefore primarily focus on the pedagogical implications of implementing student-driven feedback sessions.

2. Why should we engage in peer feedback activities?

Peer feedback and assessment can lead to a better learning outcome for the student (Nicol & Macfarlane-Dick 2007; Black & Wiliam 1998; Hattie 1987; Crooks 1988) and can even lead to a higher final assessment (Price, Goldberg, Robinson, & McKean, 2016; Balan 2012). Peer assessment is highly correlated with those assessments made by experts (Wheater, Langan, & Dunleavy, 2005; Hafner & Hafner 2003; Sadler & Good 2006, Falchikov & Goldfinch 2000). If students use and engage in making a rubric, the positive effects of learning outcome and assessments seem even more likely (Reinholz 2016; Andrade & Valtcheva 2009; Panadero & Romero 2014). The process of a student giving feedback can improve performance, even without the student receiving any feedback themselves (McGourty, Dominick, & Reilly, 1997), however receiving limited feedback, in the form a correct or incorrect answer is less likely to be beneficial (Aleven, Ogan, Popescu, Torrey, & Koedinger, 2004). Peer feedback should therefore be a part of several iterations with a complete feedback loop (Hounsell, McCune, Hounsell, & Litjens, 2008), in order to make the learning process clear and provide a student with insight in to feedback as a general concept. In an ongoing research program at SDU, lack of feedback is one the highest scoring categories when students need to describe what makes them dislike their current professional and social study environment. In that specific research context, discomfort is linked to drop-out intentions, and later cross examined with the actual drop-out rate (Lykkegaard, not yet published). A least in a Danish context, students seems to be frustrated over the small amount of feedback they can receive on written papers from faculty (Andersen 2016).

There is a reasonable amount of research suggesting that engaging in peer feedback activities is a valuable learning activity, and an activity worthy of time and resources. The argument could be aimed at members of faculty and educational developers, but in this paper, I'll direct my arguments toward the students. Universities are experiencing a steady increase in the volume of students attending classroom lessons and have fewer resources to teach the students and to give them feedback; including peer feedback sessions, which may in fact be viewed as a possible but neglected solution to the problem of overcapacity. Yet the students should not engage in peer feedback activities merely to ease the conscience of universities. Rather, they should engage in peer feedback sessions purely for selfish reasons. Voluntary peer feedback sessions have the possibility for increased learning outcomes and final assessments. Students that engage in peer feedback could, and should, see it as a competitive advantage and as a learning experience in feedback and assessment.

3. How do we convince the students?

The easiest solution would be to get students of educational development and information and communication technologies (ICT) to read this paper and some of its references, and in that way deliver academic reasoning and legitimization for engaging in voluntary student driven peer feedback. I do not have any empirical data to support this claim, but in my experience simply presenting a stack of papers is not enough to convince people to follow a new path. If it was this easy I'm sure my job as an educational developer would be replaced with a bunch of subscriptions to educational journals. People need to feel the change, and experience the beneficial qualities of peer feedback, before recognizing the value of such an activity. Hence, though it may contradict the purpose and aim of this paper, the real-life project might benefit from targeting students who have already engaged in peer feedback in a more formal setting. Even a user-friendly software such as Peergrade, still takes some time to get used to, and even more so if you want to convince students to do extracurricular work. The software itself is not important for the aim of this project, but it is important in the sense that it makes the logistics manageable for the students and makes a student driven peer feedback more achievable. Quite a few learning management systems (LMS) can make a third-party integration with Peergrade, and thereby make the software even more accessible for students. The students get to interact and interact with the software themselves and hopefully, at some point, make the connection to the potential learning outcomes.

But perhaps what is needed is a larger change in culture around feedback in higher education (Boud & Falchikov 2006; Spiller 2012, Spiller 2014). The students should experience feedback as part of a larger learning process, instead of a type of summative assessment. It would be helpful if the students had the opportunity of engaging in the creation of the assessment criteria, to develop an understanding of the purpose of the feedback process (Spiller 2014). Many students prefer to get their papers validated by their teachers (Andersen 2016), which leads to my next question of how we get students to see their peers as a valid source of feedback.

4. How do we get students to see peers as a valid source of feedback?

Another issue is how to convince students that their fellow students are a valid source of feedback. Once again, my suggestions might contradict the very aim of this project. However, I would suggest beginning with giving peer feedback in a formal setting. Some teachers at SDU have expressed concern about the quality of the feedback from the students, and how much energy they are actually willing to put in to such an activity. One of the solutions that a teachers came up with was to make the feedback an equal part of the assignment; to pass the assignment would thereby entail passing not only the written paper, but also participating in the activity of giving feedback. The software has several clever ways of making this possible via due dates, criteria, several iterations, and adaptive release on feedback and grading. Once again, the formal setting is a source of inspiration as well as a way of legitimizing the value of peer feedback within a specific academic discipline. Some learning objectives are not suitable for a peer feedback activity, and therefore the scaffolding and approval from an expert may mean a great deal in legitimizing peer feedback on a practical level. Focus should perhaps be shifted towards the development of skills in argumentation and critical thinking, more so than on the accumulation of knowledge within a specific academic area.

5. Is voluntary student-driven peer feedback even achievable?

At the Technical University of Denmark (DTU) a recent publication about peer review (Wilhjelm & Prag 2018) shows that there is a great deal to be gained by using peer feedback software. There is an estimated time reduction of 80 % for teachers, in a class of 49 students, if the teacher normally were to use 30 minutes on feedback per assignment. But for this paper it's even more interesting that 61 % of the students voluntarily participated in giving feedback, and that the vast majority said that they would engage in peer feedback activities again (Wilhjelm & Prag 2018). Some of the students even expressed a wish for giving more qualitative feedback and comments and therefore potentially adding more work for themselves, because the feedback in this assignment was fixed with a rubric. It would therefore seem that, with a proper scaffolding, there is a possibility of creating an environment where voluntary peer feedback is achievable. The major threshold task is going to be the shift from having a teacher in charge of the facilitation and practical work to leaving the responsibility with a more loosely structured group of students.

My main problem about this phase of the project is that it is largely undocumented in terms of research; I could find some inspiration in the literature about intrinsic and extrinsic motivation (Bénabou & Tirole 2003), or in extracurricular activities in general (Fredricks 2017; Massoni 2011), or maybe even a broader look at volunteer work in higher education (Holdsworth & Quinn 2010), but it does not connect the dots in a specific way. To the best of my knowledge, there does not exit a fully comprehensive and empirical research project about voluntary student-driven peer feedback. Such a project needs to draw on several academic disciplines and research areas, as well as being a practical nightmare in terms of chances of success, return of investment and the likelihood of making any long-term changes in the way students view feedback. Hopefully the discussion at the OOFHEC 2018 will help to kick-start the project and elaborate ways of actually handling it, as well as the following empirical research project.

For the sake of creating an overview and a starting point for discussion, I've summarized my preliminary thoughts, which outline the key elements upon which the project design should be based on.

- Show students the empirical proof of peer feedback's qualities.
- Promote and prime the personal motivational factors for the students, such as increased learning outcomes and the opportunity for better final assessment.
- Target students within educational development and ICT, with prior experience in peer feedback activities.
- Make the software available for students as a part of the institution's regular LMS and ICT services.
- Try to change the feedback culture around a learning process, instead of a summative assessment, thus making student feedback more valid and valuable.

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Quality in courses using mobile technologies aimed at the better integration of disadvantaged groups to socio-economic diversity

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Abstract

The European Research project mEQUITY (PROJECT Number 561527-EPP-1-2015-1-BG-EPPKA2-CBHE-JP) aims to design and develop an adapted curriculum in the degree of engineering, based on digital learning resources for mobile devices that ease the teaching-learning process for the target population. It responds to the requirements of modernization and accessibility of Jordan higher education in order to improve the educational integration of disadvantaged students - groups at risk whose special needs or disadvantaged socioeconomic status significantly constrain their possibilities for receiving a suitable education. Within the project, a MDR model has been created for the development of mobile applications with augmented reality whose objective is to improve the educational integration of disadvantaged students.

From that point on, it is necessary to establish a sound framework for the variable researched, the quality courses using digital resources. The MDR model has been designed and planned to keep a balance that guarantees teaching of all subjects while creating learning situations that encourage the use of strategies and skills, allowing the implementation of knowledge through mobile devices.

Results obtained with several online questionnaires and the analyses of the responses to the open questions are detailed in this paper. In them, teachers and students consider that the MDR model has been very positive in the courses. In general, data shows that the users are satisfied with the system and they consider that the

educational resources designed with this mobile augmented reality system are contributing to improve the learning process.

Keywords: System of applications with augmented reality, digital resources, inclusiveness, quality formation courses.

1. Introduction

Technology is necessary and important for social changes that favor the integration of populations at risk. According to Koon and De la Vega (2014: 2) technology "fulfills the right of people with special needs to get the best quality of life", understanding that these tools make integration easier and give more opportunities for those in need. In this sense, technologies applied to education are considered to be key tools for promoting equity in education, but they must be based not only on essential technological changes but also on methodological changes that ease the teaching-learning process for the population they are addressed to (Lizarazo et al, 2015).

Several authors declare that mobile devices are tools that focus easily on the needs of users, facilitate communication, collaboration and motivation among them, make the learning process faster, easier, more attractive and acceptable for students with social, cultural, educational and physical disadvantages (Villalonga and Marta-Lazo, 2015; Cantillo, Roura and Sánchez, 2012). Currently mobile technology has transformed the educational landscape, and m-Learning has emerged as a methodological approach to address the lack of collaborative, flexible and spontaneous teaching. Zenteno & Mortera (2011) point out different researches where there is a direct correlation between motivation and the use of technology in education, as well as other factors of direct influence on the improvement of learning such as self-efficiency.

The advantages of the new mobile devices such as mobility, portability, interactivity, immediacy, connectivity, ubiquity and adaptability will increase their educational potential and if they are adapted to the needs of the groups at risk of exclusion they will be true drivers of socio-educational changes. As Sugandhi, Kasture, Gupta and Varghese (2017: 38) say, “M-Learning or mobile learning is a form of distance education where m-learners use mobile devices as educational technology at their time and convenience. It is form of learning across multiple contexts through social and content interaction”.

Under these assumptions, the European Research project mEQUITY (PROJECT Number 561527-EPP-1-2015-1-BG-EPPKA2-CBHE-JP) aims to design and develop an adapted curriculum in the degree of engineering, based on digital learning resources for mobile devices that ease the teaching-learning process for the target population. It responds to the requirements of modernization and accessibility of Jordan higher education in order to improve the educational integration of disadvantaged students - groups at risk whose special needs or disadvantaged socioeconomic status significantly constrain their possibilities for receiving a suitable education.

The partners involved in the mEQUITY project are:

- Plovdiv University “Paisii Hilendarski” (PU), Bulgaria.
- Universidad Nacional de Educación a Distancia (UNED), Spain.
- Ravensbourne Higher Education Institution (RAVE), United Kingdom.
- University of Jordan (UJ), Jordan.
- Jordan University of Science and Technology (JUST), Jordan.
- Princess Sumaya University for Technology (PSUT), Jordan.

The target population for this research is the so-called groups at risk, i.e., people who are disadvantaged because of their ethno-cultural characteristics and students with special socio-educational needs. Its global objective is to improve Jordan's higher education, thus enhancing the educational integration of disadvantages students – groups at risk with special needs or disadvantaged socioeconomic status.

The specific objectives of the project are:

- To create digital educational resources for mobile devices, for improving, among other variables, motivation of higher education disadvantaged students – groups at risk whose ethno-cultural features, special needs or socioeconomic status significantly restrain their possibilities of obtaining a suitable education.
- To analyze the needs of users in different contexts and curricula in Jordan. This study is aimed at evaluating the degree of use of these technologies by specific groups of students and, by learning about their needs, at opening new educational opportunities in the teaching-learning process since it can influence the motivation of these users.
- To design digital resources (MDR Models) as motivational tools for supporting the educational features of mobile technology in order to adapt them to the learning conditions of disadvantaged groups.
- To develop and adapt mobile applications and digital educational resources. This objective tackles the need of using m-learning in different subjects for encouraging motivation of users and for fulfilling the educational needs of the disadvantaged groups which the project is addressed to.

The hypothesis which is the basis of this project is: the use of educational digital resources, mobile devices, and augmented reality et al. in the teaching-learning process increases motivation of students with special educational needs and enhances its performance, thus improving quality within the educational system.

This research wishes to contribute in getting rid of barriers and prejudices found in the integration of technology for improving education and motivation of people at risk of exclusion, whom this research project is addressed to. It is sought that all students, irrespective of their personal circumstances and abilities, benefit from a better education and that teachers see technology as a source of possibilities and resources. The mEQUITY research project is based on the MDR model, and from the improvement of this model new educational modules for students at risk have been created based on teaching methods that use mobile technology and devices.

The objective of this paper is to show the satisfaction of teachers and students taking part in the courses that used the MDR model, according to the different scenarios on which the project is based. The scenarios the project is addressed to are worth mentioning as the evaluation of this project revolves around gathering and handling the opinions of participants (teachers and students):

- Main Scenario: Jordan Universities
- Other Scenarios:
  - Scenario 1: General Secondary Schools for Children with Special Needs
  - Scenario 2: Higher Council for Affairs of persons with Disabilities
  - Scenario 4: Gaza refugees camp
  - Scenario 5: Our Lady of Peace Center

From that point on, it will be necessary to specifically analyze the MDR model in terms of its design and structure as the main element of this research.

2. The MDR model

The MDR model is based on the design and use of digital educational resources, mobile devices and augmented reality, on how they affect the teaching-learning process. Amar (2006) states that technology applied to education favors students' learning, fosters their interest and creativity, improves their ability to solve problems, enhances group work, and reinforces students' self-esteem; all these factors contributing to increase motivation in students. In general - and especially the ones designed for the MDR Model- the use of mobile devices and digital resources in education lead to innovative solutions to cover the needs of the groups at risk taking part in this research, since these devices provide resources for teachers to make complex presentations for improving understanding and study of the subjects according to the educational needs of the students (Figueras-Maz, Ferrés, & Mateus, 2018).

The MDR model is based on active learning where students discover, process and apply the information received. Intelligent mobile devices, the tools used in this project, are, among other features, flexible and specific, basic for them to be adapted to the educational needs of the users whom this project is addressed to as these tools give students the freedom and autonomy they need to overcome limitations of time and space (Ortiz and Martínez, 2017). As well, students can use these technologies both in the classroom and outside it and access a large amount of resources. Another important feature of mobile devices, and therefore of the digital model we present in this paper, is that the use of these technologies does not require great technical knowledge, thus facilitating learning the subject in a simple way and improving the acquisition of digital competences, as well as fostering innovation in the teaching-learning process. An example of this is Augmented Reality used in the MDR model.

Augmented reality (RA) is an important part of the MDR model. It is based on intuitive perceptions and personal preferences, and offers many opportunities to generate interest and motivation in the long term. This type of innovative learning makes students enthusiastically accept with a proactive attitude the subject to study through the use of everything related to technology (Díez, 2012). Augmented reality is an environment that includes experiences from the real and virtual worlds. This technology has the potential to create a learning environment suited to satisfy the interest of students in exploring the world during their different educational tasks. It leads to greater motivation for actively participating in the learning process, an important improvement in memorizing school materials and, due to the use of more senses, facilitating learning of the disadvantaged and making education more effective.

The pedagogical design of the MDR model of the mEQUITY research project aims at students to be motivated with the subjects to be studied, and therefore it must provide relevant content according to the curricular objectives and the educational needs of students at risk of exclusion. As Coll (2013) says, the activities and resources proposed must foster educational interactivity by providing opportunities for practice and feedback, favoring the transfer of knowledge, and they must be adapted to place and context.

As well, we must say that the MDR model has been developed with an electronic learning platform, DIPSEIL (http://env.dipseil.net/v3), which enables designing, developing and offering educational resources, being one of its main features to ensure support to students when necessary and as much as necessary, for them to deal with real work in a problem-based learning context. Thus, according to the needs and abilities of the students, a series of educational modules / courses in the electronic learning platform DIPSEIL have been developed and adapted.

3. The research project

For the development of the research project we start from the hypothesis that the use of digital educational resources with mobile devices, for which the MDR model has been created, improves performance of students with special educational needs and socioeconomic and labor disadvantaged.

To analyze the use of digital educational resources it is necessary to analyze the courses taught and how they have been evaluated. This evaluation is carried out globally in order to have a broad view, but a series of variables are analyzed: course design, content / methodology, teachers, usability, tools, educational resources, organization, length and timetable. And we have to do it from two perspectives: the one from the student that interacts with the educational resources of the model MDR and the perspective of the teacher that advises and guides the teaching and learning process.

In addition, to evaluate these courses, the following questionnaires were used:

- Questionnaire for the evaluation of courses – Students, Universities
- Questionnaire for the evaluation of courses – Teachers, Universities
- Questionnaire for the evaluation of courses – Students, Schools
- Questionnaire for the evaluation of courses – Teachers, Schools

Two questionnaires are addressed to teachers (one to university teachers and another to school teachers) and the other two to students (one to university students and other one to school students). Both focus on course design, content / methodology, teachers, usability, tools, educational resources, organization, length and timetable of the courses. As they will be answered by different groups of participants, the online questionnaires have been adapted to the specific features of each group.

The variables measured in these tools are:

- Dependent Variable (DV): course design, content / methodology, teachers, usability, tools, educational resources, organization, length and timetable.
- Independent Variable (IV): Digital Educational Resources

Each questionnaire consists of 38 questions divided into five blocks – one for each feature to be measured. Each of the five blocks consist of questions that can be rated on a Likert scale of 1 to 4 (1= Strongly disagree; 2= Disagree; 3= Agree; 4= Strongly agree). Thus the highest score that can be given to each question is 4, meaning to totally agree with the statement, and the lowest score is 1 which means to totally disagree with the statement.

These questionnaires are addressed to:

- Students at risk of exclusion (groups detailed in previous sections of this paper)
- Teachers of disadvantaged groups of students

4. Results

In order to assess the courses taught in the mEQUITY project, the results of the on-line questionnaires designed for teachers and students of all scenarios of these will be analyzed hereunder, by taking into account a series of internal variables such as content and methodology, motivation, organization, teachers and educational resources.

The evaluation of the courses will be carried out by detailing the results of each university, but from the perspective of the teacher and of the student; a final a global comparison of results will be detailed as well.

4.1 Evaluation of the courses offered by JUST

The students of JUST who took these courses have valued in a very positive way all the variables, with means close to 3 out of 4 as seen in Figure 1 below:

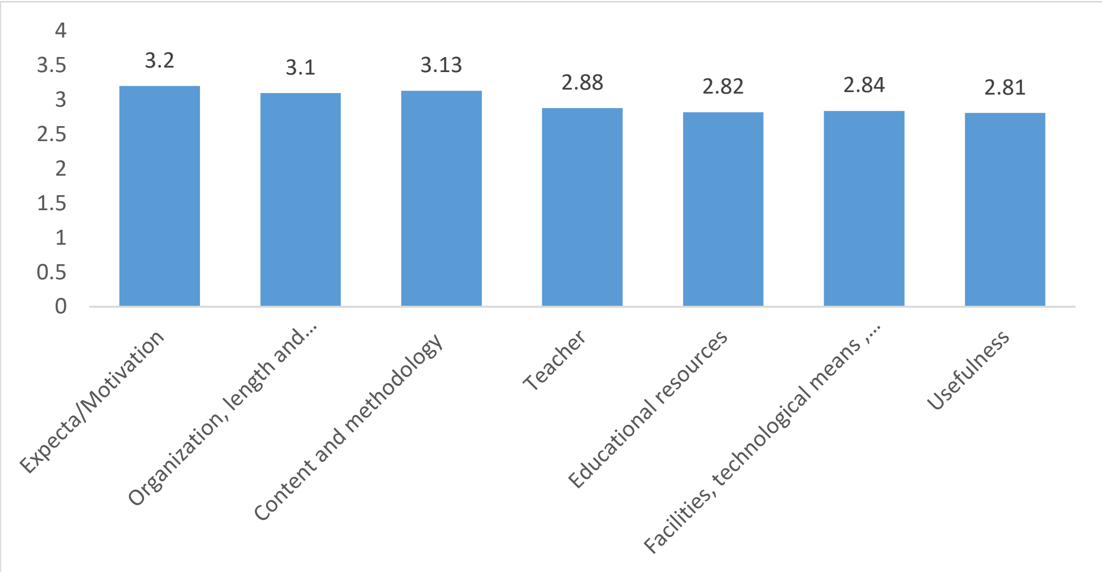

Figure 1 Mean of the courses offered by JUST - Students

Data shows that the variable expectation & motivation has obtained the best results with a mean of 3.2 out of 4. However other variables also stand out, such as the contents & methodology with a mean of 3.13 out of 4, as well as organization, length and time with a mean of 3.1 out of 4.

As well, for the evaluation of the courses a series of questionnaires were designed for teachers of all scenarios, since it is important and necessary to know their assessment. Thus Figure 2 presents the results of the evaluation by teachers divided into the mentioned variables

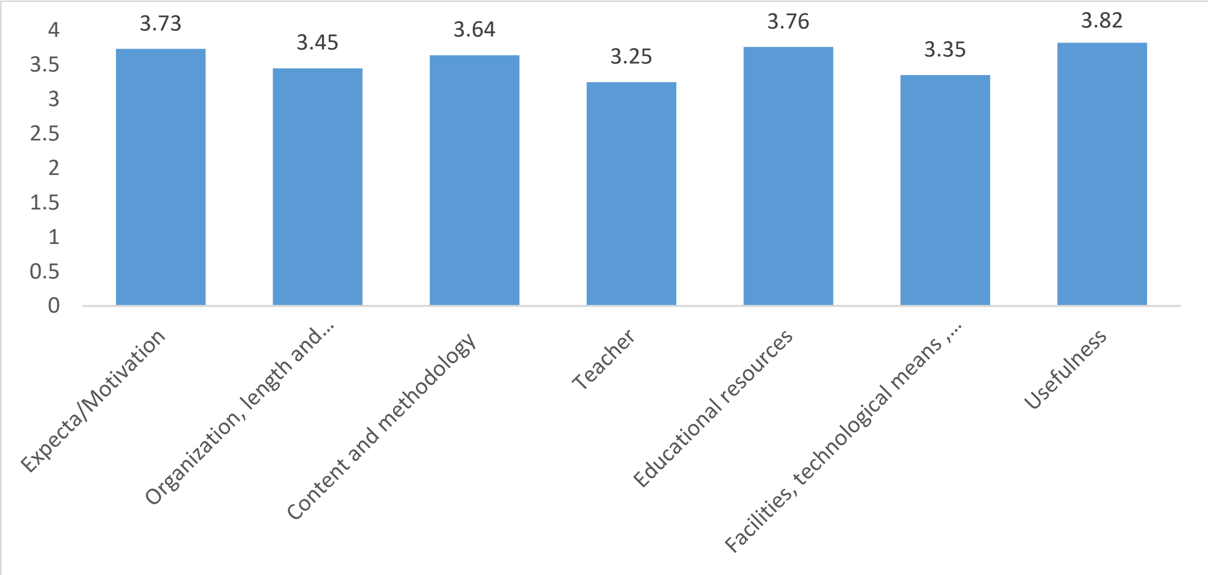

Figure 2 Mean of the courses offered by JUST - Teachers

As seen in Chat 2, the variable usefulness has obtained the best results with a mean of 3.82 out of 4. Other variables also stand out as well, such as educational resources with a mean of 3.76 out of 4, and expectations & motivation with a mean of 3.73 out of 4.

4.2 Evaluation of the courses offered by UJ

The courses offered by UJ obtained good results as well. Students have granted high scores to all the variables of these courses with means above 3.05 out of 4 as detailed in Figure 3:

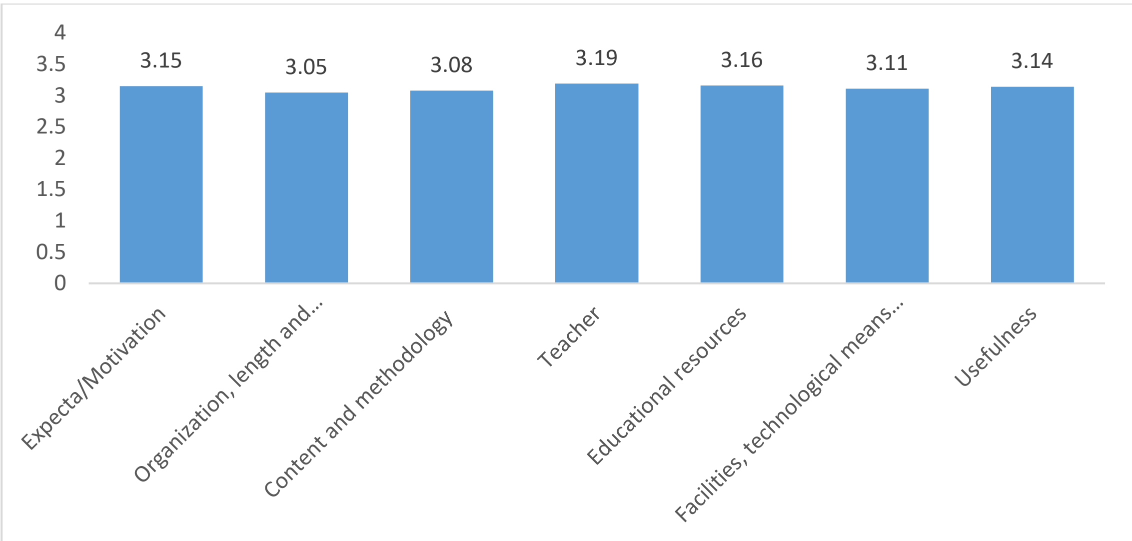

Figure 3 Mean of the courses offered by UJ- Students

As per data in the Figure, the variable teachers has obtained the highest score, with a mean of 3.19 out of 4. Other variables with very good results are educational resources, with a mean of 3.16 out of 4, and the variable expectations & motivation that scored 3.15 out of 4.

The courses offered by JUST were assessed by teachers as well. In Figure 4 we can see the results obtained by each variable:

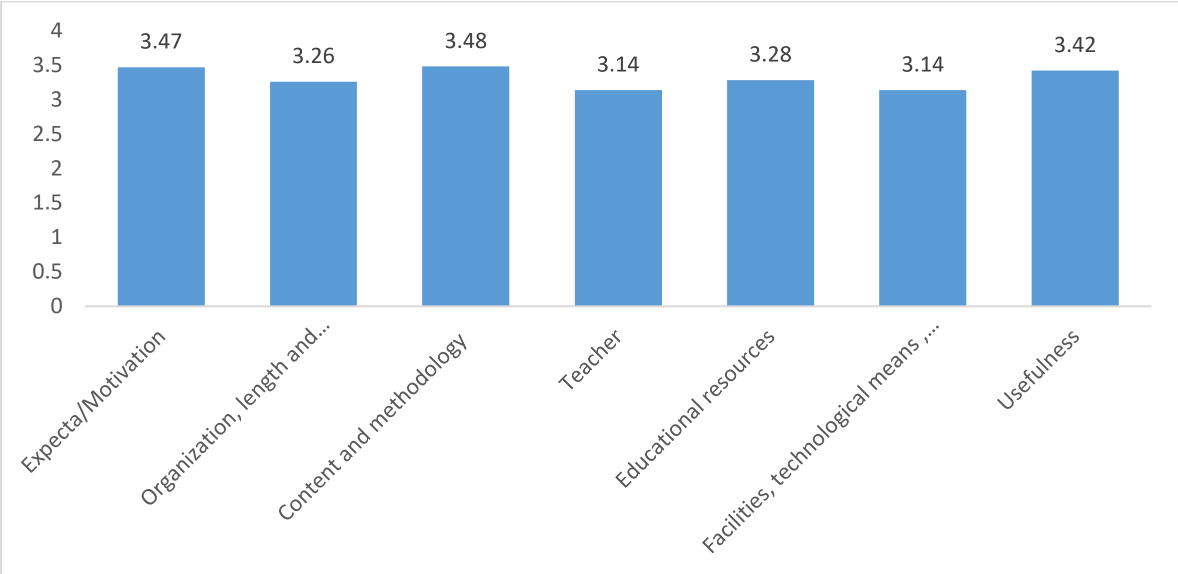

Figure 4 Mean of the courses offered by UJ- Teachers

Data shows that the variable with the highest score is content & methodology, as it obtained a mean of 3.48 out of 4. Other variable worth mentioning are expectation & motivation with a mean of 3.47 out of 4, and the variable usefulness with a mean of 3.42 out of 4.

4.3. **Evaluation of the courses offered by PSUT**

In the case of the courses offered by PSUT, students have given very good scores to all the variables, with means close to 3 out of 4:

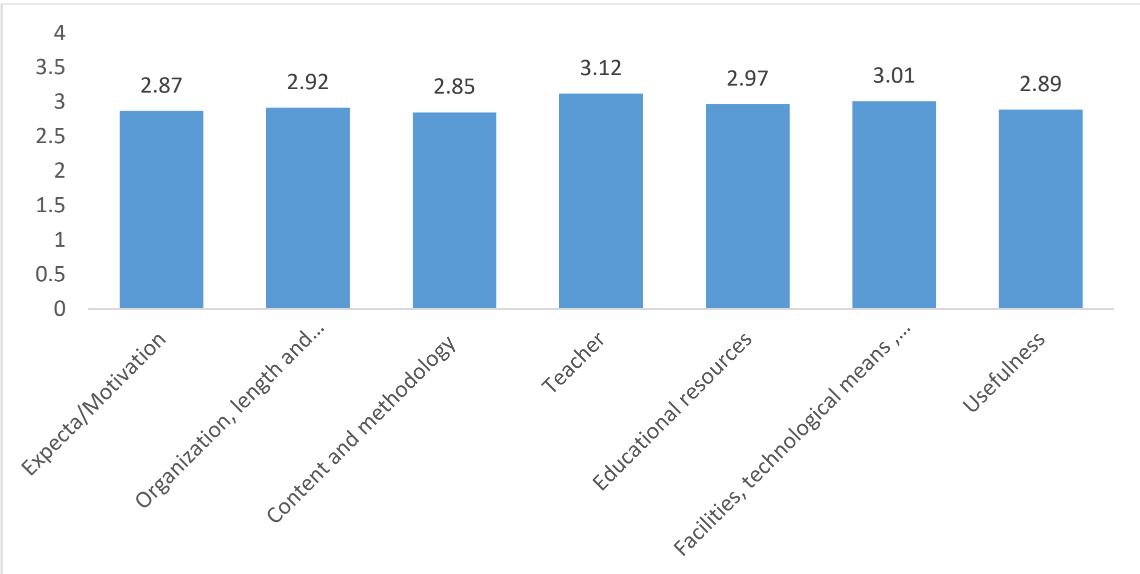

Figure 5 Mean of the courses offered by PSUT- Students

As seen in the Figure above, the variable that has obtained the best results with a mean of 3.12 out of 4 is the one referred to teachers. However, other variables also standout such as facilities & technological means scoring 3.01 out of 4, as well as educational resources that score 2.97 out of 4.

To obtain a complete view of the evaluation of the courses, results given by teachers are detailed in Figure 6 and divided into the aforementioned variables:

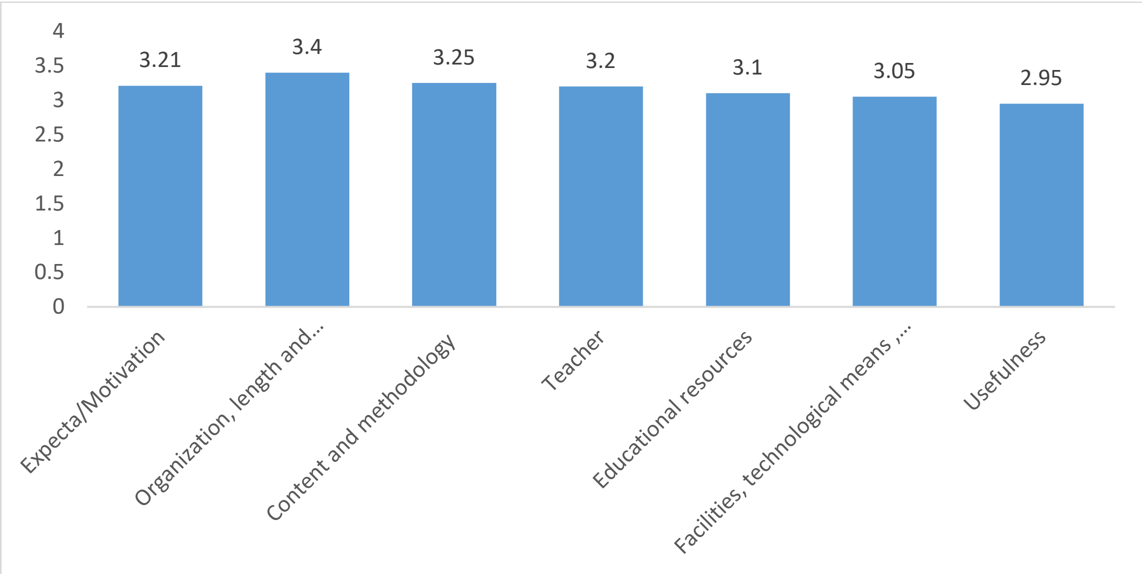

Figure 6 Mean of the courses offered by PSUT- Teachers

The Figure shows that the variable Organization, length and timetable has obtained the highest results with a mean of 3.4 out of 4. Other variables to mention are content & methodology (3.25 out of 4) as well as expectations & motivation (3.21 out of 4).

4.4. **Comparison of results**

Hereunder are detailed the scores given by teachers and students divided per university.

Table 1 shows the scores given by the students of the three participating universities:

Table 1: Mean of the courses offered by PSUT-UJ and JUST- Students

VARIABLES	**JUST**	**UJ**	**PSUT**
Expectations/Motivation	3.2	3.15	2.87
Organization, length and timetable	3.1	3.05	2.92
Content and methodology	3.13	3.08	2.85
Teachers	2.88	3.19	3.12

Educational resources	2.82	3.16	2.97
Facilities, technological means , tools	2.84	3.11	3.01
Usefulness	2.81	3.14	2.89
TOTAL MEAN	2.97	3.13	2.95

The variables that have obtained the best results are:

- Teachers: it obtained very high results, especially by the students of UJ with a mean of 3.19 out of 4. In the case of the score was 3.12 out of 4; and from JUST it has obtained a mean of 2.88 out of 4.

- Expectations & motivation: PSUT students have granted 2.87 out of 4; JUST gave a score of 3.2 out of 4; y and UJ scored the highest with a mean of 3.15 out of 4.

The following Figure summarizes these results:

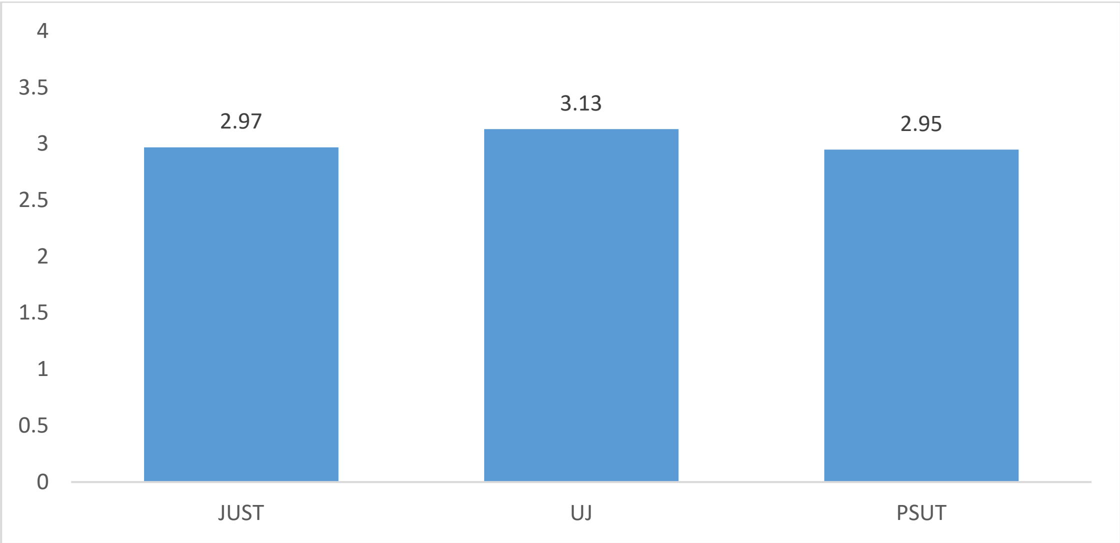

Figure 6 Comparison of means of the courses offered by PSUT-UJ and JUST- Students

According to data on Figure 6, there is no significant difference in the results obtained in the three universities. The highest score was obtained by the courses taught by UJ with a total mean of 3.13 out of 4, followed by the courses of JUST with a mean of 2.97 out of 4, and finally the courses of PSUT with 2.95 out of 4.

The results obtained by the responses of teachers from UJ, PSUT and JUST are detailed in the following table:

Table 2: Mean of the courses offered by PSUT-UJ and JUST- Students

VARIABLES	JUST	UJ	PSUT
Expectations & motivation	3.73	3.47	3.21
Organization, length and timetable	3.45	3.26	3.4
Content & methodology	3.64	3.48	3.25
Teachers	3.25	3.14	3.2
Educational resources	3.76	3.28	3.1
Facilities, technological means , tools	3.35	3.14	3.05
Usefulness	3.82	3.42	2.95
TOTAL MEAN	3.57	3.31	3.17

Table 2, shows that the variables obtaining the best results are:

- Expectations & motivation: teachers of PSUT granted a mean of 3.21 out of 4; in the case of JUST it is 3.73 out of 4; and UJ reached 3.47 out of 4.
- Content and methodology: this variable has been valued in a very positive manner, especially by the teachers of UJ with a mean of 3.48 out of 4; in the case of PSUT, the mean was 3.25 out of 4 and finally JUST has obtained a 3.64 out of 4.

These means are compared in the Figure below:

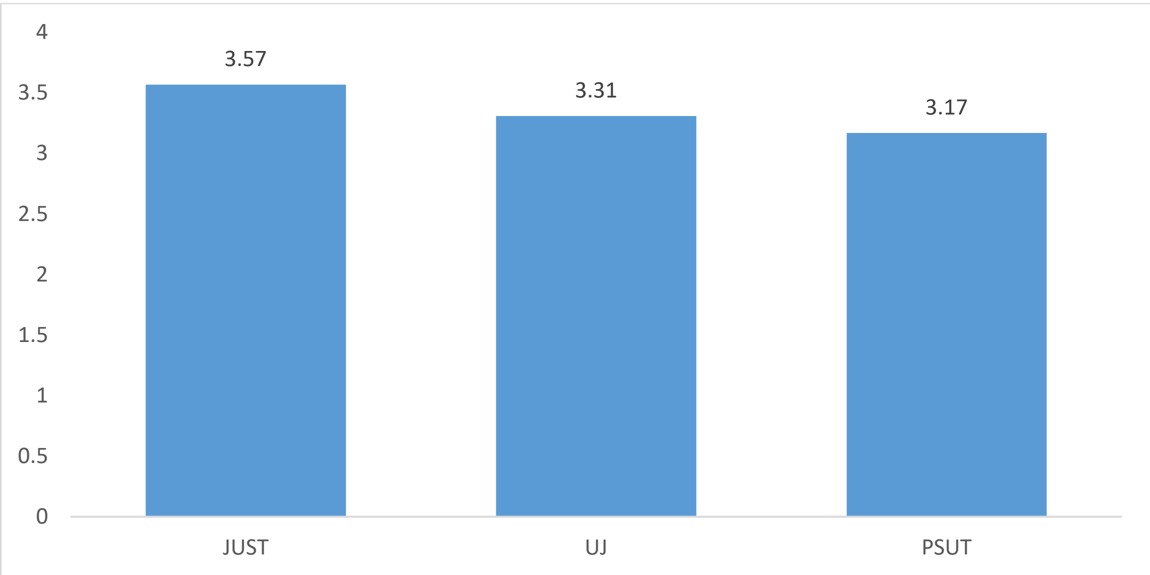

Figure 7 Comparison of means of the courses offered by PSUT-UJ and JUST- Teachers

As seen in Figure 7, the scores granted by teachers are in all cases above 3.1 out of 4. The highest score has been given to JUST with a total mean of 3.57 out of 4, followed by the courses of the UJ with a mean of 3.31 out of 4, and finally PSUT obtaining a mean of a 3.17 out of 4.

5. Conclusions

As detailed in the results obtained, we can say that teachers and students think the courses that use the MDR model have a great educational potential for students involved in this research. As per data, we can say that the respondents consider the courses to be attractive and useful, being a motivating element in the teaching-learning process for this group in particular. The use of mobile devices through the MDR model, which includes the technical part and the pedagogical design, scores high in course design, content/methodology, teachers, usability, tools, educational resources, organization, length and timetable for the teaching and learning process.

The MDR model was designed and planned for it to keep a balance that guaranteed teaching of all subjects while creating learning situations that would encourage the use of strategies and skills, allowing the implementation of knowledge through mobile devices. According to the results obtained, and analyzed in the previous section, this premise has been fulfilled. The results show and reinforce the idea that the courses designed with the MDR model foster motivation among disadvantaged groups and, in turn, promote the development of competences and skills in different areas of educational expertise, while favoring the acquisition of specific competences.

The overall objective of this paper was the evaluation of the quality of the courses that use the MDR model, thus guaranteeing a high quality in the implementation and analysis of the model. According to data collected users confirm that the courses that use the MDR model proposed in the mEQUITY project has been very favorable. In general, data shows that users (teachers and students) are satisfied with the system obtaining in all cases a score above 3 on a scale of 4.

According to the answers of students we can verify that the means obtained in all the universities are very similar. The highest score was obtained by the courses taught in UJ with a total mean of 3.13 out of 4, followed by the courses of JUST with a mean of 2.97 out of 4, and finally the courses of PSUT have obtained a mean of 2.95 out of 4. On the other hand scores given by teachers are very high as well, with total means that in all cases are above 3.1 out of 4. The highest score has been obtained by the courses taught by JUST with a total mean of 3.57 out of 4, followed by the evaluation received by UJ courses with a mean of 3.31 out of 4, and finally the courses of PSUT have obtained a mean of 3.17 out of 4.

In conclusion, the courses that use the system MDR are designed to favor students' learning, foster their interest and thus contribute to increasing performance of students. We can say that a coherent and suitable pedagogical design of the programs is basic for creating knowledge among students, thus favoring high quality learning. It is also essential that the pedagogical design assists on the development of effective learning strategies, elements that have been taken into account in this model and that the respondents have valued very highly.

6. Acknowledgements

The authors acknowledge the support of UNED´s School of Industrial Engineering, especially for the financing of the e-learning research project through the 2017 Call for Aid to support teaching and research activities in the different departments of the School, and the UNED School of Education as well as the European project mEquity (Improving Higher Education Quality in Jordan using Mobile Technologies for Better Integration of Disadvantaged Groups to Socio-economic Diversity), Erasmus+ Capacity Building in Higher Education 2015 nº 561527-EPP-1-2015-1-BG-EPPKA2-CBHE-JP.

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Research on MOOC's Progress in Lithuania

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Abstract
In Lithuania MOOC's are quite new, so it is important to identify trends and patterns. In this context, the aim of this study is to provide a MOOC research in Lithuania for 2018 and to find out the needs of institutions to identify barriers for developing MOOCs and to make conclusions with the suggestion of regulations which often affect adversely the willingness of organizations to deliver MOOCs. The research methodology was implemented by analysing generated data on MOOC's delivery in Lithuania. Results revealed that the biggest number of institutions have not decided whether to implement MOOC's in the future or not. Also, a great number of institutions is planning to add MOOC's. Just one institution of all questioned has MOOC's but already [5]. the number of institutions which are offering MOOC's decreased but the number of institutions that are planning to add MOOC's increased almost twice as much as was before. However, in 2018 almost all institutions revealed that in their opinion, MOOC's are a sustainable method for offering courses.

Keywords: Open learning; Massive Open Online Courses; Research trends; Lithuania

1. Introduction

The basic definition on MOOC's states that MOOC's are „online courses designed for a large number of participants that can be accessed by anyone anywhere as long as they have an internet connection, are open to everyone without entry qualifications, and offer a full/complete course experience online for free“ [2]. The first MOOC was introduced in 2008 by Dave Cormier. This course was designed for 25 students who were paying fees and getting certificates, as a result, 2,300 people have participated in the course online without paying fees. MOOC's now get a lot of attention in higher education institutions. The main aim of the MOOC's was to provide university-level education for so many students as possible [5]. Open courses were popular earlier than the researchers started to analyze the benefits or disadvantages of them. The research on MOOC's trends revealed that the number of researches on MOOC's started to increase just in late 2013 [1].

MOOC's entry into the HE system is changing the whole content and **structure of courses and study** programmes. Also, it is helping for HE institutions to cooperate with each other [3]. During a lot of discussions and seminars, openness and scalability were always highlighted as the main reasons why MOOC's should be provided [4].

However, researches on MOOC's in Lithuania are not so popular. There are just several of them. Of course, it can be explained by the fact that the definition of massive open online courses is quite new and just starting to gain popularity.

The main issue why many higher education institutions in Lithuania are interested but do not take any actions towards the creation of massive open online courses is that they have almost no experience in providing massive open online courses [12]. This issue creates additional challenges to institutions such as a lack of technological and pedagogical support, teachers' readiness to provide manage MOOCs, also, the traditional attitude to learning. It also requires some deep preparation: knowledge how to create, provide and manage learners and learning process, how to set up technological resources for a big number of external students, how to solve unexpected problems and how to keep up learners' motivation during the learning process. However, those challenges pay back the experience gained by providing one MOOC at least.

Analysing MOOCs provided by the Kaunas University of Technology, Lithuanian MOOCs, as well as international, enrich the learning content by including many open online resources that help to make a MOOC more attractive, more reachable and, most importantly, free for learners. Also, to keep learners motivated and interested, interactivity is a must in the massive open online course [12]. The learning material must be interactive, attractive and relevant. Also, it is important to keep in mind that learners might have different levels of knowledge in the field, to eliminate this problem, the content should be segregated by the level of knowledge [12].

Methodology

The research is based on the survey about MOOC's in higher education institutions in Lithuania. The survey was sent to the HE via email (17 HE in total). Respondents were asked to answer 56 multiple choice questions. The answers were collected and analyzed. In this research paper, the main aspects will be analyzed and reviewed.

2. Literature review

Going through a lot of different authors' researches, the common thing is that all of the authors are asking almost the same questions and trying to provide the appropriate hypotheses. These questions usually are: can MOOC's provide not that expensive education than going to universities or colleges? Will MOOC's will be so popular and disruptive that eventually will change the traditional education methods [6]? There are a lot of different opinions when talking about MOOC's. One says that MOOC's are the future of education and the others - the opposite. One of the main things which were highlighted talking about MOOC's as the future of education, self-autonomy [7]. Students may work at their own pace and learn responsibility [8]. The authors said that students lack these skills because, in the traditional education system, they are taught to adapt. Others say that this type of learning would do more harm than benefits provided. In the authors' opinion, the free autonomous learning that is flexible for students does not motivate them to learn appropriately [9]. According to the statistics, approximately, just 10% of students finish the courses on MOOC's [10]. However, a lot of tutors, course creators and researchers claims that MOOC's are not the same as traditional education and just a very small part of them enrol in courses for the degree. Following from that, they stated that as the MOOC's differ from traditional education, completion rate cannot be significant [11; 14].

Looking from the higher institutions point of view, the biggest motivation for MOOC's implementation was described as reputation not only in that MOOC subject but in the whole online learning platform [14]. Other institutions are afraid of the changed education system after the MOOC's implementation but they understand that living in the technology age, MOOC's will be some kind of necessity [16]. All in all, after the investigation of the previous researches, there is no correct opinion. Obvious that MOOC's have advantages and disadvantages. However, there were no authors who were claiming that MOOC's are not going to interact with the traditional learning system.

3. Results of the research on MOOC's in HE in Lithuania

The situation on MOOC's is pretty clear when analysing the world or Europe. However, as it was mentioned before, the situation in Lithuania was barely analyzed or actually, just was started to analyze in 2015. In this part of the paper, the authors have provided the main aspects of the gathered results from the 17 higher education institutions in Lithuania.

The first question was related to the identification of the higher education institutions positions on MOOC's. Results revealed that from the 17 institutions, just 12% already has MOOC's. Another 12% of HE's claimed that MOOC's will not be added into their courses and 76% of HE's institutions said that they are planning to add MOOC's (7 HE's) or has not yet decided (6 HE's). The results reveal that the situation is better in 2018 than it was in 2016. During the period of two years, one more institution added MOOC's and fewer institutions said that they will not be adding MOOCs. These numbers show the progress in the area of MOOC's implementation. The authors have forecasted that the situation should be better in the future.

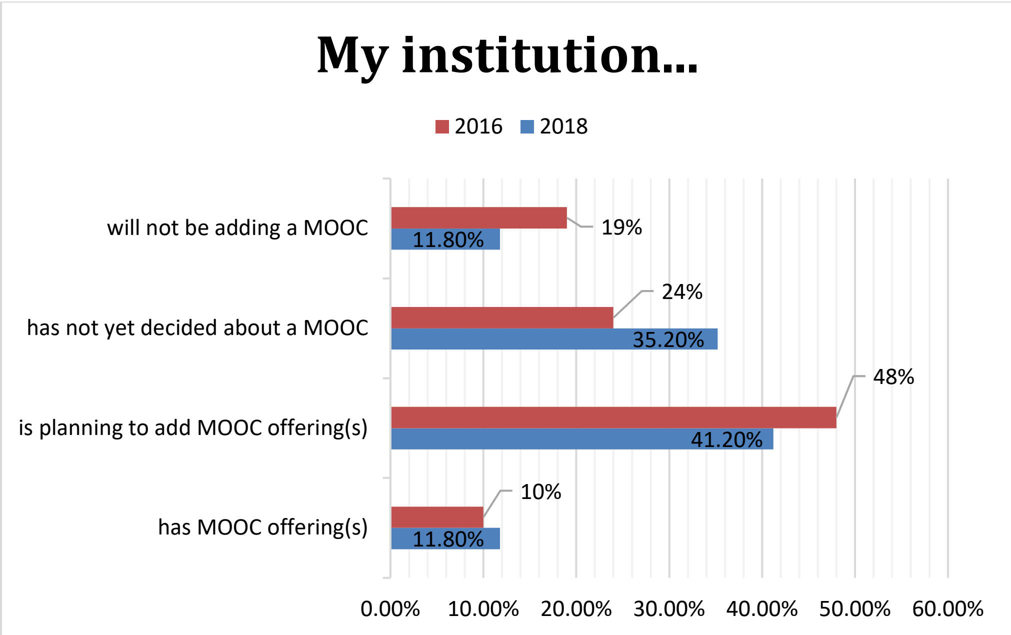

Figure 1: Institutional profile in their MOOC offering for this survey in comparison with previous survey (S 2016 Lithuania)

The second question revealed the view of HE's to MOOC's. In the whole world prevalent definition of MOOC's states that they are for everyone. This question (Figure 2) shows the opinion of HE's in Lithuania. Results revealed that the biggest part of the respondents agree with the main definition of MOOC's and say that they should be used by everyone, not specific target groups (47% HE's). Also, there was a big part of the respondents (29,4%) who said that MOOC's should be used by further education students and etc. 11,7% have stated that MOOC's would be used the best by part-time students and the same number of respondents believe that students from other universities are the main target group for MOOC's. To sum up the results, it is clear than in Lithuania a lot of HE's are getting closer to the MOOC's definition and its meaning. When reviewing the statistics from the previous year, it is obvious that HE institutions stick to the same answer. It means that MOOC's are not losing their position.

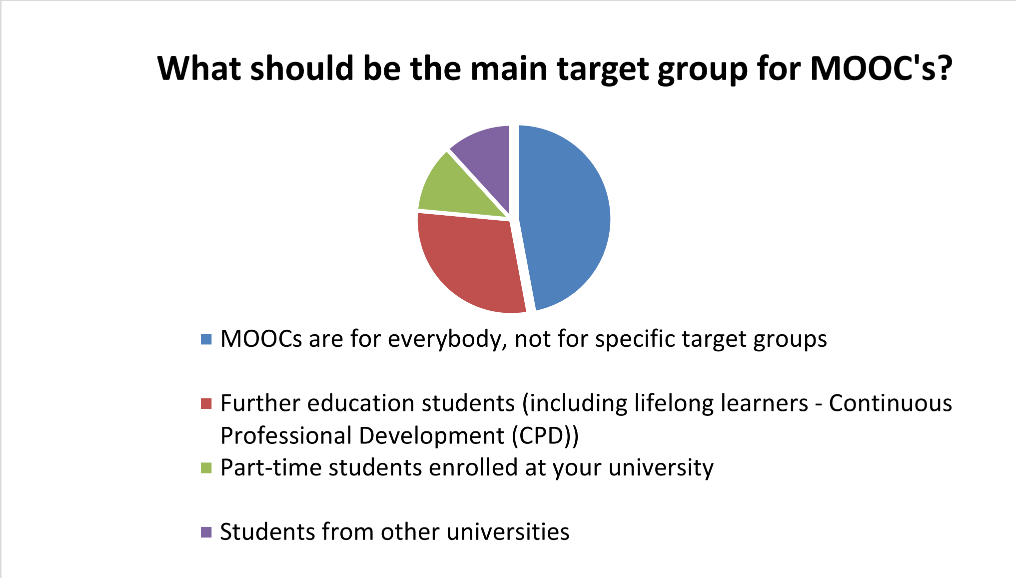

Figure 2: What should be the main target group for MOOCs?

The next statement claims that the MOOC's are a sustainable method for offering courses. As it is seen from the graph below, the biggest number of the respondents agree that MOOC's are a sustainable method. A smaller part of the respondents (35%) claimed that they do not have one clear opinion for this statement. 0 institutions out of 17, provided the answer that MOOC's are not a sustainable method. In the status report for 2015-2016 "MOOC Strategies of Higher Education Institutions in Lithuania", the clear tendency is that in 2016 HE's less affirmative about MOOC's sustainability than in 2015. The same tendency may be seen in 2018. In this year, HE's are hesitating if MOOC's are a sustainable method for learning but none of the institutions said that it is clearly not.

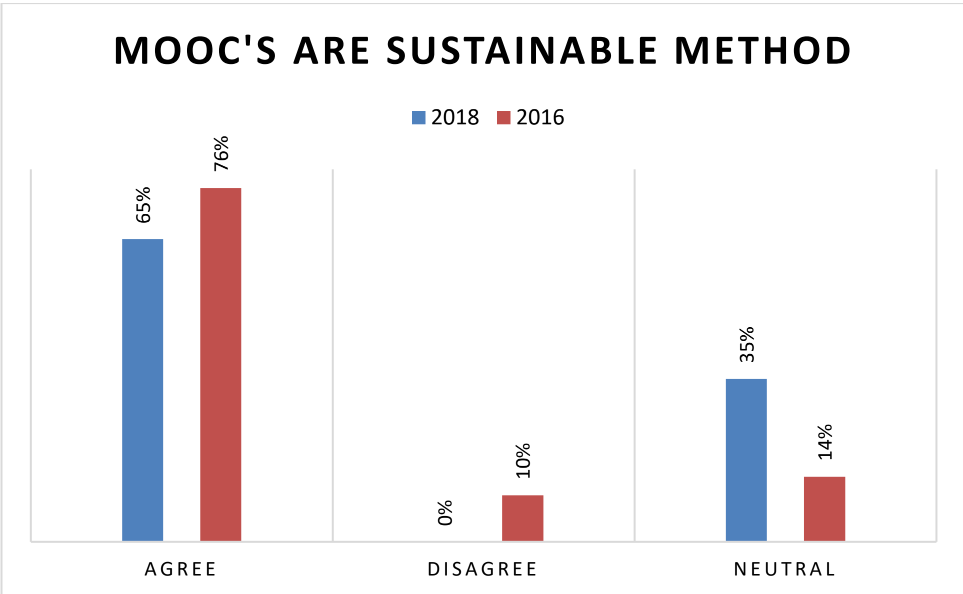

Figure 3: Replies to the question "MOOCs are a sustainable method for offering courses" in comparison with previous survey (S 2016 Lithuania)

This question regards to the institutional objectives of Lithuania institutions with regard to MOOCs. As shown in Figure 4 almost half of the respondents (41%) replied that it is too early to tell if MOOCs meet institution's goals. Only 6% stated that MOOCs meet most or all their institution‘s objectives, 35% found that MOOCs meet some of the institutional objectives.18% reported that MOOCs meet very few institution‘s objectives. When results are compared to a research of 2016 it is clear that respondents’ approach has increased on the matter of MOOCs meeting institution’s objectives. In 2016 the opinion on how well MOOCs are meeting institution’s objectives was divided between opinions that it is too early to tell (52%) and others that MOOC’s are meeting just some of the objectives (29%).

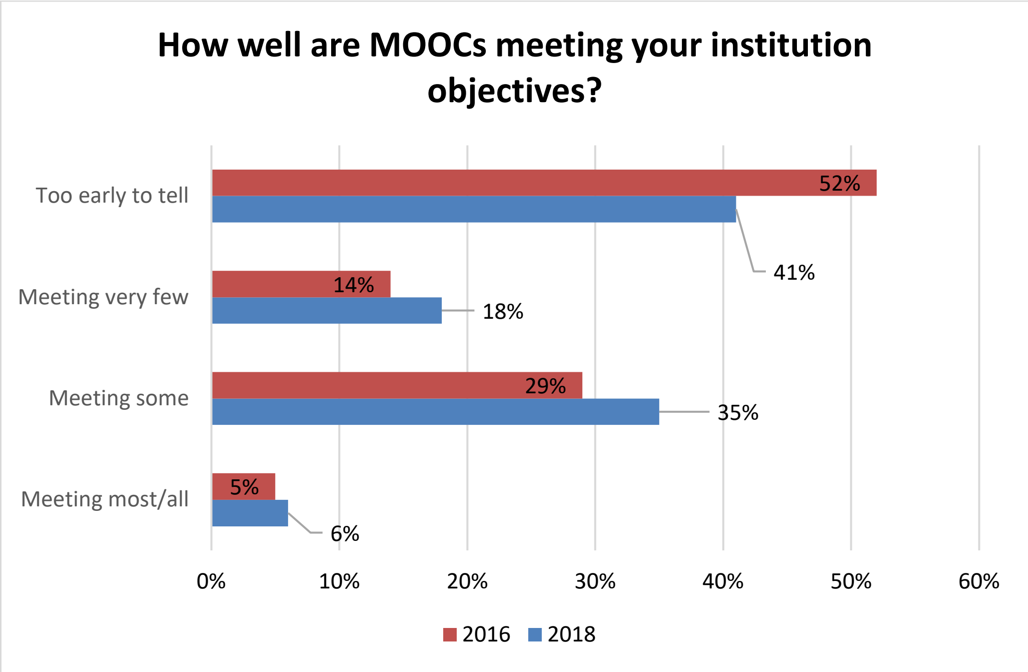

Figure 4: Replies to the question “How well are MOOCs meeting institution’s objectives?” in comparison with previous survey (S 2016 Lithuania)

According to the results of a survey, the primary objective of offering MOOCs is flexible learning opportunities (28%) (see Figure 5). 18% respondents excluded increase institution visibility and 24% seen innovative pedagogy as the most important primary objective. Remaining respondents replied that MOOC’s can help to reach new students (18%) and maybe as a supplement on-campus (6%). Also, 6% of respondents claimed that MOOC’s can help to drive student’s recruitment. Those were the main reasons to offer MOOCs in 2018. Respondents of the S 2016 (Lithuania) reported that the most important objective or MOOCs is also a flexible learning (33%), increased visibility of institution and innovative pedagogy bot get 24% of votes from respondents. 14% of the respondents from HE’s answered that the primary objective of MOOC’s is to reach new students and engage them in learning. The objective which got just 5% of the votes was to learn about scaling.

To sum up, the current data shows that the approach of respondents has not almost shifted. The main objective still remains flexible learning. Also, for HE’s is still important to reach new students, increase institutions visibility and learn with the methods of innovative pedagogy.

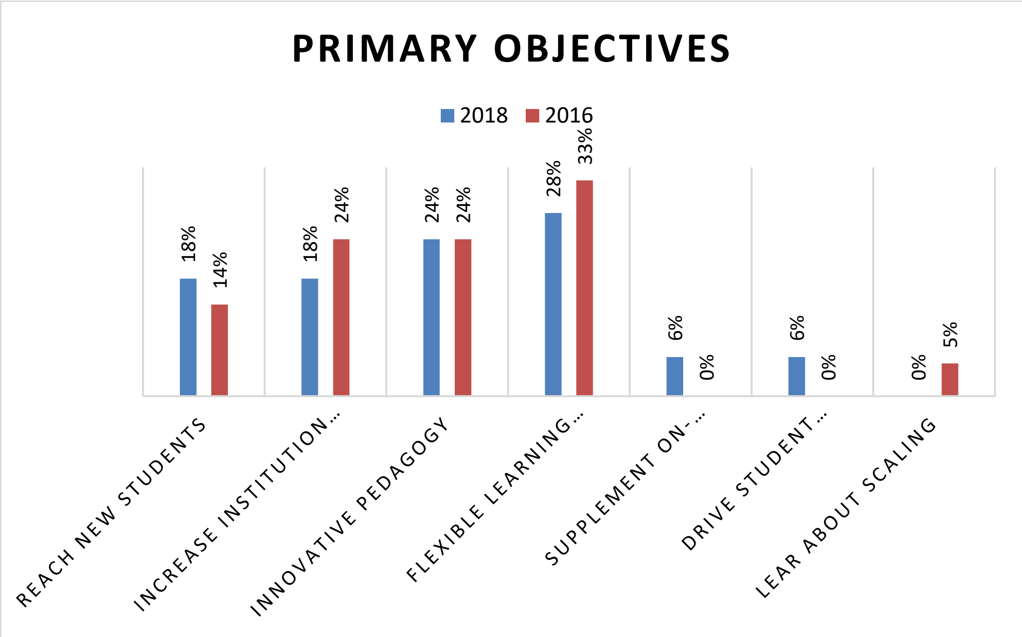

Figure 5: Primary objectives to offer a MOOC (S 2018 Lithuania) in comparison with responses from previous survey (S 2016 Lithuania)

Next question (see Figure 6) of the survey was related to the evaluation of the extent to which MOOCs are important for institutions to learn about online-based education. Respondents from Lithuanian institutions strongly agreed (65% of respondents) to the statement. 35% were neutral and none of the respondents believed that MOOCs were negative towards using MOOC to learn about online pedagogy. The attitude towards the importance of MOOCs in order to learn about online pedagogy has changed a little bit. In 2016, participants expressed more (76%) agreement on the topic, furthermore, 10% of respondents answered that they do not consider MOOCs to be needful for learning online pedagogy and 14% said that they still do not know if MOOC's are important or not.

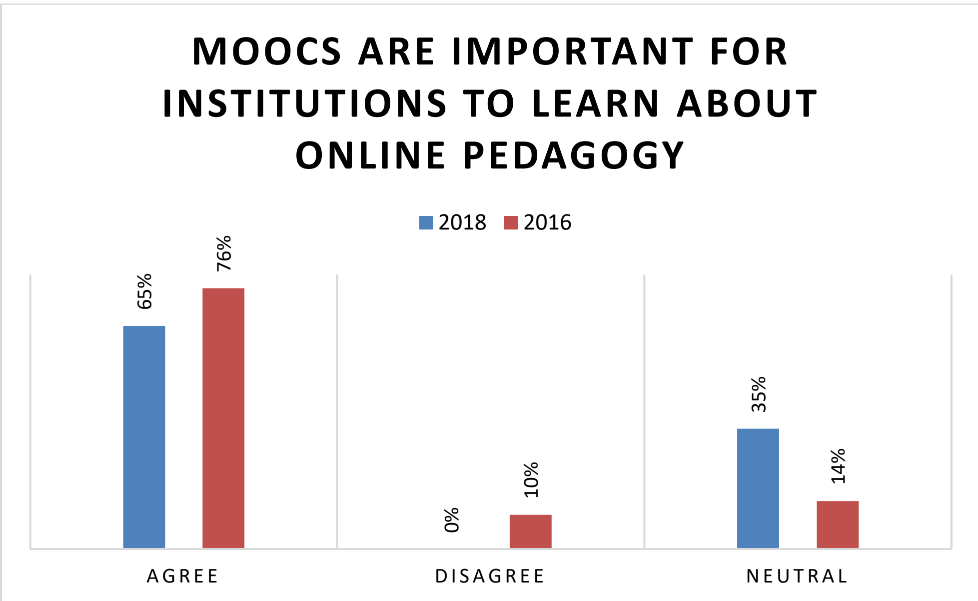

Figure 6: Replies to question "MOOCs are important for institutions to learn about online pedagogy" in comparison with previous survey (S 2016 Lithuania)

To sum up, fewer respondents believe that MOOC's are important for institutions to learn about online pedagogy but none of the respondents thinks that it is unnecessary. It seems like a good sign for the future perspective of MOOC's.

4. Conclusions

All in all, the research showed that HE institutions in Lithuania stay with the same opinion that MOOC's should be provided for all people, not depending on whether he's a student or not. The opinion about the MOOC's usability did not change since 2015 [13]. However, the sustainability of MOOC's still remains the question. The agreement that MOOC's are a sustainable method decreased during the two years.

The main findings of the research showed that Lithuanian HEIs are in the planning stage of MOOCs or still have not decided about it. Also, it is important to underline that comparing with the results brought up in 2016, more institutions offer MOOCs. This number shows the increased interest in providing MOOCs and its' consideration as a possible development area. Also, the biggest share of HE institutions agrees (65%) that MOOCs are an important factor to learn online pedagogy. However, the percentage of total agreement is decreasing and the neutral position is taking over.

Another interesting finding is that institutions do not change their primary objectives for MOOC provision. As the results of research conducted in 2018, showed that the institution declares the most important objectives almost the same while providing a MOOC in 2016. Those are increased institution MOOC Strategies of Higher Education Institutions in Lithuania visibility, use of innovative pedagogy, provision of flexible learning opportunities and reach new students. This shows that institutions still have complex objectives for MOOC delivery which correlates with the benefit and the experience they will get in the future.

Finally, MOOCs are shaping the higher education in Lithuania and more and more institutions who are willing to adapt become strong and competitive are trying to adapt MOOCs to their education systems in HE's. When comparing the results from 2016 to the results from 2018, it may be seen that the progress exists. There are fewer people who strongly disagree with MOOC's existence and appropriateness in the Lithuanian education system.

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Student’s Virtual Erasmus Exchange Program

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Abstract

We present an ambitious international project, the Short Virtual International Program (S-VIP), which has an important innovation dimension as a result of the design of the proposed courses as well as for the real prospects that offers to students at international level.

The significant evolution of the online and/or blended education offers now new possibilities to all universities at European level. Our project aims to propose a new format for the Students’ mobility and for the Erasmus program to our students. By analogy with the Erasmus exchange for on-campus training, S-VIP offers a virtual exchange via online teaching. Students taking online training at a partner university will obtain accreditation for a limited number of ECTS (European Credit Transfer and Accumulation System). We started our program with a consortium of European universities by accepting the virtual exchange of our students who wish to follow courses abroad and by including our partner’s students to our online courses. At the same time, and within our project we developed a close collaboration within the European League of Research Universities (LERU) with Leiden and Milan Universities.

Keywords: Virtual exchange, mooc, spoc, eve, s-vip, leru, accreditation, ects, online teaching, distance learning, online education, virtual mobility, e-learning

1. An innovating international dimension project

Sorbonne University today boasts an important experience in online teaching with its ODL (Online and Distance Learning) department and the creation of a large number of online courses for its students. Our university, since 2015 has been developing SPOCs (Small Private Online Courses) [1] for its first year of studies at the Bachelor of Science and Technology and for the Master's degree as well as MOOCS (Massive Open Online Course) on science, medicine and humanities.

The Virtual International program aims to highlight two major subjects, the virtual exchanges [2] and the accreditation. Sorbonne University started its experiment by joining EVE (European Virtual Exchange), a pilot project associating other European universities and providing experience in allowing the virtual mobility for their students via online teaching and the sharing of credits within partner universities [3]. It is an ambitious program that propose several organizational and pedagogical challenges.

In parallel with the EVE consortium we developed a second partnership with several LERU universities for the creation of a LERU virtual exchange program in the near future under the LERU brand. Today several other universities declare their interest and work for joining the LERU consortium.

2. Online education (SPOCs) at Sorbonne University

Today, Sorbonne University is able to offer a complete ecosystem of online courses. A significant number of SPOCs, complete blended courses, are already available on physics mathematics, chemistry, electronics and mechanics for the first year of Bachelor's degree and for the 3rd year students on thermodynamics and quantum physics. Two courses at master's level on mathematics are also offered on Basic Functional analysis.

In order to renew teaching resources and course design, this pedagogical framework was designed as equivalent to the on campus one and proposes the same number of ECTS (either the course is taken as a face to face –classical module or online) [4]. SPOCs bring together many multimedia resources that implement the chosen teaching strategies for a better understanding of scientific concepts, a reduction in dropout rates and cohesion among students. Each course contains written materials, such as conference notes and manuals, as well as knowledge clips explaining some of the theoretical or methodological aspects of the course [5]. Several activities that promote an efficient learning are proposed through our Moodle platform allowing students to exchange, discuss, collaborate, acquire, evaluate and carry out formative self-evaluations. The students are also accompanied by tutoring with organized virtual classes.

Besides SPOCs, our university proposes courses in a MOOCs format (Concurrent programming for the 3rd year of Bachelor, IOS programming for the 2nd year of Master Degree) that follow the on-campus teaching in terms of length and programmed period [6].

Today we implement measurements that will allow us to have a more detailed image of the behaviour of the students and the impact of this blended disposals. The first returns done on the population of the Online and Distance Learning department seem promising while we observe an augmentation of the students that validated their courses. This study is still in progress and will be presented later in a different paper.

3. Virtual exchange program through online education

Online education presents a great advantage for the students. They can benefit from the flexibility and independence distance learning can offer them. They can follow the courses according to their rhythm but still keep a synchronous progression with the on campus students for the handiworks and the final exams.

Thanks to the Virtual exchange program students can go further on their choice of online courses. This project can contribute to a concrete effort of increasing the students' mobility program. Students, without moving geographically can follow online courses from different foreign universities. How does it work?

Each university participating at the program prepares and proposes to the partners elective courses online. The Host University (the creator of the course) will be responsible for the online tutoring of the student during the course (semester), prepares the exams subjects and the assessments. The Home University (were the student is) will be responsible for the proctoring. The obtained credits at the host institution will be transferred to the home institution and translated to its own grading reference.

Students have consequently the opportunity to experience an innovative exchange for some elective courses they wish to follow online simultaneously with the on campus students and obtain, if they succeed, the corresponding ECTS for each course.

It is important to highlight that the possible number of validated ECTS through the virtual exchange program remains limited. The real number of ECTS that can be taken through the virtual exchange program is explicitly defined by the university and/or each scientific department.

During the academic year 2017-2018, first year Sorbonne University joint the EVE consortium there were 12 teaching units proposed globally from all the partners for the first semester and for the second semester an offer of 28 courses while there were more than 200 students' exchanges in total. Altogether 35 students succeed to their exams and validated to their home university the equivalent ECTS. For our university one student followed 3 courses abroad and validated all the exams. Two foreign students followed our programming course without passing the final exams.

On September 2018, for the first semester Sorbonne University sustaining the S-VIP program allowed 28 students to follow courses abroad that can be validated afterwards on their curriculum, meaning a substantial increase of outgoing student for the second year of this pilot program.

3.1 Further advantages for the students

By choosing courses from a growing and diverse collection of online courses proposed from leading European universities, students enrich their portfolio and develop different soft skills. They get to know diverse learning experiences, work online using multiple format contents, meet different types of learning activities proposed from the partner universities.

They also have opportunities for maximizing their learning and skills through important and enhancing intercultural exchanges [7]. Furthermore, the students, Erasmus students as well as the on campus students that follow the course, have great opportunities to interact and practice in a foreign language. Working in such environment facilitates the improvement of the multilinguistic competencies of their own field of studies that constitutes a great advantage for the professional development.

4. Institutions Perspective

The elective courses prepared by each partner will be proposed to the Partners' students following the principle of Erasmus programs. Each partner will be able to choose within the suggested catalogue of courses from every institution of the consortium and promote the selected courses to their students.

The chosen modules are validated in the curriculum of each student. Likewise, Sorbonne University added several elective courses to its proposals. This selection of courses is a delicate procedure as the coherence of each student curriculum must be guaranteed as well the pertinence of the competences to achieve. So each student candidature for joining the virtual exchange program and follow an elective abroad has to be validated from his studies' department.

Likewise, the practical and logistical management of such program reveals some difficulties, such as the management of the administrative and pedagogical procedures of inscription that varies for each university partner, the respect of the data privacy of the students, the modalities of information exchange and general management of the students that follow courses abroad.

4.1 Further benefits for the universities

This program gives the opportunity to each university that participates to enlarge its experience of online teaching units responding to a real need of the students. It is a new form of collaboration between the partner universities. Furthermore this common project allows the promotion of the world-class academic expertise fields of each university and consequently increasing its visibility.

It also permits the reinforcement of the global offer of online education with MOOCs and SPOCs. For the universities there is equally the possibility to gain mutually and enrich their competences by the top know-how domains and cultural diversity of each partner.

5. Conclusions

Short Virtual Internationalisation Program is the outcome of a long evolution of the online education and the will of different European institutions to collaborate and build a common innovating pedagogical project. Virtual exchange program inspired a number of world-class universities to get engaged in a consortium and propose selected courses to their partners as the number of proposed electives indicates. S-VIP is a complete project of virtual exchange via online education using especially SPOCs. Courses on digital format solidly integrated at the pedagogical offer of each university allow the acquisition of accreditation for a limited amount of ECTS. This program motivated the teaching teams of the courses mentioned above to work actively for the preparation of high quality educational resources. The prepared teaching material will be proposed for the on-campus and online courses participating at the global project to renew the teaching and learning offer of our university. Students will equally appreciate the advantages of the online teaching and the possibility of credit transfer besides the broader choice of courses proposed by world-class experts.

As part of the European policy that places mobility among its priorities, Sorbonne University works to offer its students significant international mobility possibilities, enabling its students to develop an international network, extremely important in their further professional career.

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The interaction between teacher educators and their students on the use of educational technology: Similarities and differences of attitudes, skills, and practice across a generational change

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Abstract
Norway has been exposed to a stronger top-down implementation of ICT in education than most other countries. The pervasive change in Norwegian school curriculum has consequently resulted in changes in Norwegian initial teacher education. National plans have emphasized digital competence as one of the basic competencies that teacher educators and student teachers are required to focus on during their initial teacher education. Teacher education has a double role in digitally rich classrooms; it develops both student teachers' professional skills and the students' ability to facilitate pupils' learning. Despite the political effort, it seems that practitioners in the Norwegian education system are not working in line with the given policy, and it appears to be a gap between what is stated in the curricula and what practitioners are doing.
This gap is often explained by practitioners' deficiency and/or lack of interest. To understand these relations better, and to help us predict the future use of educational technology in our schools, we have conducted a quantitative comparative study between teacher educators in Northern Norway and their students (N=112). It appears from the analysis that among the staff the professional attitudes have a stronger impact than digital competence regarding the extent of educational use of digital tools, while digital competence has a stronger influence than attitudes among the students. These results are interpreted through Argyris & Schön's *Theory of Action*.

Keywords: teacher education, digital attitude, digital literacy, teachers professional digital competence.

1. Introduction

Information and communication technology (ICT) in education has for many years been an important area of focus in many countries. The ongoing changes of school curriculum have resulted in several changes in initial teacher education in Norway, where digital competence (DC) is officially formulated as the fifth basic skill for all subjects at all levels of school. The government White Paper No. 11 (MER, 2008) has emphasised DC as one of the basic competencies that teacher educators and teacher students are required to focus on during their initial teacher education. This change in both school curriculum and in the general plan for initial teacher education has in effect changed the underlying premise for teaching and learning in Norwegian teacher education programmes (Krumsvik, 2014). This article studies the impact of such a pervasive strategy, by presenting a comparative exploration of teacher educators and their students at a Norwegian university (University of Tromsø, UiT).

There has already been much research on the use of digital tools in education in Norway, from primary to higher education. Looking at these surveys, we seem to move very slowly towards the described intentions regarding the use of digital tools. Nevertheless, a great gap between the political intentions and what is done in practise in higher education still exists (Ørnes et al., 2011; Tømte & Olsen, 2013). Much of the mentioned research is focused on the fact that such a gap between political intentions/curricula and educational practise of higher education exists. The Norwegian University Monitor, Digital State 2011, concludes that the use of digital tools mainly supports traditional teaching, and there is a potential for better utilizing the opportunities provided by the technology (Ørnes et al., 2011, p. 199). It is explained in the same report that professionals emphasize professional reasons for why they use digital tools in teaching, but professional reasons for *not* using digital tools are mostly out of focus in the surveys.

Some recent research shows that students who often use computers or smartphones have a tendency to do worse when compared with students who use less of such tools in educational contexts (Beland & Murphy, 2015; Carter, Greenberg & Walker, 2016; Elstad, 2016; OECD, 2010). Mueller and Oppenheimer (2014) conducted a study in which they concluded that the use of laptop negatively affected the students testresults. This study focused on the student's use of laptop instead of pen when taking notes during lectures. They raise the question whether laptop in classrooms does more harm than good. They argue that note taking by hand calls for other cognitive processes, than writing on a laptop. Elstad (2016) writes that the general formational effect of education provides the requisite cognitive qualities for understanding. One can write faster on a laptop, and take more notes. "Although more notes are beneficial, at least to a point, if the notes are taken indiscriminately or by mindlessly transcribing content, as is more likely the case on a laptop than when notes are taken longhand, the benefit disappears" (Mueller and Oppenheimer, 2014, p. 1166). To write by hand is slower and one cannot take verbatim notes in the same way as with a laptop. Instead, students listen, digest, and summarize so that they can succinctly capture the essence of the information. "Thus, taking notes by hand forces the brain to engage in some heavy "mental lifting," and these efforts foster comprehension and retention" (May, 2014). As May points out "even when technology allows us to do more in less time, it does not always foster learning".

Several Norwegian studies have also particularly examined how DC is integrated into *teacher education* (Krumsvik, 2011; Lund et al., 2014; Instefjord & Munthe, 2016). These studies report insufficient digital competence among teacher educators and that use of digital tools in teacher education is less frequent and less developed than in schools. Insufficient skills or interest among teacher educators may constantly be a main obstacle for the integration of digital tools. In Monitor School 2013, teacher education is described as institutions with limited professional profile in the digital domain (Hatlevik et al., 2013, p. 32). What is repeatedly observed in such surveys is that digital tools are not used satisfactorily, compared to the formal intentions (Enochsson & Rizza, 2009). A further conclusion to be drawn from this is that the academic staff does not have sufficient DC. Lack of DC may be *one* explanation of the difference between the management documents and educational practice, but are there also differences based on pedagogical theories, opinions and experiences?

Having this as background, the present study aims to contribute to the ongoing research by applying the 'Theory of Action' approach by Argyris and Schön (1978) for a closer inspection of the teacher education as performed at UiT in Northern Norway. This article is part of a research project aimed to elaborate further the understanding of the established gap between policies and the use of digital technology in Norway. To understand this gap we have conducted a comparative study between teacher educators in Norway and teacher students in the 4th year of their master program. Teacher education is of special interest as it has a double role in relation to DC: it develops both teacher student's professional skills *and* their expertise in facilitating pupils' learning. A teacher educator who uses digital tools for the enhancement of the learning process of the students also shows students at the same time how digital tools can be used in primary and secondary education (Drent & Meelissen, 2008; Engen, Giéver & Mifsud, 2015). Moreover, creating good-quality teacher education in the digital arena has many facets, which takes into account the needs of the student, school, and current curricula to prepare students for their future work as teachers.

2. Method

2.1 Theoretical framework

Our study is based on the *'Theory of Action'* by Argyris and Schön (1978), an approach beginning with defining a concept of human beings as designers of action (Argyris, 1992). *Theory of action* is the "mechanisms" by which we link our thoughts with our actions. The theory is a theoretical framework, which offers an analytical distinction between 'espoused theory' and 'theory in use' (Argyris & Schön, 1996). 'Espoused theory' is defined as being the theory of action that is framed to explain or justify a given pattern of activity. In other words, espoused theory can be understood as the individual's or the organization's *attitudes* towards practices (Argyris & Schön, 1996). 'Theory in use' is described as the theory of action that is implicit in the performance of that pattern of activity, in other words, practical action of *competence*. As described by Argyris and Schön (1996, p. 14) organizational theory-in-use may be tacit rather than explicit. Tacit theories-in-use may not match the organization's espoused theory. An organization's formal documents, such as policy statements or work descriptions, will often contain espoused theories of action inconsistent with the organization's actual pattern of activity (Argyris & Schön, 1996). According to Argyris (1992, p. 216), these general theories of action determine all deliberate human behaviour. The mechanisms can occur both consciously and subconsciously, it may therefore be challenging to determine the discrepancy between your 'espoused theory' and 'theory in use'.

A central and comprehensive theme in Argyris and Schön's learning theory is the link between learning, change and resistance to change. It outlines two models – Model I (Single-Loop Learning Processes) and Model II (Double-Loop Learning Processes) to highlight the potential for organizational learning.

Single-loop learning processes involve following the routines and some sort of a preset plan – both less risky for the individual and the organization, and affords greater control. It may also be characterized as technical way of thinking. Single-loop learning seems to be present when goals, values, frameworks and, strategies are taken for granted, with only minor updates. The emphasis is on techniques and making techniques more efficient. Any reflection is directed toward making the strategy more effective.

Double-loop learning processes is more creative and reflexive, and involves consideration notions about what is good. Reflection here is more fundamental: the basic assumptions behind ideas or policies are confronted, hypotheses are publicly tested, processes are challenging not self-seeking, and has an organizational goal. The governing aim includes valid information and internal commitment. Double-loop learning involves questioning the role of the framing and learning systems that underlie actual goals and strategies. See Argyris & Schön (1978; 1996) and Argyris (1992).

Theory in use

To gain insight into the respondents' theories in use, both academic staff and students were asked about the extent of their use of different digital technologies when teaching. A theoretical approach was also applied to construct statements for the questionnaire based on the term 'digital competence'. This term was operationalised by using definitions by Tømte and Olsen (2013) and Lund, Furberg, Bakken, and Engelien (2014). In accordance with their definition, the focus was on three defined aspects of digital competence: pedagogic and didactic understanding, subject-specific understanding, and technological understanding. This definition of digital competence was chosen because recent literature is generally in agreement regarding this categorical understanding of digital competence (Lund et al., 2014; Tømte & Olsen, 2013). 'Digital literacy' is also a term in common use, as many overlapping and complex terms in this field of research (Beck & Øgrim, 2009; Instefjord & Munthe, 2016; Thorvaldsen et al., 2011). It is hard to translate 'literacy' to Norwegian. The surveys are therefore based on the term 'digital competence' (digital kompetanse), to secure the comparative element in the study.

Espoused theory

To gain understanding of teacher educator and student attitudes (their espoused theories), statements were prepared, based on the OECD report 'Connected Minds: Technology and Today's Learners' (2012) and its description of the field's existing attitudes towards technology. In the report, the field is characterised by a continuum, from being technology averse to being technology positive. To include this span of attitudes, statements were prepared to identify the respondents' own motivations for using digital tools, the respondents' attitudes towards digital tools' position in the public arena, and their attitudes towards the use of digital tools in teaching.

2.2 Design and participants

The study was designed as a cross-sectional study starting with the academic staff at the Department of Education at UiT in spring 2015, with a follow up of their students three years later to be able to observe the influence of the educational process.

We conducted the survey of the academic staff at all teacher education programs at the Department of Education at the University of Tromsø. This includes preschool teacher education, integrated master in teacher education 1-7, integrated master in teacher education 5-10, integrated master in teacher education 8-13 and practical pedagogical education. Teachers from UiT presented a selection of 80 participants, where 67 participants responded to a questionnaire survey. This implies a response rate of 83.8%. We eliminated all who were mainly administrative staff, and employees who had less than 30% teaching in the past year. Data included in this survey is associated with the remaining 64 respondents. This group of respondents constitutes the target group, namely professional staff at teacher education, with 30% education or more. The student group included all 4th year master students in teacher education 1-7 (UiT, 2016a), and 5-10 (UiT, 2016b), with response from 48 of 61. This implies a response rate of 78.7%.

There were 57.8% females among the staff, and 66.7% among the students. The majority of the academic staff were above 45 years of age, while the majority of the students were 25 years or less (range 23-31 years). The young age of the students qualify them to belong to the generation of "digital natives" (Prensky, 2001).

2.3 **Instruments and statistical analysis**

The questionnaire was developed based on Argyris and Schön's Theory of action. Data was collected from teachers' and students' self-reports. A 5-point Likert scale was used for most of the questions with scoring options: 1=strongly disagree, 2 = moderately disagree, 3 = neutral, 4 = moderately agree, 5=strongly agree; or 1=never, 2 = rarely, 3 = occasionally, 4 = often, 5=extensively. The questionnaire had 38 items. Some of the items were collapsed into three multi-item constructs, as shown below, while others remained as single items. Some items had a reversed scale, denoted by REV. The survey involves three main constructs: *Digital Competence*, *Professional attitude* and *Professional applications of tools*. The two constructs of Digital Competence and professional attitude were based on Likert-scaled statements, and the professional application of tools were based on the reported frequency of use of 16 digital technologies and work methods of the participants in their own teaching in the past year. The constructs were each based on questionnaire items as follows:

Digital Competence:

- I am familiar with digital tools that can help diverse teaching.
- I am, in general, confident when using digital tools.
- I find it easy to become familiar with new digital tools.
- I can use digital tools which are appropriate for the aspects of the subjects I am teaching.
- It is difficult to use digital tools as an educational resource within my subject. REV.

Professional attitude:

- When I use digital tools in my teaching, I find it adds value.
- The use of digital tools is essential for good teaching.
- Society's expectations of the impact of digital tools is exaggerated. REV.
- Expectations related to the use of digital tools in teaching frustrates me. REV.
- In academic debates at our university, the expectations of the impact of digital tools are exaggerated. REV.

Professional application of tools:

- Digital tools for testing with Multiple Choice Questions
- Moodle or Fronter (Each university's learning management system)
- Digital tools for presentation (like Powerpoint or Prezi)
- Word processor
- Spreadsheets (like Excel)
- Use of Video
- Production of film/video/animation
- Online discussions
- Online meetings (like Lync, Adobe Connect or Skype)
- Production of Wiki (website which allows collaborative modification)
- Screen capture (like Camtasia or Mediasite)
- Programs for scientific analyses
- Student response systems (online questions answered by phone or computers, like Kahoot or Socrative)
- Tools for collaborative writing (like Google docs)

- Social media (like Facebook or Twitter)
- The Internet as a source of knowledge

The study was carried out digitally using the commercial online survey tool “Questback”. The questionnaire is a slightly modified version of the one used in our previous study (Madsen, Thorvaldsen & Archard, 2018).

The statistical analysis of the quantitative data was carried out by SPSS Version 24 by using descriptive statistics and t-tests for comparison of two independent groups. We computed Cronbach’s alpha for all constructs as a measure of internal consistency and analysis of reliability. The Cronbach’s alpha measures yielded a value of alpha of 0.75 for Digital Competence, 0.66 for professional Attitude, and 0.71 for professional Application of tools. This described the extent to which all the items in the construct measured the same concept. This evaluation of reliability of data and internal consistency in the three constructs created a basis for further analyses. We investigated differences between the two groups by using the Student’s t-test. Cohen's effect size (d-value) was applied in order to study differences between the groups. This term calculates the difference between two groups measured in standard deviations and is estimated as the difference between the groups averages divided by the average standard deviation for these two groups. King, Rosopa and Minium (2011, p. 246) refers to Cohen, who suggested that a power size of 0.2 represents a small effect, while a coefficient of 0.5 is considered a moderate effect and 0.8 is considered to be a major effect .

In Tables 1 and 2 we first present the descriptive statistics describing the results for each individual question separately for the two groups, and then results are shown from comparative tests between the groups as well as the effect size.

3. Results

When looking at the multi-item constructs in Table 1, the staff report somewhat higher digital competence than students do, but the difference is not significant. The staff scores an average of 3.91, and the students 3.74. It is natural that teacher educators are somewhat more familiar with digital learning tools in education and that they are more confident in the usage. This is about accumulated technological and pedagogical experience. This also means that they do not think it is as difficult as the students to use digital tools as an educational resource in teaching school topics (p-value=0.06). What is more surprising is that the students score lower on digitally competence in all other areas, apart from a somewhat higher score in using digital technology that is appropriate for the subject they teach.

In terms of attitudes, students are less critical than teacher educators (p-value=0.056). But on average, both groups are reasonably neutral in terms of whether they consider digital technology important for good teaching. At a personal level, both groups in average express themselves positive about their own use of digital technology adding values to their teaching. When asked if there is an exaggerated belief in digital technology in teaching, academic staff respond that both from a social and a university perspective there exists an exaggerated belief in the effects of digital technology. Of the staff respondents, only 15.6% disagreed with the statement “Society's expectations of the impact of digital tools are exaggerated”, while 57.8% of the respondents modertely or strongly agreed with the statement. Therefore, societal expectations are not necessarily expectations perceived by teacher educators. Most of the teacher educators did not agree with the perceived attitudes in the public domain. When the participants were asked to agree or disagree with the statement regarding whether or not expectations concerning the impact of digital tools in academic debates

Table1: Self-perceived results from Staff and Students. The table also shows p-values (t-test) and effect size (Cohen’s d).

Variable list	**Scale**	**Staff Mean (SD)**	**Students Mean (SD)**	**p-value**	**Effect size**
Digital Competence (c)	1-5	3.91 (.76)	3.74 (.66)	.20	-.25
I am familiar with digital tools that can help diverse teaching.	1,2,3,4,5	4.02 (1.00)	3.85 (1.03)	.41	-.16
I am, in general, confident when using digital tools.	--- “ ---	3.95 (1.02)	3.79 (.97)	.40	-.16
I find it easy to become familiar with new digital tools	--- “ ---	3.53 (1.13)	3.23 (1.13)	.16	-.27
I can use digital tools which are appropriate for the aspects of the subjects I am teaching.	--- “ ---	3.89 (1.06)	3.98 (.81)	.63	.10
It is difficult to use digital tools as an educational resource within my subject.	--- “ ---	1.81 (.97)	2.17 (.98)	.06	.35
Prof. Attitude (c)	1-5	3.00 (.73)	3.23 (.54)	.056	.38
When I use digital tools in my teaching, I find it adds value.	1,2,3,4,5	3.88 (.93)	4.04 (.74)	.31	.20
The use of digital tools is essential for good teaching.	--- “ ---	2.44 (1.21)	2.67 (1.10)	.30	.20
Society's expectations of the impact of digital tools is exaggerated.	--- “ ---	3.53 (1.08)	3.06 (.89)	.013*	-.48
Expectations related to the use of digital tools in teaching frustrates me.	--- “ ---	2.38 (1.06)	2.40 (1.10)	.92	.02
In academic debates at our university, the expectations of the impact of digital tools are exaggerated.	--- “ ---	3.42 (.94)	3.06 (.89)	.042*	-.39

N=112.

(c) Constructs combining the single variables below.* Significant at the 0.05 level (2-tailed).

Table 2: Self-perceived use of digital tools from Staff and Students. The table also shows p-values (t-test) and effect size (Cohen’s d)

Variable list	**Scale**	**Staff Mean (SD)**	**Students Mean (SD)**	**p-value**	**Effect size**
Prof. Application of Tools (c)	1-5	2.59 (.54)	2.88 (.41)	.002**	.60
I often use digital tools in my own teaching.	1,2,3,4,5	3.95 (1.09)	4.50 (.77)	.002**	.59
I mainly use digital tools in my teaching because it is expected by others.	--- “ ---	1.88 (1.06)	2.31 (.99)	.029*	.43
I have experienced that the use of technology in teaching has been disruptive for the expected outcomes.	--- “ ---	2.83 (1.12)	2.98 (1.06)	.47	.14

N=112. (c) Construct combining 16 variables on digital tools/work methods applied in teaching during the past year. * Significant at the 0.05 level (2-tailed). ** Significant at the 0.01 level (2-tailed).

at the university are exaggerated, the scores between staff and students were significantly different (p-value= 0.042). In the staff part of the study, the participants did not express confidence towards their colleagues' assessment of digital tools, but in the students' part of the study the participants' understanding of fellow students attitudes towards digital tools were more in line with the participants own attitudes. However, both staff and students, on the other hand, slightly disagree that this causes frustration.

Table 2 shows the results for the application of digital tools and work methods in teaching during the past year. The construct Prof. Application of Tools consists of 16 items, and 6 of the items show a significant higher use (p-value < 0.05) in the student group (Multiple choice, Production of video, Production of Wikis, Student response system, Collaborative writing like Google docs, and Internet as a source of knowledge). The staff group scored significcantly higher in 3 items (Moodle/Fronter LMS, Digital presentations and Online meetings). The construct Prof. Application of tools has a significantly higher score for the students (p-value=0.002), and they agree to a larger extent than the staff that digital tools are used because it is expected by others (p-value=0.029). The different scores in application may be natural as the staff relates mainly to teaching in higher education, and the students relates more to education in primary and secondary school.

Table 3: Correlations for each group separately.

	Digital Competence (c)	Prof. Attitude (c)
Prof. Application of Tools (c)	.327 ** (Staff)	.452 *** (Staff)
	.428** (Students)	.327 * (Students)

N=112.

(c) Construct combining single variables. * Significant at the 0.05 level (2-tailed). ** Significant at the 0.01 level (2-tailed). *** Significant at the 0.001 level (2-tailed).

The correlation analyses conducted for each group (Table 3) reveal interesting differences between them. Among the staff the Prof. Application of tools variable is strongly correlated with Prof.Attitude (r=.452), and less with Digital Competence (r=.337), but in the student group it is the other way around.

Table 4: Regression analysis to predict Prof. Application of Tools.

Variable list	Staff		Students	
	Beta (standardized)	p-value	Beta (standardized)	p-value
Digital Competence	.175	.16	.371	.008**
Prof. Attitude	.382	.003**	.239	.08

** Significant at the 0.01 level (2-tailed).

When we try to predict the professional application of digital tools (Prof. Application of Tools) among the students, the best predictor is Digital Competence (Beta=.371, p-value = .008), while the best predictor for the staff is Prof. Attitude (Beta=.382, p-value=.003). It appears from this analysis that the influence and contribution of digital practice is carried out quite differently within the two groups. Among the academic staff, the professional use or application of digital tools is dominated by professional attitude, while among the student group it is dominated by Digital Competence. At the same time, the Digital Competence is somewhat lower in the student group, but the professional application of digital tools is significantly higher. Adjusted R-square for the multiple regression model in Table 4 is .20 for both models, which tells us that 20 % of variation in the output variable (Prof. Application of Tools), can be explained by the predictors in the model.

4. Discussion

As mentioned earlier, teacher education is often described as being one step behind primary and secondary schools in use of digital tools, and confidence in teacher education to handle this gap has been weak (Haugsbakk, 2013; Selwyn 2016). Elstad (2016) claims that young people have digital capabilities and describes that some researchers regard youth as "digital natives", in contrast to teachers who are disrespectfully described as "digital slow-coaches" (Elstad, 2006) or "digital immigrants" (Prensky, 2001). Technology in itself is seen as a catalyst for educational change, and technology is a symbol for change is often understood as something positive, as investments in technology will support development in society. Haugsbakk (2013) argues that this reflects an instrumental perspective on technology. In addition, there also exists indications that use of education technology may not lead to better learning outcomes or increased efficiency (Selwyn 2016; Elstad, 2016).

Only 10 out of 64 respondents from the academic staff disagree moderately or strongly in the statement that "*Society's expectations of the impact of digital tools are exaggerated"*, while 37 of the employees agree moderately or strongly with the statement. Thus, most people do not agree with the signals that is communicated in the public domain.

What is more surprising is that the same trend is applicable when asked if there are excessive expectations as to the effect of digital tools in the academic debates at the university. On this question, only 8 out of 64 respondents from staff answer that they somewhat or completely disagree that the UiT's academic debates have exaggerated expectations to the effects of digital tools. However, 32 out of 64 agree that the academic debates at UiT are characterized by too high expectations for the effect of digital tools.

These figures represent a bias, characterized by a dual culture. A dual culture where employees have an attitude towards digital tools that indicate that the majority within the teacher training staff do not consider digital tools as essential for good teaching. This suggests an inner academic culture that does not correspond with the public culture and general university policies, or that the employees' attitudes are quite diverse, and possibly a fragmented and inconsistent group?

The fact that most academic staff at the Department of Education at UiT thinks that the academic debate is characterized by too much confidence in digital tools can indicate several things. For example: In debates, employees express more optimism toward digital tools in teaching than they really mean. It may concern political correctness and a desire not to go against the flow. Another explanation might be that they are the technology positive ones ruling the debates, while those who are critical choose not to express themselves.

The figures from the students are in line with the public culture and the expressed university policies. An interpretation may be that the teacher students do not have the amount of experience the teacher staff has in terms of experiencing the limitations and negative effects of digital technology. The students could be more optimistic and colored by how digital technology is introduced, and not so much how it is experienced, as they have limited experienced compared to the teacher educators. Experience and legitimacy through a long career could make it easier to go against the flow, to have independent attitudes within educational policy making when in disagreement. This is supported by some of the differences in the answers to the questions about whether they use digital technology because it is expected by others (Table 3), where student agree significantly more than the staff (p-value=.029, with effect size d=.43).

In our regression analysis, we found that the contribution to digital practice is carried out quite differently for the academic staff and the student group. For the staff, the digital practice is dominated by professional attitude, while in the student group it is dominated by Digital Competence. Argyris and Schön's *Theory of Action* may give us a relevant framework to understand this observation on a deeper conceptual level. A central theme in their learning theory is the link between learning, change and resistance to change, where the theory emphasis Single-Loop and Double-Loop Learning Processes. Single-loop learning processes mainly involve following the preset plans, while double-loop learning processes is more fundamental and includes consideration where ideas or policies are challenged.

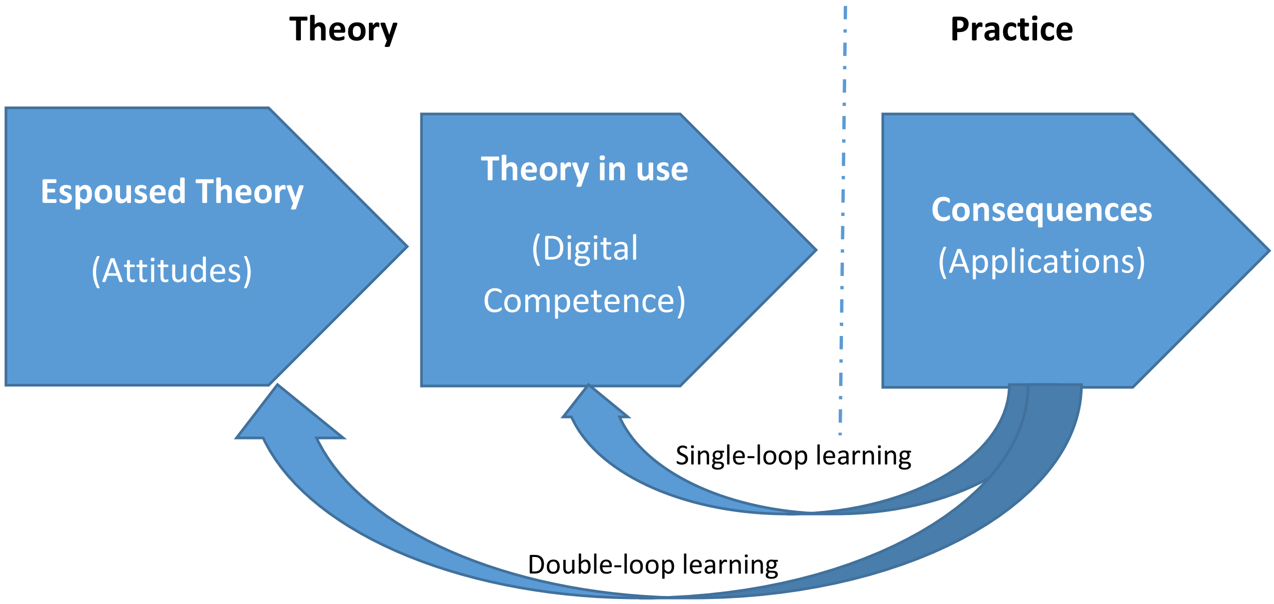

Figure 1. Sigle-loop and Double-loop learning processes. Adapted from Argyris & Schön, (1978).

Based on our previous analysis we suggest that that the students' didactical perspective may be characterized as mainly a *Single-loop learning* process based on *Digital Competence*, while the academic staff in addition is involved in a *Double-loop* learning process where also their professional *Attitudes* are involved. The interactions are illustrated in Figure 1. Single-loop learning is effective and rational on the basic didactical level, while Double-loop models are more open to discussions, adaptations, and provides more opportunity for choice.

One example of this is described in Elstad (2016b), where a pioneer Norwegian school had committed itself to becoming a showcase, 'the school of the future' with extensive use of ICT, co-operative learning, work in interdisciplinary manner and project orientation. Their aim was to be Europe's number one school regarding the use of portable or mobile computer technology. 30-35% of the teachers demonstrated enthusiasm, 10% were reluctant, while the majority had a wait-and-see attitude. Two years after, most of the positive minded teachers had changed their view of the need for managerial intervention and put forward a demand to the leader. Control issues were the subject of conflict as the pupils took advantages of the opportunities that portable computers gave in terms of non-academic activity. Five years passed before practitioners were heard and strategy changed to reduce the problem. With experience came the realization that doing more of the same was not working in regard of pupils' learning, the single-loop learning resulted in a mismatch between educational goals and achieved goals. When entering a double-loop learning process, and looking critically into the preconditions for the challenges at hand, the teachers demanded leader to change the preconditions by using a joint systemic strategy to reduce the problems of non-academic activity.

According to Elstad (2016b), political expectations regarding the modernization of schooling system using ICT, and the allocation of funds in accordance with this policy, created agendas not compatible with the constraints and operational features within the education. If one is presented with an ideology and this is guiding your practice, the students are more likely to act based on Single-loop learning. With experience comes a greater opportunity to evaluate not only policy, but also how policy affects practice. This knowledge is a prerequisite for making critical analysis of teaching and to act based on Double-loop learning.

In Double-loop learning processes, an educational organization can handle the basic challenges related to the application of technology. It is not about being one-step behind, but about taking steps aside to gain a deeper perspective. Successful teaching is not only about finding the right technology, but also about adding values, norms and attitudes that resides within the academic staff at teacher training organizations. We think Argyris and Schön's differentiation between Single-Loop and Double-Loop learning in their *Theory of Action* may contribute to a deeper acknowledgement of the fundamental challenges that still have to be settled in the domain of educational technology. Both processes exist at the same time, but with different actors. Both actors are important, and may give valuable contributions in refining the learning process.

5. Concluding remarks

In this study, we made several observations. Norwegian teacher trainers and their master students both report similar levels of digital competence, but the teacher trainers have a more critical attitude than their student towards the application of digital technology in education. Extended experience may explain why the academic staff have a different viewpoint on the pedagogical use of digital tools.

Norwegian governments have been very active to influence and reform both the school system and teacher education. The Norwegian implementation plan positions digital technology in teaching in a way that activates resistance and creates contrasts between teacher educators' experiences and work-related requirements for implementation.

It is too easy to hold the teacher education as the main responsible for the lack of successful integration of digital tools into learning practices. The limited digital success suggests that these efforts to update and improve teacher education might not be a quick way forward to the closing of the observed gap. The digital tools themselves, and their actual value in various learning environments, seem to need a deeper examination as the value of technology should not be taken for granted in the complicated domain of education.

The observation that teacher education is not successfully integrating digital tools can be related to the optimistic expectation related to the use of digital technology in our society (Player-Koro, 2013). We will need to critically examin the technological optimismthat has promoted a somewhat unrealistic view on the ability of digital tools in education. In the present study, only self-repport and quantitative methods are used. To further address and validate the observations, we have made interviews with the academic staff to be published in a future qualitative study.

Teacher educators have developed an awareness regarding how digital technology is to be integrated into the curricula, and what kind of strategies are best suited to help pre-service teacher students obtain this knowledge for their future work. This paper may contribute to increase such awareness, while simultaneously clarifying the content and the complicated processes of technology integration in teaching and learning. Argyris and Schön's highlighting of both Single-Loop and Double-Loop learning may add new perspectives to a deeper understanding of the ongoing process of developing a *sustainable* technology enhanced learning.

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The LMS as Hauptbahnhof and the joy finding an embed code

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Abstract

The use of LMSs (Learning Management Systems) in higher education is often associated with the concern that these systems prevent the teachers and students to choose freely among technologies for teaching and learning activities. LMS's has also been criticized in order to especially support teachers who focus on broadcasting instead of supporting collaboration among students**.** However, LMSs has developed and today they also provide tools that can be used for interaction between participants. These tools include blogs, discussion forums and wikis.

This paper focuses on the possibilities of using external digital services in the teaching with the LMS as a common focal point. The metaphor "Hauptbahnhof" is used in the understanding of the LMS as the central station. The crunch of the creation of this metaphor is a HTML button found in the editor that you encounter in many places in LMSs. The advantage of gathering the digital tools, used in the course, in the LMS is to support the creation of a clear structure in the course, which is important for students learning outcomes. The use of technology in teaching requires more than finding an HTML button. The use of digital tools must be scripted, which requires the teacher's commitment and participation in setting up and organizing the activities.

We have asked teachers at Aarhus University Arts about their experiences with the embed option and web link option in the LMS used at Aarhus University. Around half of the respondents finds that the weblink option and/or the embed option in Blackboard gives them opportunities to freely choose which digital tools they wants to use in their teaching. Some respondents finds that the use of the embed option and the weblink is too technical challenging and too time consuming.

Keywords: LMS, teacher, teaching, digital tools, embed code web link,

1. Introduction

All higher education institutions in Denmark use a Learning Management System (LMS). At Aarhus University we use Blackboard Learn.

A LMS delivers reliability, as well as the possibility of data integration to already used systems in a large organization e.g. study administration systems. This reliability is essential to teachers and students who can concentrate on teaching and learning. Teachers and students can access their courses in the LMS before the semester starts and can communicate with each other during the semester.

Nevertheless, the use of LMSs at educational institutions has been associated with concerns. In the literature we find three overall concerns;

• The limited ability for teachers and students to freely choose which technologies they would like to use in their courses

• The LMS's closeness towards the outside world

• The focus on the teacher as organizer of the activities in the courses

In this paper we will examine teachers' experience of being able to choose freely which technologies they will use in their teaching.

2. The LMS and teaching at Arts

All courses at Aarhus University are listed in Blackboard. Teachers and students are automatically enrolled in their courses through administrative systems. Blackboard is available at AU via the personal login used in other AU systems. Server backup is provided on the content, which secure access in the future.

Empirical research shows that clarity and structure in teaching support students learning (Meyer, 2008). The LMS at AU offers an opportunity for the teacher to establish a clear structure in the course. All Blackboard courses at Arts are designed with the same menu items. This menu allows the teacher to deliver information and materials, set up assignments, create groups, set up activities, choose and use different digital tools inside and outside the LMS. The students can interact with each other and teachers through blogs, discussion forums and wikis, as well as conduct tests and surveys. Students can upload different file formats, including audio and video files and are able to create groups to which interactivity tools are attached. Finally the teachers are able to change med menu in their courses as much as they like. All of this requires knowledge of the tools in the LMS and some technical skills.

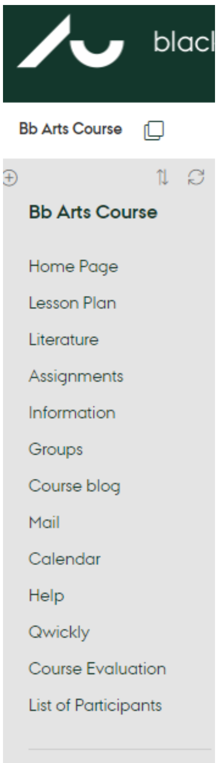

Figure 1: Course menu, Blackboard Arts, Aarhus University

3. Concerns with the use of LMS's

As mentioned in the introduction, the first concern deals with the limited opportunities for teachers and students to freely choose which technologies are to be used in teaching (C. Dalsgaard, 2006; J. Dron, 2006; Sclater, 2008). Dalsgaard writes in the light of the above concern and the concern that focuses on the teacher as organizer:

"It is necessary to move e-learning beyond e-learning systems and instead involve students in an active use of the Internet as a resource for their self-directed, problem-based and collaborative activities" (C. Dalsgaard, 2006,p . 1).

Many LMSs have been developed in recent years and provide today several tools that can be used for interaction between participants, such as blogs, wikis and discussion boards, but if teachers and students should be allowed to choose freely we need more.

The second concern relates to LMS's lack of openness towards the outside world. Dalsgaard and Thestrup recommend based on a socio-cultural learning understanding and Dewey's thoughts on openness in education:

"On one hand institutions should provide students with access to activities of others and to sociocultural practices outside the institution. On the other side should institutions try to develop relations between themselves and their surroundings "(Dalsgaard, C., & Thestrup, K., 2015) (p. 84).

The LMS's built-in closeness is based on a need to limit the teaching of the students who are admitted to the specific education. The teacher is supposed to teach a limited number of students and the materials used and shared in the courses are copy-right protected and therefore can not be shared with an unlimited number of people.

The third concern deals with the unequal power distribution between teachers and students in traditional LMSs. The teacher has traditionally the ability to organize the course, select tools as well as upload materials while the students is able to receive and sometimes contribute when allowed by the teacher (Dron, J., & Anderson, T., 2009). This is also in part the case in the modern LMS used at Aarhus University, but there are opportunities for students to participate and contribute on their own initiative. We will return to this in the next section.

The question is to what extent the use of LMSs at educational institutions can address these concerns.

4. LMS as Hauptbahnhof

On the basis of the above concerns, educations may choose to reject the use of LMS´s. This will introduce other challenges. In practice, the rejection of LMS in the teaching will cause the teachers to choose one or more external digital services that can replace the functions of the LMS in order to communicate with the students between classes at the campus. It is a challenge to choose the right external digital services, to provide students with an overview of the activities and to ensure that all students have access to everything they need. Dron writes that the disadvantage of composing and incorporating external digital services in teaching is that it can be difficult to control the learning processes for both teachers and students (Dron. & Bhattacharya, 2007).

Other challenges could be students and teachers lack of digital competencies, free digital services that are closed or is converted into payment services, resulting in a lack of assurance that activities can continue and content can be retrieved later. In addition, the limited opportunity for teachers to keep track of student activities is problematic, when they take place in external digital services. Finally, the overwhelming amount of digital services on the internet indicates that the selection process could become overwhelming to both teachers and students (Dron. & Bhattacharya, 2007).

For the students, the challenge is to access and review various external digital tools. This complexity is further increased when students usually participate in several different courses, which may use different digital services. Moreover, if the students are given the responsibility to choose the external digital tools, many will not have the skills to make wise choices (Dron. & Bhattacharya, 2007). At this point, it is not widespread to help university students to develop such skills in choosing dgital tools for learning purposes . Teachers at AU are offered courses in choosing and using of digital services, inside and outside Blackboard in their teaching.

Our focus is on the LMS's ability to act as a focal point, ie. "Hauptbahnhof" for learning activities in the course and provide access to tools in the LMS or to external digital services on the Internet. The LMS can allow the teacher to create a focal point who can provide clarity and structure in the course. The crunch of the creation of this "Hauptbahnhof" metaphor is the HTML button found in the editor you will find several places in Blackboard and similar LMSs (see picture below). This HTML-function allows the teacher to embed the external service in the course and therefore make the external tool more visible and accessible for the students (in updated versions). However, embedding requires that the teacher (or the students) are able to find the embed code in the external digital service. In addition, students have access to the HTML-button in the editor in blogs, discussion boards and wikis in Blackboard and therefore are able to embed external digitale services in their courses. This means, in practice, that students can collaborate in a Padlet (virtual bulletin board), or compile flashcards to each other and display and share the products in a blog or on a wiki page.

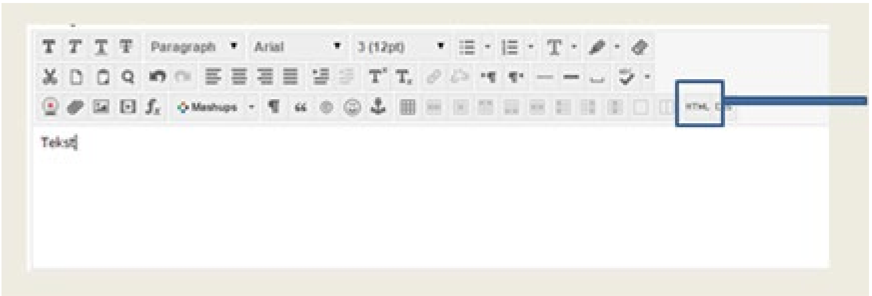

Figure 2: Editor found many places ind the LMS Blackboard. Focus on the HTML button

In the example below, the external digital service, Padlet, is embedded in a course in Blackboard. Note that the students can access and edit the Padlet in Blackboard and the updated version will be displayed in the course. Unfortunately, not all the exciting digital services found on the internet provide the necessary code, but a lot of services do.

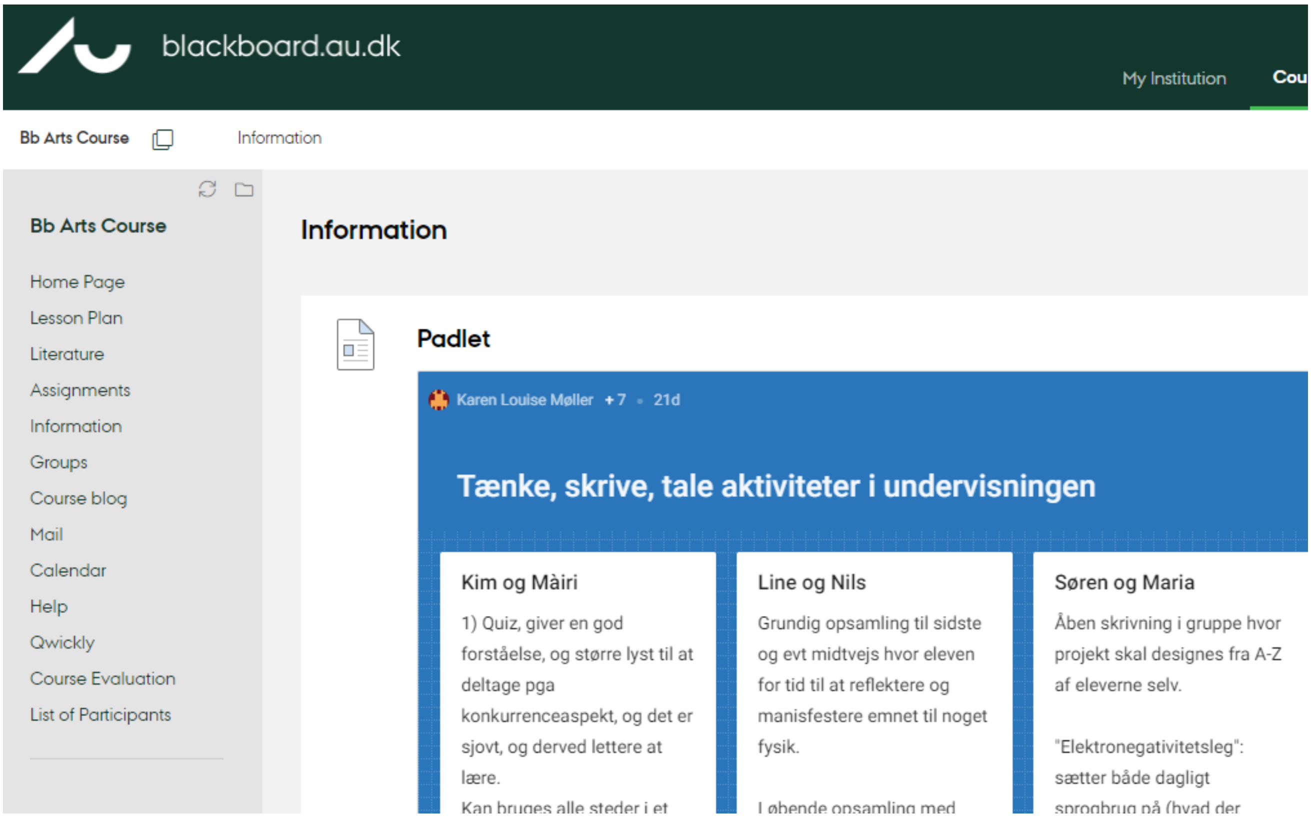

Figure 3: Padlet embedded in Blackboard

In the picture below you can see the embed code from Padlet (virtual bulletin board). The embed code is often found under a button labeled *Share* or *Export*.

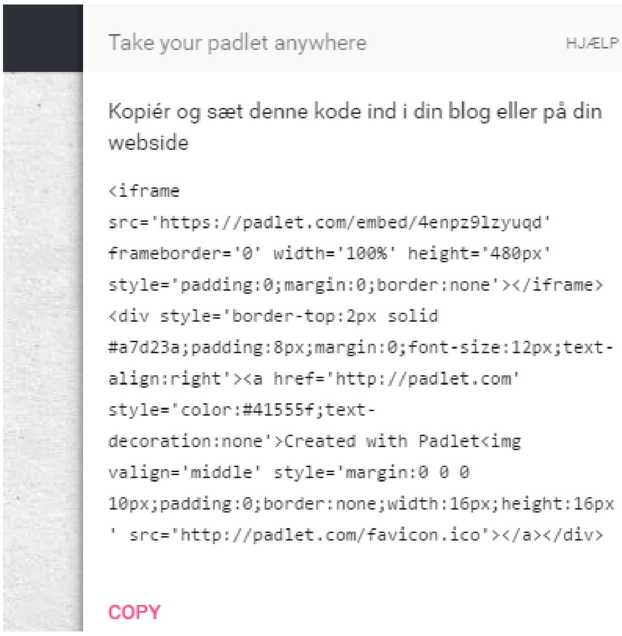

Figure 4: Embed Code

It is also possible to create weblinks from courses in Blackbord to digital services on the internet. In Mind Meister students can collaborate on a mind map and it can be shown through af weblink in Blackboard.

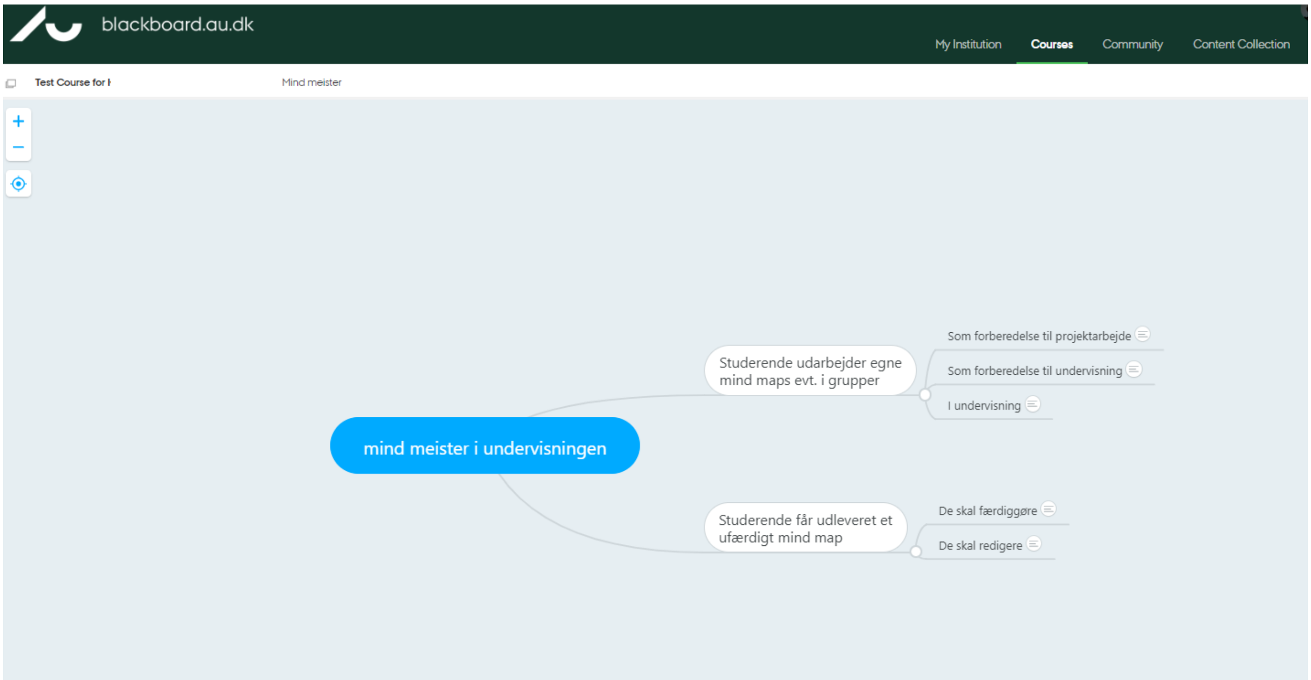

Figure 5: Mindmeister shared through weblink from Blackboard.

5. Method

Through the last three years we have teached *the teacher training course on Educational it* for Postdocs and Assistant Professors at Aarhus University Arts. This is a course in how to plan learning activities with digital media, including how to use the HTML-button in Blackboard. June 2018 we distributed an anonymous questionnaire to 43 former participants. We would like to know how they experienced their ability to freely choose digital tools in their courses with the use of the HTML-button and/or weblinks in the LMS. 19 answered the questionnaire.

5.1 Questions

The questionnaire consisted of the following questions.

Question	Question type/Answer options
1. Have you used the embed option via the HTLM button or weblink opportunity in your Blackboard courses to show and / or access external digital services?	**Yes/No**
2. What digital tools have you added to Blackboard courses via web link or embed option?	**Multiple choice** Padlet GoogleDoc A Timeline tool, e.g Timeline JS Mentimeter Mindmap tool Google Draw Poll Everywhere Youtube Quizlet I have not used embed option or weblink in my Blackboard courses
3.	**Free text**

Other digital tools than the ones mentioned above?	
4. To what extent do you agree that the ability to create a web link or the ability to embed other digital tools in Blackboard expands your possibilities to freely choose technologies in your teaching?	**Multiple choice** Strongley agree Agree Nor agree og disagree Disagree Strongly disagree Dont know
5. Comments	**Free text**

Figure 6: Questions

6. Results

Approximately half of the respondents (nine out of nineteen) have used the weblink option or the embed option in Blackboard courses to access external digital tools.

The external tools they have used through Blackboard where Padlet (8), Google Doc (6), Youtube (5), Mentimeter (3), Quizlet (1), a timeline tool (1), Twitter (1), Kahoot (1), Dropbox (1), Blog (1)

Approximately half of the respondents (nine out of nineteen) finds that the weblink option and/or the embed option in Blackboard gives them opportunities to choose digital tools freely in their teaching (figure 7).

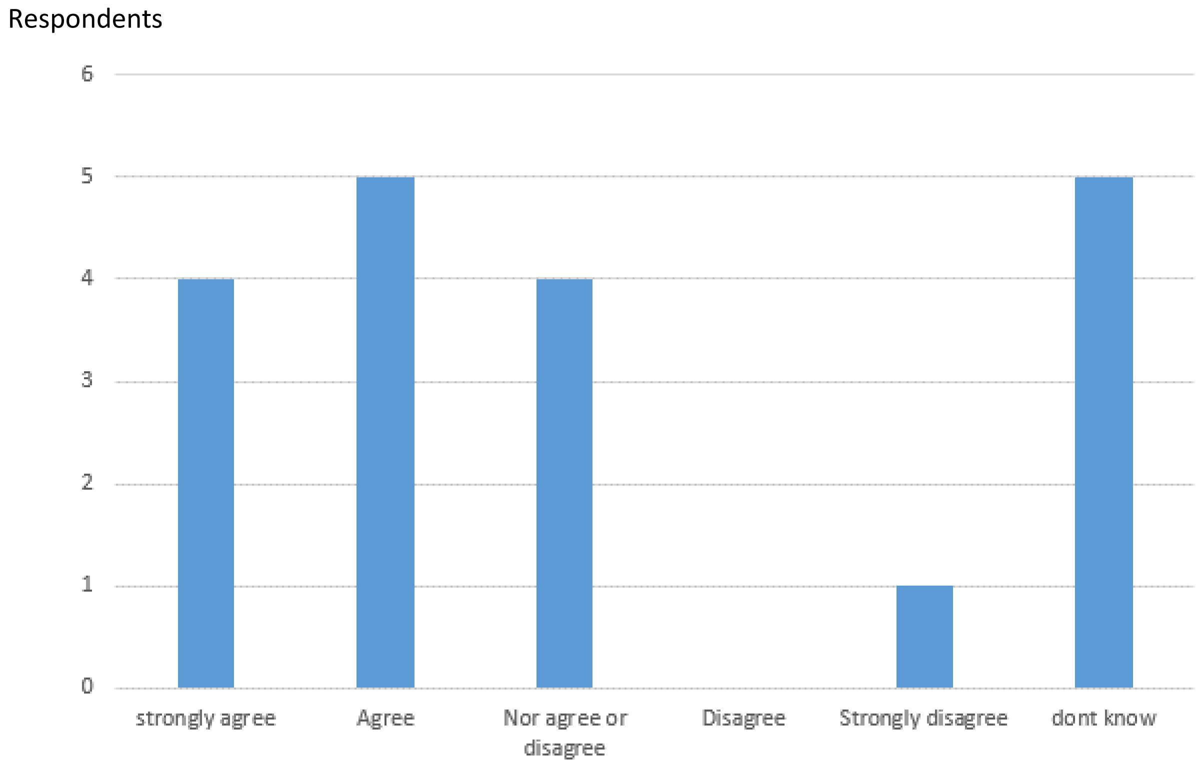

Figure 7: Distribution of answers from question 4 (To what extent do you agree that the ability to create a web link or the ability to embed other digital tools in Blackboard expands your possibilities to freely choose technologies in your teaching?)

The respondents had opportunity to write a comment in the end of the questionnaire. Seven respondents wrote a comment. Four respondents mentioned that they find it technical difficult to embed external tools in their courses. Three respontents mention that they find it too time consuming. Two respondents mention that embedding and web link makes Blackboard more flexible. One respondent write “ It is very useful and I have recommended it to several colleagues”.

7. Discussion and conclusion

Our finding suggest that the ability to embed external digital services in the LMS provides some of our teachers with the opportunity to choose digital services that are suitable for their teaching freely, but there are also teachers who find embedding and the use of weblinks too demanding and too time consuming. This indicate that if teachers should be able to choose tools outside the LMS the tools should be accessible through the LMS in a more simple way e.g. integration of the most wanted tools in the LMS. This is a possibility that is provided by many LMS´s, but it does not solve the problem of the free choice for teachers and students, because the list of integrated tools would be limited due to expenses. Support is necessary fot those teachers.

For the teachers who find the embed opportunity useful and manageble - the LMS can be used to access external digital services and be “opened” to the surrounding world e.g. through embedding a WordPress blog. These teachers could also teach their students how to use the html-button in eg. the LMS-blog tool and let them share the tools they have choosen to use in their learning processes.

To sum up: When teachers feel comfortable enough to embed external digital tools or use a weblink in the LMS they have opportunities to:

- Choose digital services freely and provide a clear structure in their courses
- Establish greater openness to the outside world in their courses
- Let students self-select external digital services they would like to use and share
- Let students create some of the activities and choose some of the digital tools in the course in collaboration with teacher and peers

This is positive, but the student's ability to choose technologies can be advantageously supported by the teacher who, on the basis of relevant competence development, can carry out such a task. Alternatively, studies of student competencies in selecting suitable digital tools and student qualification may be prioritized in the future.

Finally, the work with Blackboard as the Hauptbahnhof is highly dependent on the continuing development of the LMS; the html-button should not disappear and other options for sharing content should still be supported by the LMS.

We will work more intensively with this in the future and incorporate the topic into our course offerings. In addition, we will also try to ensure that students get even more embed opportunities in Blackboard and make the embedding process easier for them, for example, allow them the to create an Item in a Content Area. This is the easiest way to embed content in Blackboard. In addition, we rely on digital services on the Internet to continue delivering embed codes and other sharing capabilities.

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The TESI System: A digital model for teaching and learning

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Abstract

The TESI system (Adaptive Personalized System for Creating Expression Tools in Social Inclusion of Learners with Verbal Communication Disabilities -VCD-) is aimed at helping people with verbal communication problems in their everyday life and at school. The main goal of TESI is to support these people in their natural ability to live fully self-expressed, a prerequisite for acquiring skills. This system is tailored to their capabilities, the knowledge that will enable them to be active in society. The TESI software system will offer new opportunities for teaching and learning. This software is based on the conceptual model that summarizes and combines the activities of team members, teachers and parents. Teachers will design a plan-scenario for student classroom activities. Parents will specify the most important and most frequently performed activities of their children in their everyday lives. Thus, the TESI software system will lead to a better integration and will improve their opportunities of integration in society by providing easy access to expressive objects for target groups. The TESI Project is funded by the Erasmus+ program of the European Union, in particular the Key Action 3 of TESI, initiatives for policy innovation, social inclusion through education, training and youth. An international consortium taking part in the project- including experienced EU partner universities - will assist partners in the

different stages of use and integration of ICT in education and will promote the effort of partners in modernizing the educational programs intended for the integration of disadvantaged groups.

Keywords: Inclusiveness, Digital Technologies of Teaching and Learning, Mobile learning, ICT support, Disadvantaged learners.

1. Introduction

The principles that facilitate effective learning include equity and quality in teaching, inclusive and student-oriented social learning environments that are well designed, structured and personalized, sensitive to individual and group differences of students (Dumont, Istance and Benavides, 2010). Effective learning also implies a relationship with the community and explicit collaboration among students. Thus mobile collaborative learning supports ubiquitous learning by using different cooperative strategies, promotes more interpersonal social interaction, and makes easier self-regulated context-based and reflective learning as well as fostering cross-cultural interaction (Fua, Hwang, 2018).

Crompton, Muilenburg, and Berge define m-Learning as learning across multiple contexts - through social and content interactions - using personal electronic devices (Crompton, 2013). Mobile learning represents a technological advance that enables rich, distributed and contextualized approaches to learning (Crompton, 2014). Research evaluates the effectiveness of mobile devices on student learning (Foti, 2014), as different variables may be of influence in this process: familiarity of students with the device, the duration of use, as well as knowledge and skills of the teacher when using the device (Crompton, Burke and Kristen, 2017). m-Learning can provide new possibilities to students such as contextualized learning that is personalized and not hindered by temporal or environmental constraints. They can scaffold synchronous and asynchronous types of learning, customized instruction and individualized assessment, rich communication, as well as learning anywhere and anytime (Mehdipour and Zerehkafi, 2013).

Although a wide variety of devices are being used in mobile learning (smartphones, PDAs, tablets, eBooks and iPods) the key element is not the type of device but the access to them (Sun, Chang and Chien, 2016). Even nowadays it is still difficult to integrate m-Learning in formal settings (classes) although its impact is higher in informal settings (Sung et al, 2016). The following barriers stand out among the numerous ones detected: financial limitations that lead to limited resources; non counting with effective educational policies; lack of a skilled staff for an effective implementation of mobile pedagogies; shortage of hardware resources such as infrastructure and bandwidth, as well as reservations of parents due to the perceptions of health and psychological issues associated with the prolonged use by students of mobile devices (Bano , Zowghi, Kearney and Schuck al., 2018). Moreover, many students consume knowledge but they do not become collaborators in creating knowledge.

Many teachers are still reluctant to allow widespread access to mobile devices in a formal classroom setting (Khaddage, Lanham, & Zhou, 2009), often due to not being able to control the activities of the students and having general safety concerns on technologies such as mobile apps that may still have difficulties in finding their way into the primary/secondary classrooms and becoming a valuable component of the curriculum. The introduction of this technology into the classroom is no longer tied to obstacles to overcome, such as technological problems, additional technical skills, and further challenges on privacy and security issues. It might be due to this reason that the fusion of mobile technologies into educational settings has not yet been widely adopted even though educators and schools have become interested in the application of mobile learning via apps that bridge the gap between formal and informal learning. To be orchestrated in mobile integrated education, it requires software to come to be more flexible and to count with skilled enough teachers (Sung, Chang and Liu, 2016).

On the other hand, the educational need of students with disadvantages - coming primarily from socio-economic, cultural, and/or linguistic factors - is to compensate for the disadvantages attributable to these factors (OCDE, 2016). For them the use of mobile devices is becoming ubiquitous in mainstream learning environments; thus the skills that are needed to access to information, data and the knowledge they can deliver, are vital for their integration in the mainstream culture. If deprived from these devices the non-users are at a disadvantaged position and they are less able to access to education and training, its benefits, support, social status and democratic representation (Hayhoe, 2015). Assistive technology and devices, and specifically augmentative and alternative communication systems, may ease the social and physical integration of students from different contexts. Language and communication technology should allow children to make choices, demonstrate their personalities, and participate in class discussions and activities (Bambaeeroo and Shokrpour, 2017).

2. The TESI System: A digital technology for teaching and learning to support Social Inclusion of Learners with Verbal Communication Disabilities

It is estimated that over 60 million people in the EU are affected with social (pragmatic) communication and expressive language disorders, characterized by difficulties in the use of social language and communication skills. The Erasmus+ “Adaptive Personalized System for Creating Expression Tools in Social Inclusion of Learners with Verbal Communication Disabilities. Tools of Expression for Social Inclusion” TESI Project has as global and specific objectives the social integration of people with verbal communication disorders at risk of social isolation. It is dedicated to conceptualize and develop of social competences (SC) related to personal, social and professional growth of people with verbal communication disorders through the creation of an adaptive, affordable and easy-to-use software solution that will enrich their opportunities for personal expression. This adaptative learning software includes the ability to accurately “sense” the levels of commitment of learners with verbal disabilities, while providing care institutions as well as parents and family members with an easy-to-use, simple solution. The software is based on the conceptual model that summarizes and combines the activities of team members, teachers and parents. Teachers draw up a plan-scenario for student classroom activities. Parents specify the most important and most frequently performed activities of their children in their everyday lives. They implement their knowledge and experience for defining expressive objects connected to specific training objectives and for selecting suitable methods and techniques to use them for personal expression in training. The expressive objects are personalized; they can be used individually or in a group. Therefore, TESI ensures access of these disadvantage learners to interactive learning processes in the classroom. It enables users to express themselves using visual and audio cues, and assists them on creating messages and improving their social integration. Taking into account the diversity of the profiles of people on the spectrum of verbal disorders (including autism, dyslexia and intellectual disabilities), the training software system is addressed to all care givers and professionals irrespective of their area of knowledge.

Finally, the TESI system is aimed at helping people with verbal communication problems in their everyday life and at the school using personalized software based on different elements: (1) Adaptative learning software effective to leverage multi-model behavioral cues (2) Use of smart technology and digital resources (3) It overcomes limitations related to time, planning and training materials (4) It does not require preparation in advance (5) It is a cost effective solution (6) It offers high quality and supports professional care givers in the different contexts of life. The main goal of TESI is to support these people in their natural ability to live fully self-expressed, which is a prerequisite for gaining skills and the acquisition of certain knowledge, tailored to their capabilities that will enable them to be active in the society. It is subject to the assumption that by providing an easy access to expressive objects for target groups, the TESI software system leads to better integration and increases the opportunities for their inclusion in the society as a whole.

3. Methodology

3.1 The design of the TESI Project

The fulfillment of the main objective and the expected results (R) of the TESI Project requires to achieve five specific objectives associated with main the phases of the project, the activities in its work packages (WP) and to carry out a series of actions to attain them (Figure 1).

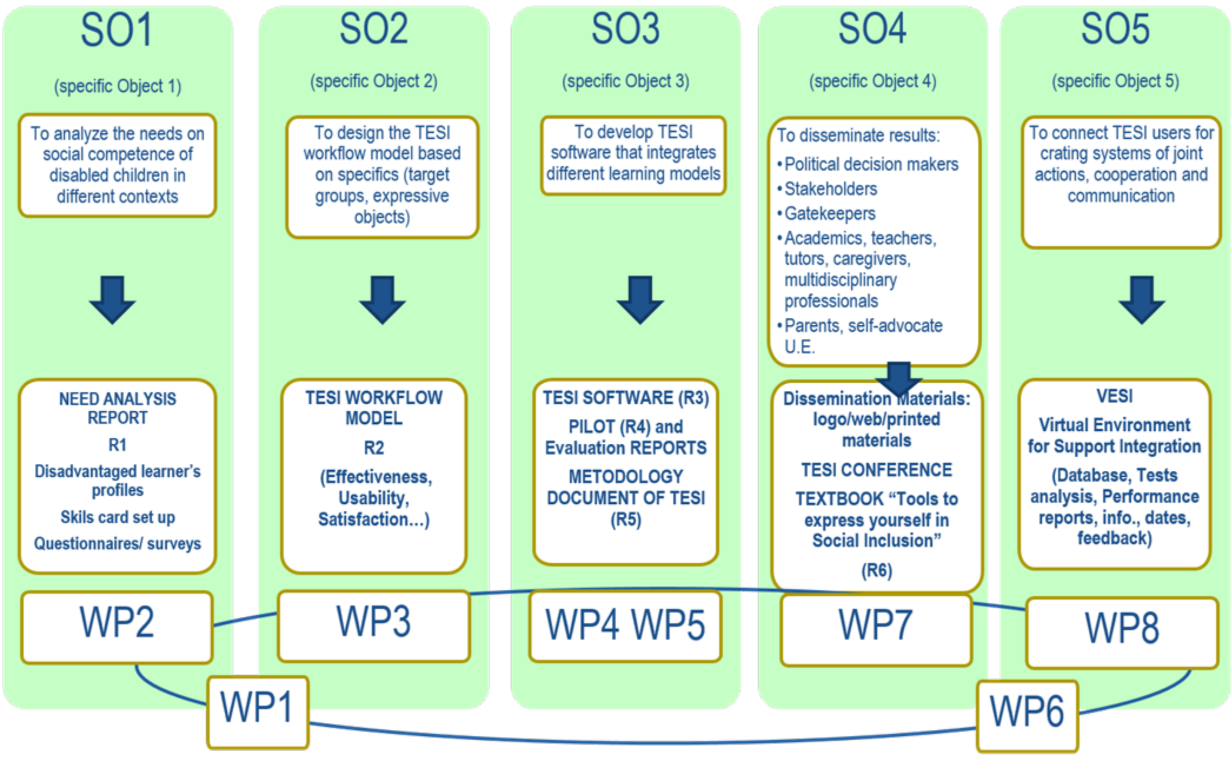

Figure 1: Design of the TESI project.

Hereunder we describe the main elements of each WP of the TESI project.

WP1: Management, Planning & Control

WP1 covers all the phases of the TESI Project, alike WP6 (Evaluation and Quality Assurance Plan). Its duration is 24 months, starting December 2017. The aim of WP1 is to manage a plan addressed through the following objectives: to ensure an effective PMC (O1.1.); to develop the project work plan (O1.2.); to ensure results in accordance with fixed responsibilities, milestones and schedule (O1.3.); to control budget and funds as well as to prepare cost, efforts, progress, final and quality assurance reports (O1.5). The following key activities will be carried out: (1) Definition of the work scenarios. (2) Design of templates (3) Definition of functions within the Work Plan (4) Definition of the Risk Management Plan -RMP- (5) Control the schedule of the work plan (6) Implement procedures to control budget (7) Draft of technical reports .

WP2: Needs Analysis

The aim of WP2 is to analyze the needs of the target groups in different contexts, addressed through the following objectives: to define the profiles and the main features of disadvantaged learners (O2.1); to define the profiles of other users of each group (O2.2.); to define specific learning and communications needs and requirements (O2.3); to create a didactic model (02.4); to identify skills, knowledge and competence of every target group (O2.5); to detect other needs. The following key activities to be implemented and the expected results are: (1) Definition of the profiles of the target groups (2) Definition of the profiles of teachers, parents, tutors and supervisors (3) Definition of needs, requirements (results: lists of needs and requirements) (4) Definition of knowledge (5) Description of selected expressive tools (6) To produce the needs' report (7) Description of other aspects.

WP3: The TESI Model Workflow

The aim of WP3 is to develop the TESI conceptual model addressed through the following objectives: To identify the basic components of the TESI model workflow (O3.1); To design the workflow (O3.2.) and to prepare the documentation of the TESI Model (O3.3). The following key activities will be carried and the results expected are: (1) Definition of expressive objects (2) Selection of training methods, assessment techniques to use for personal expression depending on the needs of target groups; educational capabilities of the expressive tools and assessment of the results of training; software specific characteristics on presentation and access to digital objects (3) Design of educational tools (4) Organization of resources -expressive objects-and (5) Construction of the library of objects (6) Selection of instructions (7) Writing of the conclusions on the TESI model "WP4: the TESI Software System: Express yourself".

WP4: The TESI Software System

The aim of WP4 is to develop the TESI software system addressed through the following objectives: To write functional specifications (O4.1); To write technical specifications (O4.2); To create a design for the user interface (O4.3); To create the structure for a relational database and to setup the storage of resources (O4.4);. To implement web services (O4.5); To implement the user interface (O4.6); To test and evaluate the quality of the TESI software (O4.7); To create a resource repository (O4.8). The following key activities will be carried out: (1, 2,) Definition of functional and technical specifications, (3) Design for the user interface (4, 5) Creation of a relational data base structure and setup of resource storage to optimize the efficiency for both costs and performance (6, 7, 8, 9, 10) Implement web-services for users (registration, management, authentication). All this involves a definition of categories to organize resources into groups and tags to attached them, the management of resources and the definition of instructions which guide users.(11) Interface on working (12) analysis of the results of the TESI software (13) To set up a repository of resources (library of expressive objects -images, audio and video).

WP5: Pilot Study

The aim of WP5 is to assess the TESI model and software system on their users -learners and tutors- to verify its efficacy, efficiency, functionality and usefulness to meet specific requirements for improving their social competences. Addressed through the following objectives: To design a quasi-experimental pilot study and to carry out the preliminary "TESI Software" training of tutors, care givers and parents (O5.1); To implement the TESI training software solution (O5.2); To analyze the results of the implementation of TESI (O5.3) and to provide a guide for the documents on the methodology of TESI (O5.4). The following key activities are to be carried out: (1, 2, 3) Selection of pilot sample -target groups- in school project partners, training activities and its assessment (4) Put into practice the TESI software (5) Analysis of data from the Pilot to confirm/refuse the hypotheses on the TESI system (6) Construction of a TESI educational methodology, a guide giving possibilities for designing, developing and offering expressive objects to support the social inclusion of disadvantaged learners.

WP6: Evaluation & Quality Assurance Plan

The aim of WP6 is to develop the quality assurance plan by addressing the following objectives: to establish internal monitoring and formative evaluation process (O6.1); to develop the Evaluation Plan and Strategy, taking into account preconditions, inputs, processes, results (O6.2) to put into the practice the TESI Evaluation Plan, which is reflected in the following key activities: (1, 2) Establishment of procedures for communication and reports (mailing, social media, networks) (3) Design the TESI evaluation plan to describe the cyclical nature of the evaluation process, its purpose, the framework of topics to be addressed, the key areas where evaluation is necessary, indicators, considering who should collect evidence, ways and procedures for recording evidences (4) Verification of the results of TESI results report decisions on improvement. The ISO 9001:2015 quality model will be used as reference. This model highlights the importance of risk-based thinking, the Plan Do Check and Act (PDCA) Cycle and an approach based on processes.

WP7: Broad dissemination of TESI Project

The aim of WP7 is to develop a dissemination plan by conducting a dissemination process. Activities will be carried out since the beginning of the project and will go on throughout its lifetime by addressing the following objectives: to disseminate multilingual materials (electronic and printed versions) (O7.1); to maintain a vigorous publicity (O7.2); to ensure that the TESI results are recognized among all target users at participating partners (O7.3); to present the final results from the study, (exhibitions included) (O7.4) to publish a Textbook that will include the results from TESI project (O7.5). The following key activities will be undertaken: (1) Design and maintenance of the TESI Web portal (2) Production of news (3) Organization of info-days (4) Organization of a final international conference and (5) preparation of a practical guide to design expressive objects for smart devices.

WP8: Exploitation of TESI Project Results

The aim of WP8 is to ensure exploitation activities and sustainability of the results of TESI by fulfilling the following objectives: to create a Virtual Environment for Support and Integration –the VESI platform for communication of TESI users (O8.1); to monitor the adaptation of TESI and smart technologies to disabled users and to upscale the good practices (O8.3). The following key activities will be carried out (1) Creation of the VESI platform to share their social inclusive issues; support and be supported a well as receiving information by building a database of differentiated groups of interconnected users (2) Preparation of reports and newsletters (monitoring and performance reports) and (3) Proposals of training activities for other targets groups of TESI.

3.2 Participants on the TESI Project

Interdisciplinary projects are usually more time-consuming as they need an additional effort to set up an integrated team and concept (Net4Society, 2014) but in turn they bring with them a rich variety of theoretical perspectives and methodologies, as the experts who take part in these types of projects provide different references to theory formation (Scanlon and Conole, 2018). A wider international consortium - including experienced EU partner universities - assists partners at the different stages of use and integration of ICT in education and enhances their effort to modernize their educational programs intended to the integration of disadvantaged groups of learners. Partners in the TESI project are: EU Partner Universities: (1) Plovdiv University PU (2) The National Distance Education University UNED (3)Craiova University UCV (4) The Jan Kochanowski U UJK. Supporting schools: (5) Scola Gimmaziala Speciala SF. Mina Craiova MINA (6) OS-Matosa Josip Matos PS. (7) Special School for Students with hearing Impairments CHD Belinov-Plovdiv. Association and Centers that work with learners with disabilities: (8) Association for Education & Development of Disabled People ASEDDEDIPE. Associated Partners include regional policy markers, work centers, organizations working with adults and a foundation: (9) the Municipality of Plovdiv (10) S-Ivenna (11) Paralelen svyat (12) the Regional Inspectorate of Ed. At the Ministry of Ed. and Science Vocational Training Center "Ekpedeytiki Kavalas" (13) Adult Training Center of the Municipality of Kavala (14) Fundación Docente Omnes (15) Volkshochschule Hannover (16) Eurocultura.

4. Results

The TESI project currently is on an early phase of its implementation. The results of the analysis of needs are being studied and the questionnaires designed to gather information from the different groups of users are being validated. However, as follows we advance the first results obtained.

4.1. The Project Management Centre -PMC-; Work and Risk Management Plans;, Evaluation & Quality Assurance Plans

The on-line project management center - PMC (see Figure 2) – has been created. This is a server to be used by all partners to ensure the effective exchange of information after their authentication with a password.

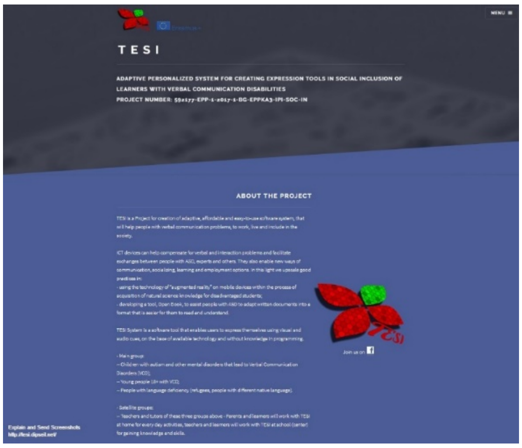

Figure 2: The TESI project (tesi.dipseil.net)

This platform counts with updated information of the project, the results of its different activities as well as the Work and Risk Management Plans and Evaluation & Quality Assurance Plans.

In order to ensure quality in the TESI project, all partners have agreed in adopting the following criteria, concepts and procedures (Figure 3).

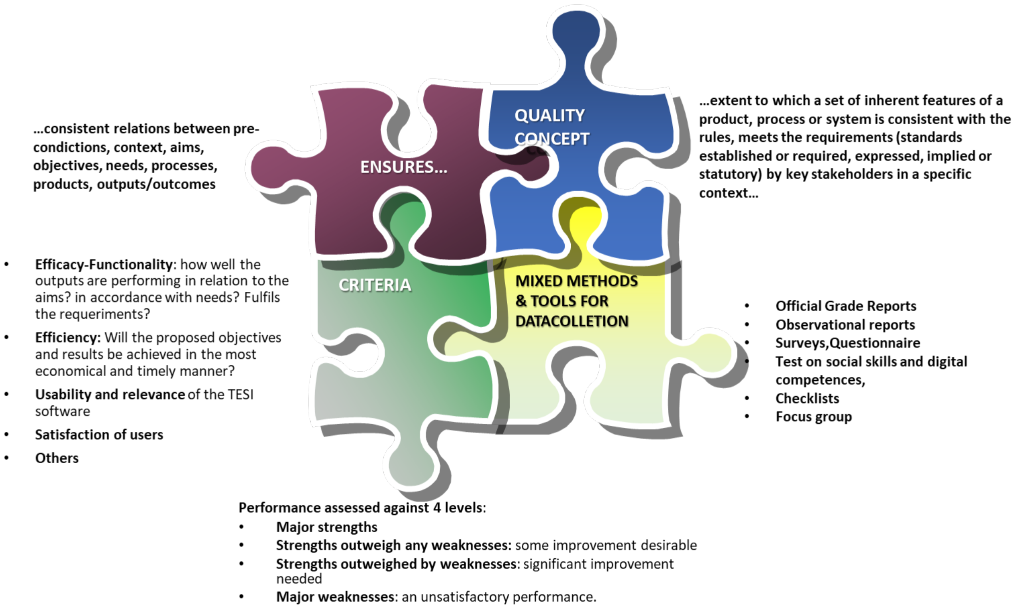

Figure 3: Evaluation and Quality Assurance of TESI: criteria, concepts and procedures

The design of the Quality Assurance Plan of the TESI Project is based on the ISO 9001:2015 model, adapted in all its phases and objectives – global and specific – thus resulting in the following model for quality assurance:

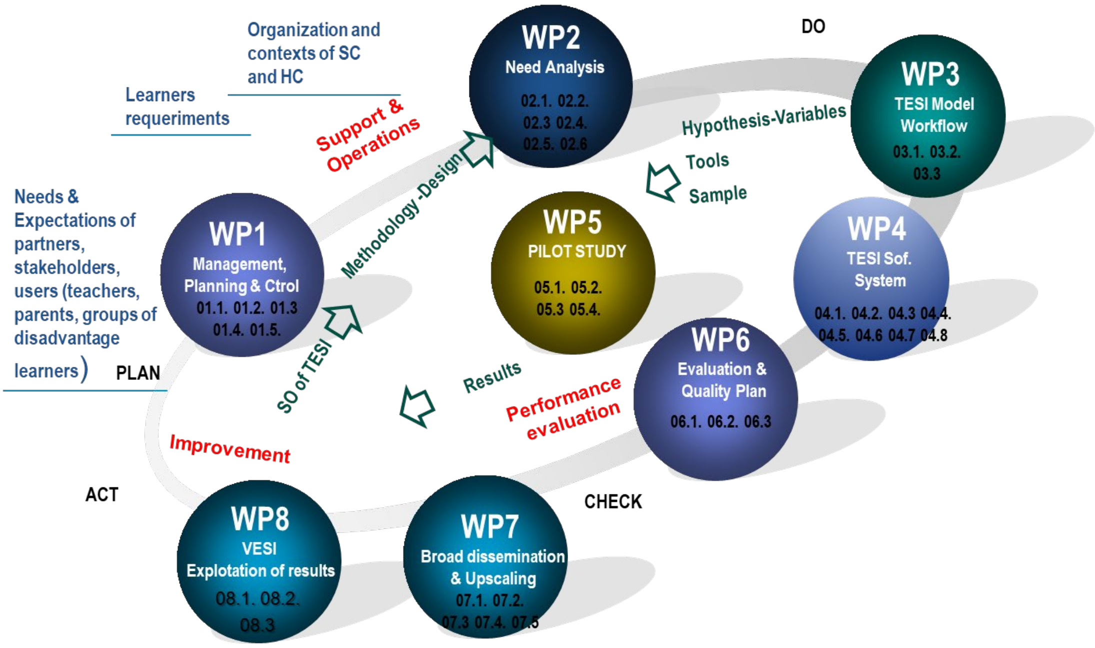

Figure 4: The Quality Model of TESI based on ISO 9001: 2015.

4.2. Key Evaluation Indicators of the TESI project

A system of key indicators has been designed based on the objectives of each WP. They take into account the aforementioned quality assurance criteria and they relate all the variables of the TESI project, as well as being the basis for the creation of the questionnaires designed to gather information of each WP (Table 1). From this indicators we chose several items from their constructs. Each item is a declarative statement where the respondent is asked to express their agreement using a five-point Likert scale. Currently we are validating the questionnaires addressed to the groups of users: direct users -VCD- and Tutors -parents, educators, university students and system administrators.

Table 1: Key Evaluation Indicators of each Work Package (WP)

WP	Topics	Indicators
WP1 Management Planning & Control	PMC Tool	1. 1. Effective use 1.2. Accessible deliverables layout and Templates 1.3. On-line control & review of possibilities
	Planning & control	1.4 Adequate definition of Work Plan functions based on tasks, responsibilities 1.5. Adequate definition of Risk Management Plan (detection, analyses, management and monitoring –unresolved, resolved) 1.6. Adopt appropriate management processes to cope with difficulties in project (adjustment or corrective actions to be carried out) 1.7. Develop & review the different phases of the project 1.8. Activate, as well as partners, the scheduled controls to meet formal requirements of the project 1.9. Appropriate control of Budget (availability of resources)

	Coordination and Communication among partners	1.10. Appropriateness of the coordination carried out 1.11. Effectiveness of communication channels 3.3. Effective assistance and recommendations to the project`s team in its effort of producing results of the highest quality; 1.12. Appropriate and effective kick-off meetings (useful, participative
	Reports	1.13. Useful, suitable costs, efforts, interim and final reports 1.14. Relevance of changes in past project activities 1.15. Relevant findings
WP2 Need Analysis	Needs profiling	2.1. Efficiency of processes on needs analysis 2.2. Appropriate data collecting methodology 2.3. Communication skills possibilities & potential needs 2.4. ICT usage/digital competence 2.5. Prior ICT knowledge
	Meeting needs & requirements of students and other users	2.6. Relevant needs-requirements articulation 2.7. Contextualized list of needs and requirements
	Didactic Model	2.8. Appropriate learning mechanism to acquire knowledge, communication skills and digital competences 2.9. Appropriate choice of methods and training techniques
	Other needs	2.10. Others needs of groups at risk of social exclusion related to language and communication skills.
WP3 TESI Model	Development of the TESI Workflow model	3.1. Appropriate identification of the components of the TESI Model taking account the profiles of needs of the target groups, the educational capabilities of the expressive tools, training results and software requirements 3.2. Useful design of educational scenarios 3.3. Quality of components of the TESI model Teachers: attitudes and prejudices toward problems related to the M-learning. Teachers: Use of innovative methods
	Design of TESI Model	4.3. 4.3. Effectiveness, functionality, efficiency 4.4. Potential to improve social integration in daily life- leisure time contexts (sharing information) 4.5. Potential to increase participation in social activities 4.6. Potential to facilitate peer interaction 4.7. Adaptability, flexibility to be adapted to the learning style 4.8. Accessibility 4.9. Suitable library of resources
	Documentation of the TESI Model	4.10. Relevant guidelines to users (instructions on how you must act) 4.11. Extent and appropriateness of information
WP4 TESI System	TESI Software System	4.1. Appropriateness of specifications (functional, technical) 4.2. Perceived ease of ICT use: useful instructions to enable users to express themselves using visual and audio tools 4.3. Perceived ICT usefulness: students, parents, teachers 4.4. Level of satisfaction of users on the website 4.5. Interface suitable for users, database, storage of resources 4.6. Special arrangements for users support, taking into account their needs and the TESI Workflow model 4.7 Appropriateness of selection of measuring instruments to test the preliminary version of the software

4.3. Population sample for the pilot study, analysis of needs and hypotheses

A pilot study will be conducted in the following phase of the project to assess the TESI Model and software system. The population sample is composed of disadvantaged groups of learners with verbal communication disabilities: Down syndrome, language and speech impairments, autism, developmental delays, learning disorders, foreigners and migrants with inadequate language and communications skills. Three target groups consisting of students with verbal impairments, their teachers and parents were studied in order to identify their global and specific needs for improving their communication in daily life. The results of our study will be used to design an application for mobile devices which uses a series of images to express basic sentences and actions. After an intentional sampling process among the supporting schools (Scola Mina Craiova, OS-Matosa Josip, Special School for Students with hearing Impairments Belinov, Association and Center for work with learners with disabilities and Association for Education & Development of Disable People), the final pilot sample consists of: 44 students (33 male, 11 female) aged between 7 and 45 years; 70 parents (39 female, 31 male) and 61 teachers (51 female and 20 male). The first set of preliminary results of the analysis of needs can be seen in Figure 5.

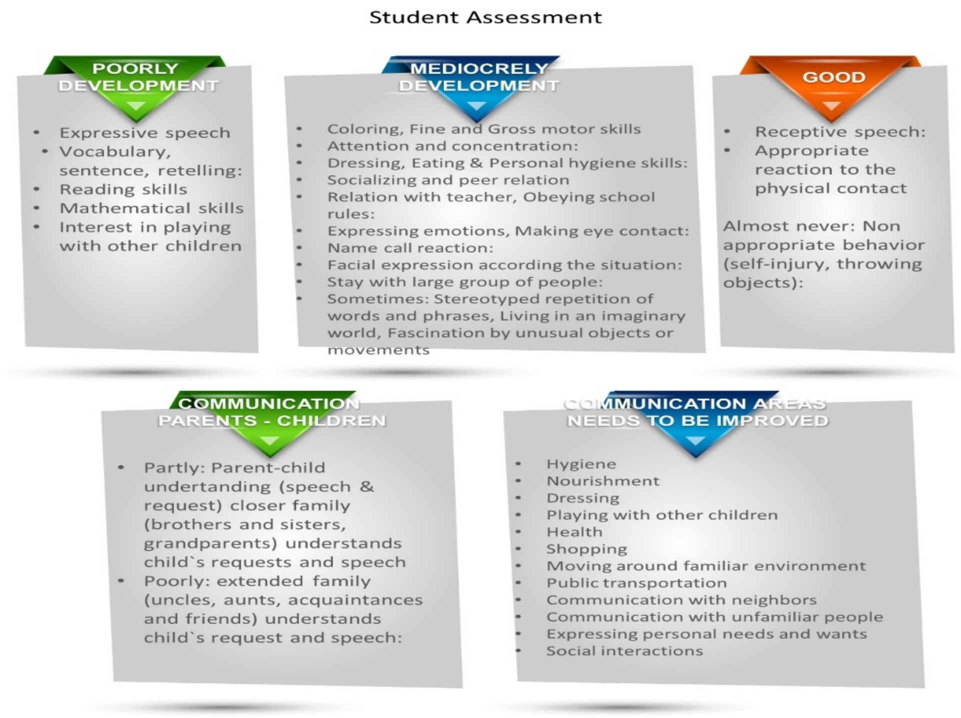

Figure 5: Analysis of needs, preliminary results

On the other hand, the main hypotheses and variables to be studied in the pilot test have already been agree by the partners of the project:

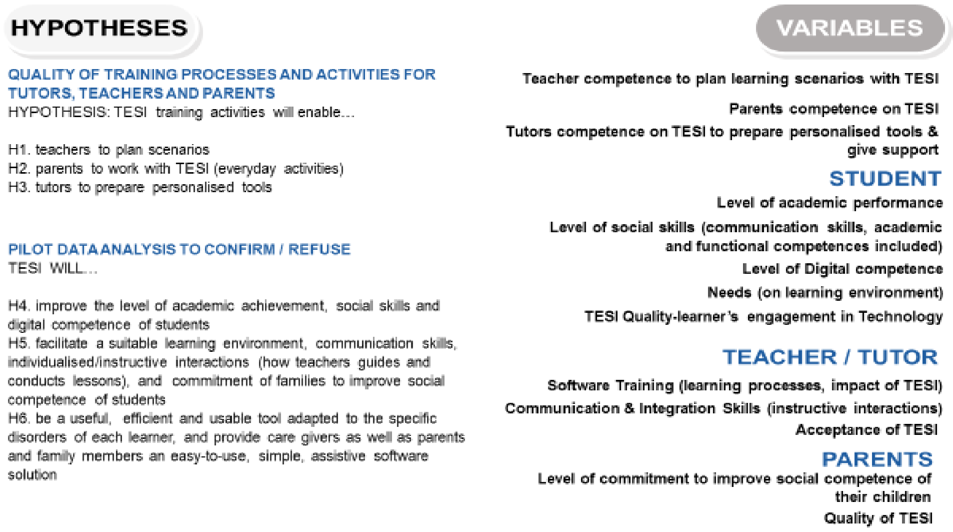

Figure 6: Main hypotheses and variables of the Pilot Test

4.4. The TESI Model Workflow & Software System

We designed a didactic model according to the previous specific learning and communication needs of diverse groups of users. The development of this conceptual model is based on the specifics of target groups training, the features of the software used, the educational capabilities of the expressive tools, the particularities of presenting digital objects and the access to them from smart devices as well as the instruments used for assessing the results of training with expressive tools for the different target groups. This model describes the main functionalities of the software - what users can do with the system and which concepts they need to be aware of. The TESI software consists of two end-user applications: (1) A mobile application for users with communication difficulties, which runs on Android, iOS and Windows and (2) A web-based application for parents and professionals, which works on the latest versions of Google Chrome, Apple Safari, Microsoft Edge and Internet Explorer. “Express Yourself” is a software tool that enables users to express themselves using visual and audio cues. Users start by selecting an item from a specific category / tag - Sentence Start. Then, they can choose objects from different categories to create a sequence of objects that describe a notion. Users should be able to send an expression (created sequence of expressive objects) to their tutors with a click of a button. Tutors will define resources that annotate certain cues and make them available to their users. Naturally, every resource is a cue, defined by its name and multimedia presentation. Currently, we count with the programming skills required for designing 3D graphics and writing high-level scripting code in XML.

5. Conclusions

Effective learning takes into account equity and quality in teaching and learning (Dumont, Istance and Benavides, 2010). Assistive technology interventions can be helpful for adolescents and adults with learning disabilities, but interventions need to be carefully compared, and customized to the individual (Foti, 2014; Perelmutter, McGregor and Gordon, 2017). TESI, an Adaptative Personalized System for creating Expression Tools in Social Inclusion of disadvantaged learners provides a software solution to offer opportunities for improvement the social competence of students with verbal and communication disabilities. The TESI Project, as described above, may identify barriers and challenges for effective implementation of mobile technologies with great potential both inside and outside classrooms.

The TESI project is currently being implemented, therefore the preliminary results on planning, evaluation & quality assurance plans, profile of needs and the TESI model workflow and software system have been presented in this paper. Future outcomes will be the reports on the pilot study to test the hypothesis and learning materials, case studies and textbook entitled "Tools to express yourself in social inclusion" that may be considered useful tools and examples of good practices in m-Learning.
To conclude we can say that TESI offers added value to other professions, socialized schools and umbrella organizations taking part in this project. As well, VESI ensures the sustainability of its results and resources.

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Transforming Higher Education with Blended Learning: Experiences from a BA Program in Theology Targeting Part-Time Students

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Abstract
According to current research in educational technology, blended learning has become "the new normal" (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). In light of this global development, even traditional "brick-and-mortar" universities work on creating new learning designs to meet their students' needs for flexibility, mostly concerning work/life/study balance and opportunities for lifelong learning. In October 2017 the Faculty of Catholic Theology at the University of Graz in Austria conceived the university's first blended learning bachelor program. It targets non-traditional adult learners and part-time students in Austria and neighboring German-speaking countries, who need the flexibility of a blended learning design to seek a degree, and who largely work remotely, instead of being on campus. This paper sets out to discuss the first year in review of this flagship initiative, including challenges faced and lessons learned. Additionally, the authors offer guiding questions for how to transform traditional face-to-face (F2F) learning designs into hybrid settings that cater to both students' needs and teachers' competences. The authors use data from student surveys and interviews as well as interviews with faculty members and other stakeholders, to give insights into the process of implementation that could be used for future projects in blended learning, particularly in on-campus higher education institutions (HEIs).

Keywords: Blended learning, distance learning, higher education, learning design, evaluation, part-time students

1. Introduction

Digital transformation and digitalization are political buzzwords and the metaphor "education 4.0" is both cherished and feared as we enter the fourth industrial revolution and prepare future generations for living and working in a new digital world. Ideas for what such an education and its corresponding institutions should look like are currently negotiated on different levels (European Commission, 2018; Henderikx & Jansen, 2018; Blackboard, 2017). In Austria, the strategy for digital education is seen as a blueprint for improving digital competences and infrastructure across all sectors of education (BMBWF, 2018). Hence, the digital economy even affects traditional "brick-and-mortar" higher education institutions (HEIs).

The University of Graz, Austria's second oldest and second-largest university (founded in 1585 with currently about 32,500 students across six faculties[1]) continues to define itself as a traditional on-campus university while adopting new ways of teaching and learning in the twenty-first century. Technology-enhanced learning (TEL) is encouraged and supported by the Center for Digital Teaching and Learning and the university's centralized IT Department as well as in the form of incentives, including a teaching excellence award for classes that utilize TEL and an e-tutor training program for students to assist faculty members. The university's e-learning strategy (Universität Graz, 2015) follows a "pedagogy first" approach and aims at supporting faculty members through ongoing trainings and professional development. Together with Graz University of Technology, the University of Graz also hosts and creates content for Austria's leading MOOC platform "iMooX" (Neuböck, Kopp, & Ebner, 2015). At the same time, only about one quarter of the classes in the course catalog use a virtual learning environment (VLE) to complement or partially substitute face-to-face (F2F) teaching and blended learning study programs are in its infancy.[2] Aside from a few part-time education programs offered through the university's life-long learning center and selected courses by "early adopters," teaching is done F2F, rather than in synchronous or asynchronous online settings.

In an attempt to attract a wider target group, but also largely as a consequence of decreasing student numbers, the Faculty of Catholic Theology set up the university's first full blended learning bachelor of arts (BA) program in the winter semester of 2017/18. A pilot project that was decided "top down" at the level of the faculty, the program targets non-traditional adult learners (NALs)[3] in Austria and neighboring German-speaking countries, who need the flexibility of a blended learning design to seek a degree, and who largely pursue their studies part-time and remotely, instead of being on campus.

This paper sets out to discuss the first year in review of this flagship initiative, including challenges faced and lessons learned, and offers recommendations and guiding questions for how to transform traditional F2F learning designs into hybrid settings that cater to both students' needs and teachers' competences regarding digital media and technology. The authors use data from student surveys and interviews as well as interviews with faculty members and members of the program management, to give insights into the process of implementation that could be used for future projects in blended learning at other on-campus universities.

2. Distance and Blended Learning in Context

Distance education has a long tradition. As early as 1728 an advertisement for correspondence courses in stenography could be found in the Boston Gazette: "[Any] Persons in the Country desirous to Learn this Art may be having the several Lessons sent weekly to them, be as perfectly instructed as those that live in Boston" (Battenberg, 1971, p. 44). With the establishment of the World Wide Web, technologies found their way into distance education. In the 1990s, for example, the first computer conferencing systems were introduced at Open University UK (Mason, 1998). These systems eventually evolved into today's (VLEs)[4], gaining more and

[1] The English term the university uses for its colleges or schools is *faculty* ("Fakultät" in German), which should not be confused with individual members of the academic staff, subsequently referred to as faculty members or instructors.
[2] The university has been using Moodle as its central VLE since 2012. Of approximately 12,000 courses offered between March 2017 and January 2018 only 22 percent had a Moodle course. Often, the VLE is designed as an add-on element to F2F lectures and seminars, with some instructors only using the platform as a repository for course materials.
[3] While definitions vary based on country and context, non-traditional adult learners (NALs) or non-traditional students, generally have one or more of the following characteristics: aged 25 years or older; works full-time; is financially independent and does not qualify for financial aid; has non-spousal dependents, such as children or elderly family members; is a single parent; has a nontraditional educational trajectory, such as delaying enrollment in higher education institutions (Chen, 2017; Pechar & Wroblewski, 2012).
[4] The terms VLE and LMS (Learning Management System) are often used interchangeably, describing software systems that combine "aspects of the delivery of materials and of communication" (Jones, 2015, p. 151).

more pedagogic value through technological innovations such as Web 2.0 and mobile learning (Siemens, Gasevic, & Dawson, 2015). Thus, VLEs developed from a compilation of different computer applications to frameworks that handle all aspects of the learning process (Watson & Watson, 2007). Nowadays, they have become established in higher education (Gaebel, Kupriyanova, Morais, & Colucci, 2014), not least because they serve as a basis for the pedagogical model of blended learning.

2.1 Blended Learning as a Technology-Driven Pedagogical Model

According to current research in educational technology, blended learning has become "the new normal" (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). The NMC Horizon Report 2017 for Higher Education goes a step further and states that "if institutions do not already have robust strategies for integrating these now pervasive approaches, then they simply will not survive" (Adams Becker et al., 2017, p. 2). The ubiquity of blended learning is well-documented by myriad studies, yet the definitions of the term are often ambiguous and refer to different practices (Smith & Hill, 2018). Garrison and Vaughan (2008) broadly talk about the "thoughtful fusion of F2F and online learning experiences" (p. 5), yet do not indicate what exactly would constitute such fusion. Valiathan's (2002) definition adds an important distinction between synchronous and asynchronous learning in saying that blended learning "mixes various event-based activities including face-to-face classrooms, live e-learning and self-paced learning" (p. 50). Kerres and De Witt (2010), in turn, see blended learning as the "mix of didactical methods (expository presentations, discovery learning, cooperative learning, etc.) … [and] delivery formats (personal communication, publishing, broadcasting, etc.)" (p. 103), thus highlighting forms and methods of teaching and the use of different types of media. Benefits as well as challenges of blended learning are widely-documented too, with the overall consensus being that blended learning assists learners in the learning process, especially if they trigger interactive and collaborative processes (Kenney & Newcombe, 2011). Blended learning offers the opportunity to outsource individual learning phases or learning processes, which allows students to learn more independently in terms of time and place. This is an advantage for full-time students, but, above all, it benefits those who can only study part-time and/or those who need access to their learning materials off campus.

2.2 Challenges of Blended Learning

The development of blended learning scenarios and their implementation in study programs are rather complex processes (Y. Wang, Han, & Yang, 2015; Stein, 2014). It is important that the design of blended learning is aligned with the needs of stakeholders. This includes students as well as teachers/instructors, and the management/administrative levels of HEIs. At the same time, pedagogical, technological, and institutional aspects for the use of blended learning need to be considered (Ma'arop & Embi, 2016). In the following, these three aspects form the framework for blended learning to discuss potential challenges.

Pedagogical level

On the pedagogical level the use of blended learning has to be considered both from the point of view of instructors and from the perspective of the students. Required components of blended learning arrangements in higher education have been documented widely (Garrison & Vaughan, 2008), yet design approaches vary greatly (Alammary, Sheard, & Carbone, 2014). In their comprehensive literature review Boelens, De Wever, and Voet (2017) identify four key challenges in this context: Incorporating flexibility, facilitating interaction, facilitating student´s learning processes, and fostering an affective climate. Increased flexibility is a key feature of the online component of blended learning, especially when non-traditional adult learners are addressed, because they need at least some level of control over time, place, path, and pace of learning (Horn & Staker, 2014). For (seasoned) instructors this means that they have to design blended learning classes differently than their F2F classes, and carefully consider which contents, pedagogical methods, and technological tools are suitable for both context and target group. Since this design differs from traditional on-campus settings, instructors need to invest additional time to adapt their "traditional" teaching and to find the proper design that corresponds with the intended target group. This includes, for example, rephrasing learning objectives, redeveloping assignments, and revising syllabi. Apart from that, instructors need to acquire new skills, for example when it comes to the pedagogical and technical uses of a VLE.

During online phases, the interaction between instructors and students, or among students themselves, takes place predominantly in written and asynchronous form. It is therefore essential to build appropriate communication channels and to facilitate the expected interaction. This can be achieved, for example, through the use of online forums or through individual support via email. Here, clear rules are important on what is being communicated, in which form, and when. Asynchronous communication prevents immediate queries, for example if students do not understand an assignment. Thus, instructions must be formulated clearly and unambiguously, with one well-known framework being that of Gilly Salmon's "e-tivities" (Salmon, 2013). Moreover, online communication tends to reduce social interaction, which means that students have fewer opportunities to exchange ideas and experiences. This disproportionately affects part-time and distance program students who cannot regularly socialize on campus. These groups should be supported in either using the provided platforms or encouraged to organize their own channels of communication. At the beginning of each course, it is further advisable to set aside time to establish and explain students' access to the VLE and engage in a phase of online socialization (Salmon, 2011).

In blended learning scenarios, students have more autonomy about when, where, and how they learn. But that requires a high level of discipline and engagement on the part of the students. During online phases it is their own responsibility to plan their study times, to participate in online discussions, and to complete their tasks on time. By facilitating the learning process, instructors can help them to deal with these issues. At the beginning of a blended learning course, organizational information and course expectations should be communicated, and students should be familiarized with the technology used. Throughout the course, student activities should be monitored regularly by instructors, online tutors, and student assistants. While individual learning progress can be measured with the help of (automated) self-assessments and online progress tests, timely, personalized instructor feedback on tasks and assignments is indispensable. In this context, online participation can be increased by designing activities as group work and by setting up peer review processes.

Ample and clear communication, the ability to cope with learning goals, and opportunities for socialization are key factors in keeping students' motivation high. If these factors are not sufficiently taken into account, there is an increased risk of students dropping out. This danger can be counteracted by several actions that foster a positive climate: creating opportunities for socializing and networking at the beginning of the course/study program, implementation of thought-provoking questions to foster peer discussion throughout the semester, game-based activities, or the initiation of problem-based learning approaches (Kintu, Zhu, & Kagambe, 2017).

Technological level

The implementation of online phases during blended learning classes requires the use of (web-based) technologies (Henderson, Selwyn, & Aston, 2017). In higher education, a VLE is often the first choice for this, because in addition to providing teaching materials centrally, VLEs also offer tools for interaction, feedback, and collaboration. Since pedagogy should drive technology and not the other way around (Oliver & Stallings, 2014), utilizing tools that support these communicative processes online is essential. Furthermore, VLEs are increasingly being used for the analysis of student data, which offers students additional support in the form of learning analytics (Naidu, Singh, Hasan, & Al Hadrami, 2017). However, it must be ensured that teachers as well as students can manage the VLE properly, both pedagogically and technologically. If these skills are not developed enough, it is necessary to provide appropriate training and support.

Specific training and support is needed as learning content is increasingly offered in audiovisual form. Videos now constitute a central element in blended learning scenarios when it comes to knowledge transfer. Although a host of learning materials are available on the Internet, academic staff often produce new videos due to specific contexts and contents. Keeping that in mind, the (pedagogical) design of the videos is of crucial importance. Generally speaking, videos should be short, articulate, and condensed (Guo, Kim, & Rubin, 2014). Since this differs from traditional academic teaching, instructors need to be trained on how to prepare a video unit and how to present the content. Although recent studies appear inconclusive on whether this is the best format (J. Wang & Antonenko, 2017), many videos integrate a video of the instructor as a "talking head." Thus, instructors have to be given on-camera training.

By producing and providing videos, instructors – at least those working in central Europe – face several challenges (Kopp, Ebner, & Dorfer-Novak, 2014): They struggle with copyright issues (especially when videos should be made available on the Internet); video production increases their workload without giving them any real benefits concerning their reputation or career; they do not get additional financing; and they need ongoing support from other departments that, for example, provide legal advice or video production services. Since videos are an essential part of blended learning scenarios, these obstacles have to be overcome in order to make it easier for instructors to do their jobs. In this context, the institutional level of HEIs plays a crucial role.

Institutional level

Although blended learning has a rather long tradition, it is still not adopted by traditional HEIs to its fullest and most effective extent. Apart from the reasons mentioned above, there are additional explanations located at the institutional level. First, decision makers do not devote enough interest to the topic. It is their responsibility to provide leadership, support, and resources, and to reward faculty members who are engaged in blended learning. Resources are important, not only regarding state-of-the-art technology but also in the form of additional staff, as one key success factor always mentioned in literature on implementing blended learning programs is comprehensive teacher and tutor training (Bowyer & Chambers, 2017). Second, in many cases there is no corresponding strategy or policy for the implementation of blended learning. However, according to Porter, Graham, Bodily, and Sandberg (2016), such a policy would have a great influence on the motivation of instructors to adopt blended learning, not least because they would have more backing from their institution and would not be left alone in their endeavors to best support their students.

Another challenge is to connect stakeholders at an institutional level (Vaughan et al., 2017). Such a network should include faculty members and students as well as representatives of the institutional management and the affected administrative and service units. The network could not only provide the basis for a valuable exchange of experience and knowledge, but also plan blended learning projects together. Collaboration becomes particularly crucial when not only individual classes but whole study programs are designed as blended learning. When that is the case, additional areas are affected, such as the adaptation of curricula, the central administration of the students, and the joint promotion of the study programs.

3. The Blended Learning BA at the University of Graz: A Year in Review

The blended learning BA program "Grundlagen theologischer Wissenschaft"[5] was first introduced at the University of Graz in the winter semester of 2017/18. It was primarily conceived as a possibility to acquire a

[5] In the absence of an English translation, the program's name could be translated to "Basics of Theological Science."

post-secondary degree for either individuals already working with the Diocese or with church-affiliated organizations, or those who are simply interested in the subject matter and cannot, for whatever reason, study on campus full-time. With a traditional F2F curriculum already in place before, the new study program was adapted to a blended learning setting with reduced on-campus class time (usually three to four Fridays per semester) and the use of the VLE Moodle for asynchronous online teaching. For some of these classes a flipped classroom model was used with micro-learning videos created specifically for this target group. Two classes were taught as summer intensives in a F2F format (students had to come to campus for one week in July and September, respectively). Lastly, for some cross-curricular lecture classes that took place on a weekly basis, the lectures were recorded and made available on Moodle. The re-design of the existing modules and courses was a collaborative process between faculty members and instructional design specialists. Support for faculty members was provided also with the production of digital learning objects and materials, some of which were created as open educational resources (OER). Course development is ongoing as the program now enters its second year, by utilizing the iterative processes of the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model of instructional design as a heuristic framework (Branch 2009).

In the first year, approximately 40 students officially enrolled, with about 30 students actively pursuing their studies. This by far exceeded all expectations and was attributed largely to a strong publicity campaign. By the end of the first year, preliminary data based on course outcomes (grades and activity) suggests a drop-out rate of approximately one third of those that had been previously active. With retention rates of online and distance programs being much lower than in conventional education (Simpson, 2013), this was to be expected.

In line with existing research that highlights the importance of "ongoing evaluation" for the successful implementation of blended learning programs in the long run (Bowyer & Chambers, 2017), it was clear from the beginning that regular feedback had to be obtained from students and faculty members alike. In this section we first describe how the empirical data was collected and analyzed for this study. Then, we present five key aspects that were extracted from the qualitative and quantitative material: role of students, role of faculty members, pedagogical aspects, technological aspects, and role of the institution. These intersecting aspects together should serve as a "work in progress" canvas for evaluating and further developing blended learning programs at traditional on-campus HEIs.

3.1 Study Design and Data Analysis

All enrolled blended learning BA students were given the opportunity to complete an online survey at the end of the winter and summer semester, respectively. The questionnaires used for these two evaluations contained both closed and open-ended questions, with a focus on learner satisfaction. At the end of the summer semester, students had the possibility to sign up for a more in-depth group interview with two of the three authors. Four students participated in this discussion that lasted over one hour and was subsequently transcribed. In addition to collecting student perspectives and opinions, three F2F interviews and one telephone interview with instructors were conducted by the second author of this paper, with two of the instructors also being members of the program management team. These interviews were transcribed and coded together with the comments on the open questions of the online student survey. The empirical data was coded and systematically reduced to five core aspects, with the analysis of the codes following the method of a qualitative content analysis (Mayring, 2010). Khan's (n.d.) e-learning framework and Ozkan's and Koseler's (2009) Hexagonal E-Learning Assessment Model (HELAM) served as a useful orientation in the analysis of the collected empirical data. The following section goes into detail with our lessons learned based on five core aspects and provides some critical self-reflection in the form of guiding questions.

3.2 Lessons Learned: Course Design and Implementation

As Bowyer & Chambers (2017) maintained, the implementation of a blended learning program "requires coherent and co-ordinated [sic] planning to be successful" (p. 18). This needs to be based on ongoing evaluation, so that programs can be continuously adapted to remain successful. In this section we will concentrate on the interconnected roles of students and faculty members, the learning design embedded within the larger context of pedagogy, and corresponding technological aspects. While the role of the institution is, of course, essential in this context as well, we will take it out of the equation, because the general framework introduced in chapter 2.2 applies to the specifics of this BA program too.

Role of students / Student practices and attitudes

Survey data shows that for most students enrolling in this blended learning BA was not only their first contact with the University of Graz but with HEIs altogether, as most do not have prior postsecondary degrees. In addition to their lack of experience with university culture, students' limited time resources and reduced physical presence on campus made it harder to get acquainted with the system and establish important social support networks. Consequently, there was a misconception concerning the workload among the interviewed students. They were misled by the definition of the program being "part-time," suggesting compatibility with work and family. The word "part-time," however, only refers to obligatory in-class time being reduced to a few days per semester to enable working students or those who travel from afar to attend, not necessarily to the idea that studying can be easily done "on the side." This led to some frustration among the students, as one comment from the online survey showed: "The study program is interesting, but next to my job I cannot attend all lectures and seminars because the amount of work is tremendous and time-consuming for me. I want to also be able to finish the seminars and pass the exams. That's why I couldn't take all classes offered in the summer semester. During exchanges with other students that's often a point of discussion."

Underestimating the workload and inexperience with the system led students to the expectation of being able to do the full load of courses offered – in addition to their professional and private obligations – something the program management had not necessarily intended them to do. As our evaluation revealed, students took information on which courses were offered per semester as suggested and did not initially have the skills to individually decide what workload would be realistic for their own personal circumstances. Thus, although the possibility to study while working (often full-time) was one of the main motivations for enrollment, this was also one of the key challenges for students. As one student explained, "Well, it took a while to get the hang of it. In the beginning we all started pretty enthusiastically and so in the first semester we signed up for everything that was offered, but then we realized, well that's not going to be manageable."

Exacerbating the situation, in comparison with other forms of continuing education, a university degree program certainly demands more self-organization, autonomous work, and time management skills, all of which the students vastly underestimated. Another side effect of the students lacking experience and contact to more senior peers on campus was they did not know how much time they needed for reading required course materials, preparing assignments, writing research papers, and studying for exams. Our data shows that in trying to maintain a work-life-balance, some students use their evenings after work for keeping up with their studies, while others only find time on the weekends, often having to mix their study practices with family duties and household responsibilities. As the interviews revealed, it is not unusual for students to watch lecture recordings while ironing their clothes, cooking meals, or while their children are playing in the same room.

Overall, what became clear in the first-year evaluation is that part-time students need more guidance with regard to workload, mainly as they often compare themselves to "full-time" students and are not really familiar with the meaning of the European Credit Transfer System (ECTS). One student reflected on a striking experience she had: “When you look at the ECTS credits, you see it’s essentially a regular study program. That’s when my girls at home, who also studied, looked at me and said, ‘Mom, how are you going to do that? Are you crazy? That’s never going to work out. Forget it!’ … So I’m still not sure, is this going to work out or not?”

Many students are still in the process of developing their independent study skills, which takes more time without the opportunity to rely on the experiences of other students in the same program. To a certain extent, faculty members can assist students in developing these skills and strengthen their self-efficacy with clear course design, effective communication and – most importantly – time tables as well as estimates of students’ workload. What would further be useful is more interaction and communication with peers and the election of a student group representative. This person could – as the program continues to grow – make more realistic, personalized recommendations regarding workload from the perspective of a peer than the dean of studies, who needs to follow the more general recommendations of the curriculum.

Despite efforts on behalf of the program management to offer students a space to connect online, which was realized in the form of a separate Moodle course that provided administrative information and an open discussion forum, it seemed that students were reluctant to use the VLE for informal communication and the feeling of being part of a learning community was not as pronounced as anticipated. Insecurity, few or no prior university experiences, divergent standards known from other educational formats, obligations besides studying, limited time resources, and overall different standards/expectations because of their life experience and their age sometimes led to student behavior that faculty members and the program management interpreted as passive. One faculty member even shared their impression that the students see themselves as clients of the university: “What we found out in a feedback discussion, in an oral midterm evaluation, is that students have a very strong sense of themselves as customers. Well, that sense is much stronger than with regular, with young students. … Yes, I use this term [of customers] because at least in this oral feedback round the student behavior was very much like this: We have enrolled in this program, you told us it is compatible with work … now you have to give us this and that.” This interpreted sense of “entitlement” may be due to the fact that non-traditional adult learners come with a lot of needs that are different from those of full-time students who have just graduated from high school.

Among the needs students expressed in interviews and online evaluations were: acknowledgement as students of “equal value” to full-time students on campus, appreciation as individuals and understanding for life commitments outside the university, information on courses and F2F meetings as early as possible, respect for holidays as time to recharge and spend time with family, a gentle introduction to the scientific discourse (especially to conventions of academic writing), additional course materials (especially lecture notes), fast exam grading, repeated VLE training, and a larger number of electives offered as blended learning courses.

All this leads to four guiding questions that should be taken into consideration when implementing or trying to improve a blended learning program, as learner satisfaction is linked to the success of the program overall:

- *How do students see themselves and their roles as students? What expectations do they have towards the program management/the faculty members?*
- *How can expectations of students and instructors/the program management be brought together? What needs to be done if they do not align?*
- *How can students be supported to exchange experiences, to reflect on the organization of their studies, and to learn from each other?*
- *How can a sense of student community be created within a blended learning study program?*

Role of faculty members / Faculty member practices and attitudes

When evaluating blended learning programs, the dominant focus tends to be on the students. However, knowing the perspective of faculty members is as important for the program's success. Therefore, when designing and implementing a blended learning program, faculty's attitudes – what we term their "dis/engagement" with blended learning – have to be considered from the start.

In our evaluation, some (senior) faculty members expressed concern about their lack of digital competences. Additionally, they were skeptical about their workload in this new program, about learning outcomes, and about the lack of F2F interaction in blended learning settings. Reluctance to include blended learning was also based on a lack of motivation to put extra effort into teaching, a general resistance against change, the fear of empty lecture rooms, and the concern to become redundant as an instructor. As one faculty member put it, "Another thing that creates a little bit of insecurity are the videos because there is a little bit of fear that the instructors, once they are always video-taped, do not have to teach the courses anymore and instead are more or less replaced. That might be an unreal or unreasonable fear, but it exists in a certain way. … I do not know how it will develop, but there is a certain uncertainty or a certain skepticism here."

Other instructors expressed great interest in the new challenge and were open to trying out something new. The collaborative potential of the VLE was something one instructor particularly enjoyed, "It was fun to enter a new field with other people, giving some input yourself but having it expanded by others." Of course, any positive previous experiences with blended learning affects instructors' motivation to do it again, as do affirmations by other colleagues in the program who can practice positive reinforcement as well as alleviate fears and concerns. This is where some instructors expressed more need for exchange and collaboration among each other, predominantly with regard to looking at how classes are designed on Moodle: "Everyone was kind of doing their own thing and one didn't really know what works for the others and what doesn't work. … I would wish for more collaboration [in this context]."

Interestingly, there exists the misconception among some instructors that teaching in a blended learning setting – even though it means more work upfront – would lead to reduced working hours in the long run, as the following quote reveals: "OK, it's true, I have to have all my videos recorded … before the semester starts. But I do that once and then I'm done with it for at least two rounds if I want to, and then I have my three, four face-to-face sessions and other than that, … I basically am done with teaching then." While it is true that less preparation time is needed if videos are re-used in subsequent semesters, supporting students in their learning takes new forms that are just as time-consuming as teaching practices in F2F programs. Lack of awareness for the changing role of teachers in blended learning settings shows that they need additional support and information to adjust their own expectations and attitudes so that ultimately students are best supported in their learning processes throughout the semester.

As diverse as the teachers' attitudes towards blended learning were the attitudes towards the students. Some were motivated and expected to get new input and stimulation from this new group of NALs, something perceived as particularly enriching for the study of Theology, as one faculty member put it: "They [students] have greater life experience and have also overcome crises. This is what they come with and the fact that they are able to contribute something based on their biography, their experiences, their crises. … I believe we'd have to highlight that and use it." Others harbored skepticism towards the students' competences, their motivations, and their level of engagement. Some interviewed faculty members perceived the blended learning BA students as more in need of support, less connected to each other, and – as mentioned above – more convinced of their role as customers than students in the other programs. Others saw them as a "black box," not knowing exactly what they needed or where they were at. Wherever negative impressions exist, a more thorough analysis is needed as to why that is the case, what this means for the instructors, and how negative attitudes can be changed. It is important to take instructors' concerns and their insecurities seriously, with several questions arising in this context:

- *How can instructors be motivated to participate in a blended learning program? What hinders motivation and engagement?*
- *How can the program management on the one hand, and the administrative staff familiar with TEL on the other hand assist instructors in understanding their changing roles as teachers?*
- *How can faculty members find out more about their group of students? How can teacher-student relationships be built with only minimal F2F time?*
- *How can prejudices regarding blended learning be countered? Whose responsibility is it to do this?*

Pedagogical aspects

A blended learning program that uses one VLE for all courses comes with several advantages for students: In the best case, the VLE archives all courses so that students can access course material, online discussions, and uploaded assignments at all times. Such an unlimited availability could be used by teachers to support sustainable student learning, for example, by referring to past courses and assigning students to connect current content with previous discussions/postings/homework and to reflect on their argumentative development. One student mentioned that communication with teachers on the VLE was easier to comprehend and clearer than email exchange. The most important advantage for students, however, is the flexibility with respect to time and place that a VLE gives them for their studying. It allows them to access course material anywhere and at any time, granting them the possibility to reconcile learning activities with their daily schedule of household responsibilities, family duties, and paid work. Learning videos can be watched as often as necessary, which is something that a teacher positively mentioned too. If a discussion revolved around something that was mentioned in the video, it was easy to watch and analyze the segment together.

As mentioned above, detailed knowledge of both students and instructors, their interests and motivations, as well as their skills and competences are central for designing a blended learning program, because the specific student and instructor needs differ from traditional F2F environments. In our empirical research, both groups were concerned with the contents provided in the VLE (specifically learning videos), in addition to communication and interaction. As one useful framework to interpret and evaluate our interview data in this context, we have drawn on Kerres' and De Witt's (2010) "3C-didactical components of a learning arrangement" (p. 103), which distinguishes between three components that should be a part of any VLE: 1) a content component (required and optional course materials), 2) a communication component (the forms and channels of communication that offer interpersonal exchange among students as well as between instructors and students), and 3) a constructive component (individual or collaborative learning activities and tasks). Based on our interview data we will subsequently focus on 1) and 2), but we acknowledge that 3) is an aspect we need to take into special account as we design our next round of evaluations.[6]

[6] One possible explanation for why our interviewees did not talk much about the constructive component of the blended learning program could be that the majority of classes in the first year were introductory lecture courses that typically offer fewer opportunities to engage in collaborative tasks and activities than seminars. Of course, when re-designing lecture classes for a blended learning setting, faculty members should be open to new ways of engaging their students, both individually and with each other.

When talking about the content provided on the VLE, students expressed a preference for short micro-learning videos that were produced for two lecture courses in the first year with the help of the university's Center for Digital Teaching and Learning. These "talking head" learning videos, shot in front of a green screen at the university's video production studio, simulated a virtual classroom with the instructor's presentation slides in the background, and were on average between 10 and 15 minutes long. Students acknowledged the additional work that it took to make these videos for them and suggested that this was not only a comprehensive and effective way to present course content with the videos serving as "orientation guides," but also showed the instructor's motivation to engage with blended learning and try out something new. Thus, both length and format were reasons for perceiving the short learning videos as a much better support for the learning process than simple lecture recordings, which are typically 90 minutes long. Nevertheless, lecture recordings were useful for students to explain required readings and give them a feeling of connectedness. As one student said, watching these recordings felt like "almost being there in person."

Good communication between students and instructors plays a major role for both of these groups, which is – of course – no surprise because it is one aspect that differs greatly between blended learning settings and F2F programs. Students highlighted the need for regular messages through the VLE to obtain personalized feedback, get reminders about assignment deadlines, and receive additional input during the online phases. All this is described by students as motivation to remain active in a course and in the program as a whole, as one of them insists: "Staying in touch with us regularly demands intensive working and results in commitment [on behalf of the students]." From the point of the students, the main responsibility for online student activity lies in the hands of the instructors who are expected to stimulate students through critical questions and other activities. This is an important finding because it reveals information on the attitudes and expectations of the students. More importantly, however, it also supports existing research on the effect of good "e-teaching," defined by Ellis, Ginns, and Pigott (2009) as "online feedback from the teacher about class activities or submitted written work, as well as online communication to keep students informed about matters," all in addition to the "e-moderation" of online discussions to promote collaborative online learning (p. 306).

Faculty members, too, have expectations when it comes to how they want to communicate with their students. With the Faculty of Catholic Theology being the smallest of the six faculties at the University of Graz, the student-teacher ratio is very low, and the relation between faculty members and students is usually stronger than at other faculties. Consequently, faculty members expressed a strong need to build relationships with their students in F2F interactions. One instructor said, "Well, for me, I partially live from the contact with the people, even in a lecture." As a result of this attitude, the blended learning BA program created a big challenge for those instructors that were used to getting to know their students in class or during their office hours, rather than online. Most instructors, especially senior faculty members, are not used to communication via online forums and lack the routine and experience to foster discussions in the VLE. Therefore, despite the technical possibilities and prior faculty training in e-teaching, some instructors remained rather passive in their online communication, which, in turn, led to less activity on behalf of the students, and resulted in both parties' dissatisfaction with the other group's perceived passivity.

To ameliorate this flaw in communication on both sides, it would need more faculty training on the elements of e-teaching on the one hand, and more socializing events between faculty members and students on the other hand. However, even though the interviewed students expressed the wish for more F2F contact with each other and with their instructors, they simultaneously doubted to have the time and motivation to participate in meetings and events outside of their course schedule.

Other points of discussion that came up in the interviews were of a more organizational nature regarding the VLE. Based on the heterogeneity of answers, these points will again be phrased as questions to consider when designing and implementing a blended learning program. Notably, there is never a way to satisfy all learners' needs, however, being aware of them can help making the right decisions for a particular context:

- *Should the entire course content immediately be visible and accessible in the VLE to give students a sense of the full workload and allow them to work at their individual pace, or should content be made available according to a set schedule to encourage working on smaller learning units at a time?*
- *If courses can only be offered as F2F short-term courses or (summer/winter) intensives, should they be held during holidays and semester breaks or should teaching only happen during the semester?*
- *Should assignment deadlines be set during or right after holidays and semester break so that students can work when classes are not in session (something that is common in full-time study programs) or should there be designated free times, recognizing part-time students' struggles to maintain a good work-life-balance based on their life circumstances?*
- *Should F2F exams be held all in one day to minimize students' time and effort to come to campus, or should exam dates be spread out to avoid work/study overload?*

Technological aspects

Technical difficulties and challenges in blended learning programs are usually viewed critically by students who depend on good functionality, high usability, and the reliability of the VLE and other technological tools used. Contrary to expectations and concerns on behalf of the program management, there were surprisingly few problems concerning technology. Neither students nor faculty members reported any major issues with getting used to the VLE, despite very divergent computer skills and almost no prior experience in working with Moodle. It is, of course, likely that this is a result of intensive and individualized coaching of faculty members, as well as a 90-minute Moodle workshop during the "welcome day" for students, both provided by the Center for Digital Teaching and Learning. This continuous support, financed by the university at an institutional level through the office of the Vice Rector for Studies and Teaching, prepared both instructors and students for their use of the VLE.

Additionally, faculty members did not have to create learning videos themselves, thus decreasing the risk of technological barriers and work overload, but instead were supported by an in-house multimedia production team responsible for production and post-production. Instructors further received on-camera training and assistance in preparing the contents for their videos (mostly with advice on structure and ways of promoting student engagement), as well as recommendations for the visual presentation of their content (slides, screencasts, etc.). The latter included awareness-raising on copyright issues and open educational resources. Instructors indicated that they expected such comprehensive support, in part because it helped them to alleviate their insecurities regarding the new and unfamiliar setting. This statement is representative of the tenor expressed: "Well, at the beginning I was pretty uncertain how I should tackle the whole thing, but then I was supported really well [by an instructional designer] and I received good suggestions and some training in Moodle. So then I was able to gradually familiarize myself with it [blended learning] and could develop my own initial concept for the class."

As a further service for students, the program management financed a student assistant who was available as an online tutor during designated office hours and via email. Even though this service was not used as extensively as anticipated in the first year, the evaluations show that students need more support, for example, with regard to use of online library services, such as e-books and online databases, so that access to literature is not restricted to physical presence at the library. As a result of the feedback received, from now on the online tutor will offer monthly online chats to discuss any technological barriers as well as any organizational matters, while simultaneously serving as an informal facilitator to connect students online.

Overall, the level of technology is strongly influenced by the university's financial means and the program's funding, tying in with the role of the institution, as indicated above. As guiding questions in this area, we consider the following as most important:

- *What kind of support do faculty members and students need to cope with technological aspects and technological challenges of blended learning?*
- *How can media and computer literacy be developed in light of scarce time resources?*
- *How can faculty members and students be assisted in coping with changing technologies, such as updates in the VLE that change the appearance of the interface, new tools that are implemented, etc.?*
- *How can the program management and other stakeholders offer incentives for faculty members to engage with technology themselves, rather than delegating these tasks to administrative assistants?*

4. Conclusion

Blended learning harbors great potentials for traditional "brick-and-mortar" HEIs who want to expand some of their programs to attract non-traditional students unable to engage in full-time studies. At the same time, the challenges when implementing such programs are significant, particularly when taking into consideration lack of experience with such a setting on the level of program management and the faculty members involved. Therefore, it is crucial to engage in frequent and ongoing evaluation of the design and implementation of such programs. The blended learning BA in Theology at the University of Graz offered such opportunities in the first year of the program. Surveys and interviews with students and faculty members revealed some gaps in expectations on both sides, which points to the need for additional information exchange between the groups involved. Part-time students need more support in their learning processes, particularly during online phases, as student motivation is higher when faculty members engage in different forms of e-teaching. As the program continues, the focus should remain on student satisfaction and engagement, particularly to address the issue of retention, but also take into consideration instructors' needs for ongoing support when it comes to (re-)designing their courses and setting up their VLEs.

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Understanding student paths in higher education blended-learning: beyond success and dropout

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Abstract
Blended-learning offers a flexibility that gives students constrained by distance or professional and family obligations the opportunity to enrol in higher-education programs and complete university degrees. However, dropout rates in distance learning programs tend to be higher and students tend to take longer than foreseen to complete their study programs (Xenos, Pierrakeas & Pintelas, 2002; Lee, Choi & Kim, 2013). Factors influencing dropout are often investigated through surveys and self-administered questionnaires to describe different student paths beyond typical student "success" or "dropout" characterizations. In this study administrative data from three blended-learning diplomas (continuing education, bachelor and master) in two institutions were used to investigate two measures of progress toward curriculum goals: time since initial enrolment and percentage of credits accumulated. We first aimed to identify critical instances that characterise common student paths and deviations that lead to certification, interruption of studies or dropout in blended-learning. We then crossed the path types and degrees of completion with available student characteristics to infer various student profiles. Using time and credits required to graduate to identify path deviations may provide insights on early warning signs of potential dropout and lead to seeing dropout, not only as academic failure but also as possible fulfilment of learning goals independent of certification. These results will allow us to understand various paths and goals students follow in higher-education blended-learning study programs to propose guidelines for designing curricula that are more open and flexible in their delivery while maintaining support for learning progression to achieve program learning outcomes.
Keywords: blended-learning, student paths, curriculum planning.
Keywords: dropout, blended-learning,

1. Introduction

By combining distance and face-to-face modes (Deschacht & Goeman, 2015), blended-learning offers non-traditional post-secondary students, that is, those that are constrained by factors related to professional or family commitments, or geographic location, the possibility to pursue a university degree. There is, however, an evident paradox in considering blended-learning as being particularly adapted to non-traditional students (Levy, 2007), while mentioning that the risk of dropout is also greater for this specific population, particularly in blended-contexts (Pierrakas, Xenos, Panagiotakopoulos & Vergidis, 2004). This paradox is apparent in the contradictory results observed in the literature. Some studies highlight blended-learning's the positive effects on examination results for non-traditional students (Deschacht & Goeman, 2015). Other studies highlight the higher dropout rates in blended-learning courses compared to traditional face-to-face courses (Levy, 2007). Faced with this paradox, it is difficult to demonstrate a cause and effect relationship between blended-learning and learner performance, using an acceptable means of comparison that is neither artificial nor biased (Deschacht & Goeman, 2015). This difficulty does not arise for studies that focus on a specific population of learners (De Paepe, Zhu & DePryck, 2018), and seek to understand the processes that lead to dropout, rather than compare learning modes and contexts.

2. Dropout of non-traditional students in blended-learning

Numerous conceptual models aiming to understand dropout have been proposed. Though Tinto's *Student Integration Model (SIM)* (Tinto, 1975) remains the most influential, because retention is considered a measure of learner social and academic integration (Rovai, 2003), it is not easily adapted to distance-learning, nor to non-traditional students. To deal with this limitation, Bean and Metzner (1985) developed the *Student Attrition Mode (SAM)* adapted to non-traditional students such as distance-learners, part-time students, commuter students or mature students (over 24 years old) (de Paepe & al., 2018). This model identifies four distinct factors influencing dropout: background variables, academic variables, and environmental, academic and psychological outcomes. According to the authors, these variables explain why dropout rates among non-traditional students is greater than that of traditional students (Bean & Metzner, 1985; Rovai, 2003). Based on these two models, Rovai (2003) proposed the *Composite Persistence Model (CPM)* that takes the needs and competencies required to take part in distance learning. This model identifies two important types of influencing factors for non-traditional students in blended-learning related to learners' pre-admission characteristics and competencies and post-admission internal and external factors. However, the impact of learner characteristics in predicting dropout is also contradictory (de Paepe & al., 2018). Lee and Choi (2011) listed no less than 69 factors that can impact distance-learners' decision to drop out. These models and studies give a rich conceptual framework to understand causes of dropout, but do not shed light on the process that leads to dropout (Mabel & Britton, 2018). To identify processes, it is necessary to look at data that covers the entire curriculum (Deschacht & Goeman, 2015), rather than individual courses, which few studies do (Arbaugh & al. 2009. This requires gathering information on particular aspects of study progressions leading to diploma qualification or graduation which allow for predicting student success (retention) or dropout. Analyses of the early phases of programs, for example, showed that the majority of dropouts happen early within the first study module (Simpson, 2013). Simpson thus showed that 38% of students dropped out before the first evaluation, and that half had dropped out prior to the fourth evaluation. De Paepe et al.'s (2018) study confirmed that dropout was frontloaded, seeing that 48.1% of students dropped out just after the start of their first course. This rate decreases to 26.9% in the second course. The authors conclude that success in the first course is a good predictor of subsequent course success. Passing or failing courses can also be an indicator of the process leading to dropout. According to Adelman (1999), repeating or dropping 20% of courses can reduce the probability of graduation by 50%.

The accumulation of credits is another measure related to study program progression studied by researchers in varying ways. Some showed the early accumulation of credits was positively related to obtaining a degree, and that obtaining less than 20 credits in the first year was negatively related to obtaining a degree (Adelman, 2006). Moore et Shulock (2009) also state that 91% of students that obtain 30 credits the first year go on to obtain their degree, versus 45% of students that obtain less than 20 credits their first year. For Marti (2008), the accumulation of credits should be analyzed as a function of duration in time. He showed that "long-term" decliners, i.e. students that show a decline in the accumulation of credits over time, were at a high risk of dropping out. Attempting to link the accumulation of credits to the duration of studies, Mabel and Britton (2018) note that taking only the length of the study program into account can mask the state of progression within that program, especially for students that are slow to accumulate credits and extend the time it takes to obtain their degree. Thus, they model dropout as a function of the progress made in accumulating credits, rather than as a function of the prescribed length of the program. They went on further to study "late departures" by analyzing the number of credits that these students accumulated before dropping out. The results showed that one third of students that dropped out had obtained less than ¾ of the credits needed to obtain their degree.

This study underscores the need to analyze dropout using the number of credits accumulated, in addition to the moment dropout occurs. This brief review of the literature reveals a large concentration of studies on variable-centred analyses to predict student perseverance or retention (Marti, 2008). Very few studies inform on the characteristics of study progressions that lead to dropout. Amongst the data that can shed light on the progressions of students the dropout, so as to identify patterns, we retain the number of credits obtained before dropout, the moment within the curriculum that students dropout, and the level of success per course. This study has the particularity of comparing student progressions of students that dropped out across three different study programs in three different disciplines. The population in this study come from different institutions and faculties with varying academic calendars and study programs, thus the length of the study program itself was not used as a measure. Additionally, this measure was already previously seen by Mabel and Britton (2018) as not particularly pertinent in analysing dropout of non-traditional students in blended-learning.

In conducting a comparative analysis of three programs differing in discipline, duration and qualification, we considered whether there were aspects specific to the discipline studied or the degree to be obtained and were attentive to the types of profiles could emerge from within the three different contexts. In this case, characteristics specific to the particular population (non-traditional students) and the context (blended-learning) could be called upon to explain theses emerging profiles. More precisely, this exploratory study aimed to answer several research questions. The first question aimed to understand at what point in their path progression were students most likely to dropout, so as to identify critical moments for early and later departures of non-traditional students within blended-learning contexts. The second research question aimed to characterise these critical moments of withdrawal by identifying the degree of completion of students' curriculum in terms of the number of credits obtained before they dropped out of their respective programs. The last question examines the respective curricula, looking particularly at "critical" courses so as to identify potential critical moments.

3. Curricula description

This study looks at dropout in three different study programs, given in two different higher education institutions. The common characteristic of these three programs is that they are all distance-learning programs given in blended-learning modes, even though the organisation of the face-to-face and distance learning periods differ between them. Students enrolled in all three programs are considered non-traditional as defined by de Paepe & al. (2018). The majority are employed, over 25 years of age or geographically distanced from their institution. For this study, we consider a dropout to be any student that is administratively unenrolled from the study program "for whatever reason and before graduation" (Lassibille et Gomez (2008). The three study programs are briefly described below.

3.1 Master MALTT (University of Geneva)

The Master of Learning and Teaching Technologies (MALTT) at the Faculty of Psychology and Educational Sciences of the University of Geneva is a 120 credit program. Obligatory courses are spread out in 6 domains and make up 102 credits, of which 30 are given for the master's thesis and 6 credits are given for practical internship. Students can choose to complete their degrees over 4 or 6 semesters. Students follow courses for one week, and work at a distance for three 4-5 week periods during each semester. The table below shows the distribution of the number of students having obtained their degree, dropped out or having been eliminated for the period reviewed.

Table 1: Counts of MALTT students

	Number of students	%
Students graduated	47	40
Students still enrolled	42	36
Students dropped out	23	19
Students eliminated	6	5
TOTAL	118	100

3.2 Bachelor of Psychology (Unidistance)

The Bachelor of Psychology at UniDistance is a 180 credit program made up of 18 obligatory courses of mostly 8 to 10 credits. Only the first module is 6 credits. Face-to-face courses are given every 4 weeks during each semester. The bachelor program Is organized over 9 semesters, offering 2-3 courses per semester.

Table 2: Counts of Bachelor of Psychology students

	Number of students	%
Students graduated	25	10
Students still enrolled	35	13
Students dropped out	183	71
Students eliminated	16	6
TOTAL	259	100

3.3 CAS in the Design and Development of e-Learning (University of Geneva)

The Certificate of Advanced Studies in the Design and Development of e-Learning is a 12 credit continuing education degree for professionals offered at the Faculty of Psychology and Educational Sciences at the University of Geneva. The certificate is offered over two semesters, with each course being worth one credit and being made up of one day of face-to-face courses followed by a 3-week distance learning period. A final practical project and report worth two credits can be submitted in the second, third or fourth semester upon request.

Table 3: Effectif des étudiants du CAS

	Number of students	%
Students graduated	9	32
Students still enrolled	2	7
Students dropped out	17	61
Students eliminated	0	0
TOTAL	28	100

4. Research design/method

4.1 Design of information to be collected

The data collected on student progressions came from administration databases of each program. Given that each program follows a different calendar and timetable and differs in the degree obtained and number of credits required, it was of little use to group this data for comparative analysis. Independent analyses of each program were run, and comparative interpretations were formulated based on the trends and patterns observed.

The data was collected for students enrolled between the winter 2012 semester and the spring 2017 semester, for the MALTT and Bachelor of Psychology programs and between winter 2015 and spring 2018 for the CAS e-learning program[1]. Only data pertaining to students that dropped out before obtaining their degree was retained for analysis.

5. Results

5.1 Enrolment duration

Master MALTT

The majority of students that withdraw, do so at the start of the program during the first or second semester (79%). The 20% remaining students, withdraw between the 4th and 8th semester. It seems most are early rather than later departures.

[1] The curriculum and organization of the CAS in the Design and Development of e-Learning was redesigned in 2015 and earlier data could not be used for intra-program analysis.

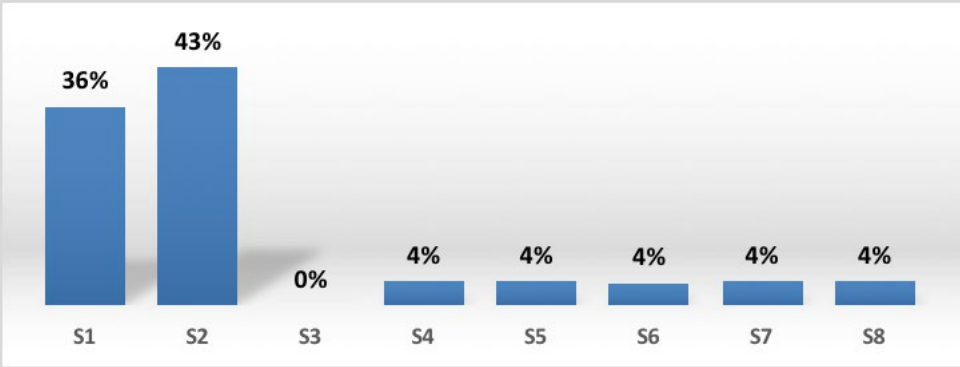

Figure 1: Enrolment duration (Master)

BA Psychology
Within the Bachelor of Psychology, again the early departure pattern is repeated, with almost 85% of withdrawals occurring during the first two semesters.

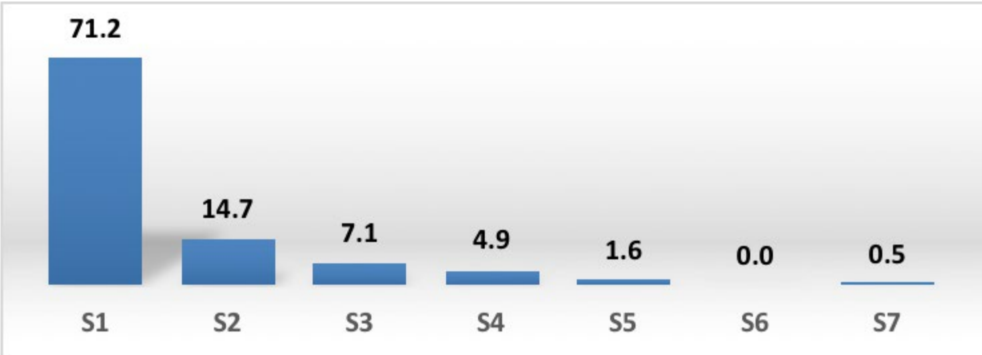

Figure 2: Enrolment duration (Bachelor)

CAS e-learning
With the continuing education certificate program, there are some departures in the first two semester, but more than half of the departures (59%) occur before the end of the standard duration of the program, and are followed by another 23.5% dropout rate when following the extended duration path option.

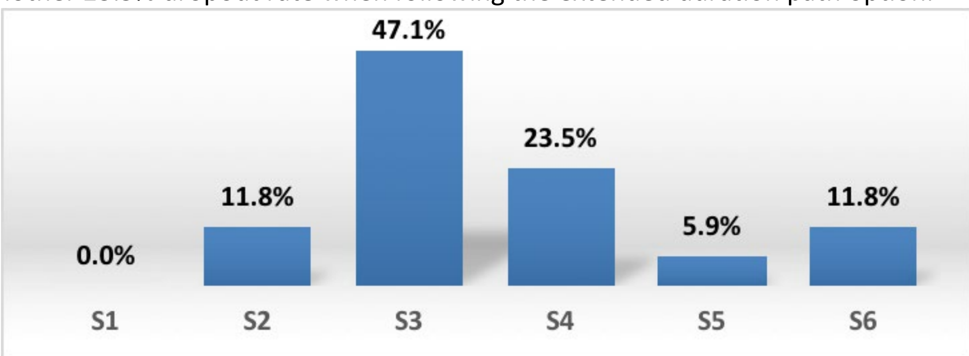

Figure 3: Enrolment duration (Certificate)

5.2 Credits earned before withdrawal

Master MALTT
The figure below shows that MALTT student dropout as often when they have accrued 90 credits as when they have accrued none. Those that withdraw after having obtained 90 credits (3/4 of the credits requierd to graduate) do so just before having to complete their Master's thesis project worth 30 credits. This shows that the accumulation of credits is not a sole determinant of withdrawal, as 17% of the students dropping out have already accumulated 90 credits. Departures after having obtained 60 credits (13%) mark the end of the first year of the 4 semester program.

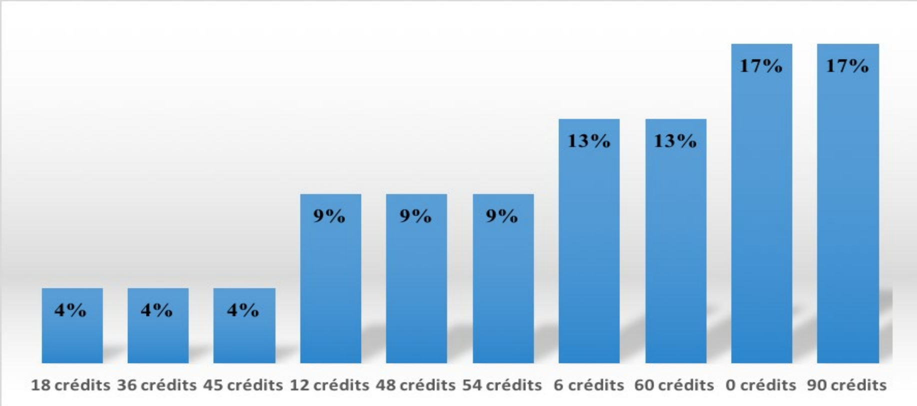

Figure 4: Credits earned before withdrawing (Master)

BA Psychology
The majority of students in the BA in Psychology program withdraw before obtaining any credits (72%) or after having completed one course in the first semester (7%). The remaining 21% of withdrawals occur at varying points in the program with a small peak (5%) at 16 credits marking the end of the first semester.

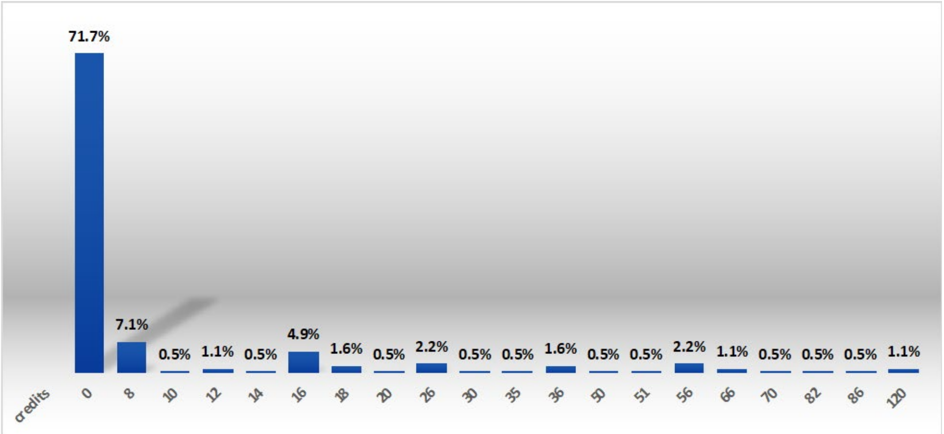

Figure 5: Credits earned before withdrawing (Bachelor)

CAS e-learning
In the CAS e-learning program, credits are accumulated for a series of 1 credit courses with 6 credits per semester. The final two credits of the second semester can be completed during the third semester as they represent the implementation and reporting of a practical project. Students in the CAS e-learning program tend to withdraw midway in the first semester after obtaining 2 or 3 credits (18%), or at the end of the first semester which culminates with a concrete conceptualization of the project they will develop during the remainder of the program (18%). However, the largest dropout is seen going into the third semester, where 41% of withdrawals occur before undertaking the implementation and reporting of their practical project.

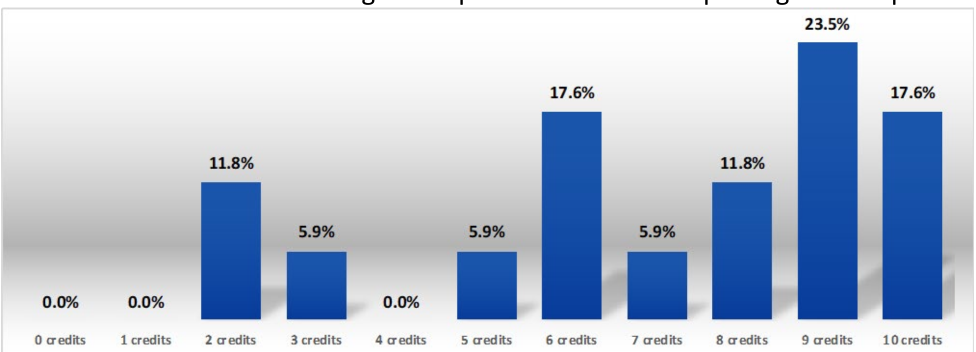

Figure 6: Credits earned before withdrawing (Certificate)

5.3 Analysis of critical courses

Master MALTT

Enrolment in courses within a program are a measure that can help identify “problematic” courses where the general trends related to length of time enrolled before dropping out. Here the degree of participation seems clearly related to the duration of enrolment, since enrolment in courses decreases gradually during the program. The course that with no enrolment is the course at the end of the study program in which the master’s thesis is completed. The “missing students” are the students that enrolled in the course but never validated the course because they were either absent during the exam or did not complete the evaluated course work. This rate of missing students remains relatively constant throughout the various courses. Among the students that enroll in courses, few fail or fail to complete graded course work or show up to exams (go “missing”)

Figure 7: Course enrolment (Master)

Bachelor of Psychology

Given that courses in this program are sequential, with two or three courses per semester, as the program progresses, less we find less missing students, and smaller number of enrolments, as these students have already dropped out. The courses M01 through M04 are first year courses divided over two semesters. In the first two courses we see few passes, few fails and a majority of missing students, who fail to complete graded course work or show up to exams. With these students having dropped out, lesser students enroll, but they persist. This schema draws attention to these early courses that may be presenting a problem for students leading to early withdrawal from the program.

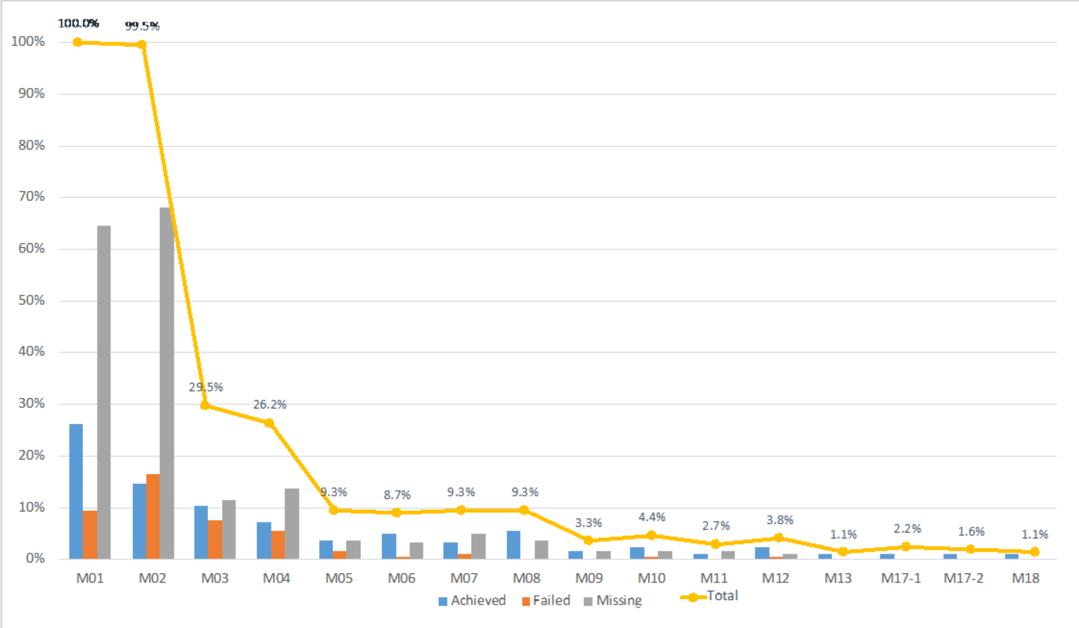

Figure 8: Course enrolment (Bachelor)

CAS e-learning

In this certificate program where 10 of the 12 credit courses are given sequentially over two semesters and a final project course is completed at the end in the third semester, we note that student enrolment remains full during the first semester, with minimal failures, but there are missing students throughout the various courses. These students seem to not return for the second semester. Enrolment for the six courses of the second semester drops, but this is explained by the fact that students only need complete 5 of the six courses offered with some being more popular than others. The first semester ends with a lengthy written report on the project they will develop during the remainder of the program and this appears to present a critical moment for students enrolled in this program that leads to a portion of them dropping out of the program. And while over ¾ of the students that begin the program enroll in the final project 2 credit course, they do not complete their projects and are thus absent from the final evaluation.

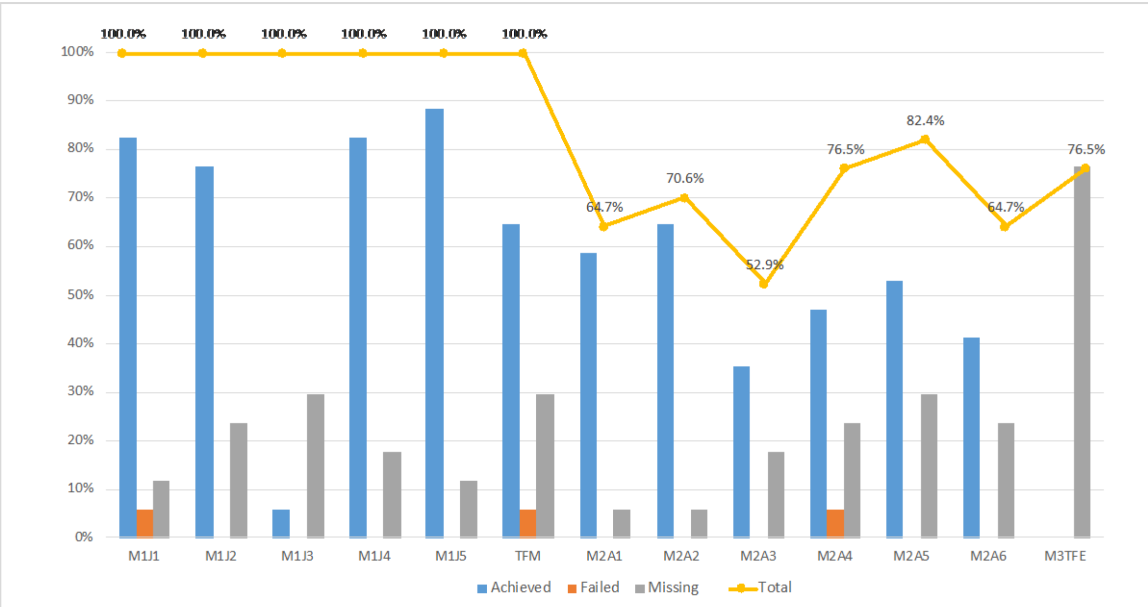

Figure 9: Course enrolment (Certificate)

6. Conclusions

In answer to our first research question, we can confirm that for the Bachelor and Master programs, the majority of withdrawals are early departures that occur during the first two semesters of their respective programs. The withdrawals from the certificate program occur later, with peaks at the end of the first semester and a spike before the 3rd semester. This difference can be explained by the shorter duration of the certificate, where we note the first peak of "missing students" at the end of the first semester. The start of a program appears to be a critical moment, irrespective of the discipline. This result contradicts findings by Hornik, Sanders, Li, Moskal & Dziuban (2008), where the dropout rate was found to be lesser in disciplines "with high paradigm development", such as fundamental sciences, than for disciplines with "low paradigm development" such as the humanities and social sciences. This finding was particularly strong for advanced level courses where dropout with respect to the number of students enrolled was less prevalent

Regarding our second research question, which looked at the state of progression within a program before dropout, we did not find similar trends in all three programs. The majority of students in the Bachelor program leave before obtaining any credits, contrary to certificate students who obtain at least two credits or the Master program where a minority leave with no credits earned. Organizational factors can perhaps explain this phenomenon in part. The certificate program offers 1 credit courses of short duration that are quicker to complete, while at the other end of the spectrum, the Bachelor program offers 3 courses of 6 to 8 credits over one full semester. In both instances, it may take students the same amount of time to decide to dropout, but in the first case they will have already completed at least two courses.

Contextual and individual characteristics of students may also be called upon to explain this difference in credits accumulated before dropout. Klein, Noe & Wang (2006) showed that students in blended-learning that perceived blended-learning programs as an advantage rather than an inconvenience were more motivated to learn, and showed better results. The programs in which Master and certificate program students were enrolled, aimed in part to develop their technical and digital competence and thus could be considered to have had more positive attitudes towards the "culture" of distance and blended-learning, i.e. the technologies and methods used. The students in the Bachelor program may have been confronted with an unfamiliar "culture" that presented a significant barrier to success.

Our third research question looked at student path progressions to identify potentially problematic courses within a program that could explain observed critical moment. The results reveal an interesting constant. For all three programs, the heavier courses at the end of the program that serve as a culminating point in each program are never completed by students that dropout. The prevalence of thesis attrition has already been observed as a major problem at the University of Stockholm (Karunaratne, Hansson & Aghaee, 2017). For Marti (2008), this problem is linked to student goals do not necessarily linked to academic success. According to this author, 16% of students that begin post-secondary education in a community college state that they enrolled for their own personal enrichment. For 22% of students, their motivation is tied to acquiring professional skills and competence. Such students set goals to be accomplished that do not necessarily include getting the diploma or degree offered by the program in which they enroll. The certificate program and the later withdrawals from the Master's program may be good cases in point. Students in the certificate program are continuing education students with existing degrees, as are a portion of the students in the Master's program. For these students the degree associated with the program may be less important than the skills they seek to acquire, completing larger portions of their programs, but not staying to complete the heavy final course that may be seen as not worth effort once their learning goals have been achieved.

The results of this exploratory study respond in part to the need to identify patterns from multi-institutional data extracts (Marti, 2008) readily available in most administrative databases and the necessity of focusing on "process and mix" (Arbaugh, 2009) so as to better understand dropout as a process in blended-learning programs and adapt them accordingly.

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Unschooling in Higher Education

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Abstract
Is it not remarkable that education, especially higher education is still dominated by Instructivism, i.e. a know-it-all teacher in front shares knowledge with know-nothing students in a classroom setting, following a strict schedule? After decades of pedagogical and learning research, we have not left the stone-age of education. Moreover, how much of school/university resources go to the teaching, a.k.a. the delivery method? All of this is based on this single but questionable assumption: teaching leads to learning (Holt, 1989).

And finally, how much longer are young people going to accept this failing model? Today's students have grown up in an always-on internet access world, possibly through multiple channels, and devices. Disruptive, efficient, ubiquitous is absolutely normal to them. Maybe it's time to remove teaching from the center of education, replace it with learning...

An unschooled university has no classes, no classrooms, no curriculum, no teaching schedule, no teachers. Instead it utilizes students' propensity for digital and online communication and the exponential growth of open online course material, like MOOCs but also learning apps, games and VR/AR content. Moreover, a student will not choose a program but determine his/her own learning objectives, with the help of learning guides (formerly known as teachers). This approach is not futuristic. It will increase inclusiveness of education as it is open to the disabled, travelers and people in all stages of life.

Keywords: unschooling, self-paced, personal learning objectives, no class, no classrooms, no teachers

1. Introduction

This paper raises the time-honoured question why education has not evolved at the same pace as the rest of society, and leaves it unanswered. Rather than delve in the doubtlessly fascinating reasons behind societal forces holding back progress in education this paper would like to accept this lack of progress, as witnessed in countless articles, books and Ted Talks. And then suggest a possible answer to another question: “how can we organise higher education to be more in line with societal evolution?”

If Sir Ken Robinson was not the first to voice his concerns about the antiquity of most of our general education system, he most probably is unique in the humour and amiability of his exposés during his memorable Ted Talks on the topic. He illustrates how our current education system was modelled to serve a emergent industrial complex in need of ever greater workforce, see Figure 1 below; smart enough to operate the machines of the mechanical era, but also ready to take orders, no questions asked. (Robinson, 2016)

Figure 1: Sir Ken Robinson’s schools are like factories analogy.

Perhaps it is because the educational system was to produce a workforce for a factory-dominated economy that its design also progressed along factory doctrine; in a context of mass production, with systematically standardized ‘products’ rolling out of the machine in batches, based on age.

The pity is twofold, he explains. Not only are we killing creativity in children as they go through the workings of the machine, by disregarding children’s individuality we needlessly and callously reject a significant number of people as being stupid, weak or dysfunctional.

In today’s information age, knowledge economy and a society in transition, struggling with numerous challenges as climate change, inequality, religious conflict, mass migration, etc. many agree that this industrial-style educational approach is losing its relevance. (WEF, 2018)

Disclaimer: One of the authors, Steve Clemens, proclaims having suffered greatly from the one-curriculum&pace-fits-all-send-only educational model. Not only the daily struggle with boredom was exhausting, its inspiration and motivation killing effect cost him dearly.

2. Background

Two students at Windesheim University of Applied Sciences, Zwolle, The Netherlands, narrate a possible day in school for a typical college undergraduate (Remorie & Vanden Bos, 2017);

> "*What would an average school day of an average Dutch student look like from an observer's perspective? Supposedly, she would check her schedule the evening before, and set her alarm accordingly. She would get up early, travel to university, and together with dozens or hundreds of her fellow students, she would sit down in a classroom or lecture hall. Most likely, she then takes out her notepad or laptop and gets ready to listen to her teacher for the next few hours. Every now and then the teacher asks a question or a student raises his hand to make a remark. Still, the learning setting could overall be considered quite passive, making it difficult for most students to stay focused throughout the whole session. A few of them are distracted by their phone or chitchatting with their neighbor, others are doodling or staring out the window.*
>
> *However, as soon as exams or assignments are being discussed, most students almost instinctively direct their attention back to their teacher. This information is relevant to them; they need to listen if they want to obtain good grades, and eventually their diploma. When the teacher indicates that he is finished, the student packs up her stuff and makes her way home. There, she reads the course material and attempts to memorize it for the multiple-choice exam that is scheduled for next week.* "

This is arguably a suboptimal setting for learning. The depiction of the current education system as a factory is perhaps less tenable as educators have been adding internships, group work, reflection and online elements to curricula. The foundation of education however remains unchanged. The system provides the same resources and knowledge to all students, with little regard for any special needs or individual differences, with focus on linear instruction, fixed curriculum and standardized testing. (Bray & McClaskey, 2015) The teacher, as the proverbial last mile of the education system, became responsible and accountable for learning instead of the learner, who "got lost lost in the equation." The above described educational method we will for the purposes of this paper call Instructivims, a term often coined in opposition to Piaget's Constructivism (1950), not to be confused with Papert's Constructionism (1991).

Add to that the knowledge that "contrary to popular belief, the brains is not designed for thinking. It's designed to save you from having to think."(Willingham, 2009) Daniel Willingham, a cognitive psychologist endeavors to tackle the clash between the dominant educational model and students' propensity for displaying fragile attention, by showing respect for students' cognitive limits and actively varying difficulty levels of tasks and the pace, essentially based on flow-theory (Csikszentmihalyi, 1990)

If learning is a residue of thought (Willingham, 2009) which learning-activity promotes most thought about an educational topic, e.g. import/export INCO terms?: 6 slides in the powerpoint during a lecture at 8 am or during a 6 month internship at an export business (Dewey, 1899. IBM, 2010. Pink, 2009)?

Figure 2: John Dewey, "*If we teach as we taught yesterday, we rob our children of tomorrow*."

This paper aims at putting forward one educational system for higher education, not as the one-and-only solution, the absolute best substitute to Instructivisme, or the best system to make education future-ready. Merely one of many possible alternatives to Instructivism. We have named it *Unschooling in Higher Ed* after the term unschooling first coined by John Holt in 1970 (Holt, 1989).

Unschooling, often cited in one breath with homeschooling is an educational philosophy that promotes learner-chosen activities as a main means of learning, through natural life experiences, against a background of life, work and play (Deci & Ryan, 2000). Curiosity is innate and children want to learn, is the premise of Holt's approach, with a view that this holds particularly true for young, (pre-)school children. He believed that "children who were provided with a rich and stimulating learning environment would learn what they are ready to learn, when they are ready to learn it". With regards to testing too, he focused on his students being able to grasp concepts, rather than the correct answer. Ultimately he felt that schools were "a place where children learn to be stupid".

In this paper we would like to posit that the tenets of Unschooling as John Holt introduced, hold true for adults as well. Learning happens all the time, in life, work and play.

3. Unschooling in Higher Education, a proposed educational approach.

An unschooled university has no classes, no classrooms, no curricula, no teaching schedule, no teachers. Instead it utilizes students' propensity for digital and online communication and the exponential growth of open online course material, like MOOCs but also learning apps, games and Virtual Reality and/or Augmented Reality content.

Moreover, a student will not choose a set program but determine his/her own learning objectives, with the help of learning guides (formerly known as teachers).

3.1 How can knowledge be taught without teachers?

Most of the learning will happen outside of school setting, from books, MOOCs, a knowledgeable uncle, working in a logistics department in Barcelona, lectures at other schools, etc. All this so we can focus on learning. This is particularly applicable for the knowledge components of learning.

The acquisition of skills and attitudes however will be harder to manage. That is why we will invest considerable resources in coaching, guiding, support of students with their difficult choices with regards to study path and learning goals, but also through the (crowd-) process of identifying and managing suitable knowledge transfer sources in the global world.

We will also suggest students absorb meta-skills such as time-management, learning how to learn theory, personal development, allowing them to truly co-create their own educational career. We propose to do this by means of regular and frequent – probably monthly – events, on campus (or through web presence when applicable) where students intensively work together on real-life challenges, bootcamp and/or hackathon style. These events, where students are grouped without regard for age, progress level, interests and social parameters will allow us to introduce and monitor such skills as communication, creativity, collaboration, etc. A secondary and not unintentional function will lay in the social aspect; connecting and forming bonds with each other, as learning happens in a social and connected context (Siemens, 2005).

3.2 Student experience

A student, e.g. Betty, enrolling at an unschooled university for a 4 year BBA degree would first, advised by his/her learning coach pick and choose a set of learning objectives that make up a BBA program. She is facilitated by a digital database including all available learning objectives and their respective hierarchy of sub-objectives, down to the level of learning topics.

The database of learning objectives should provide him/her an overview and suggest combinations that have been successfully used in the past. Its graphical representations of a learning path through the jungle of learning objectives could look like the dotted lines in Figure 3 below, with the 4 planes representing the progress levels, going from typical 1s years learning objectives to 4th years.

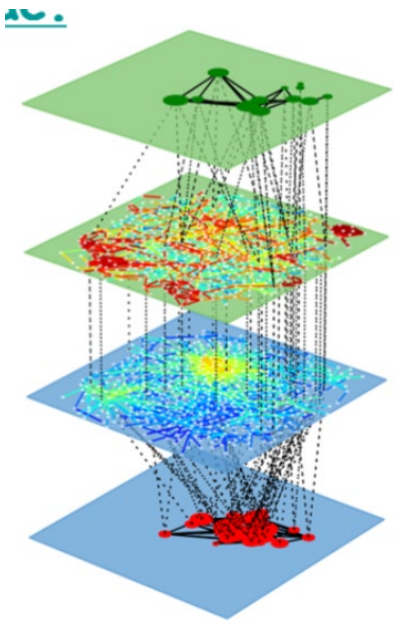

Figure 3: a hierarchy of learning objectives and the learning paths within.
(source: http://people.maths.ox.ac.uk/kivela/mln_library)

After the level and suitability of the chosen learning package has been checked by an educational/pedagogical board, Betty dives back into the database to find out about the *best-ways-to-learn-this* suggestions which were uploaded by his/her peers. She will also interact with peers offline to try and form study-circles or other modes of learning she finds agreeable.

When Betty’s ready to be tested, a simple message to the test centre is all it takes to book an appointment. Test questions for knowledge learning objectives are grouped into clusters based on area of expertise. Which tests test which combination of learning objectives is publicly available, so students know exactly when they are ‘ready’ for a test.

Passed tests lead to study credits and allows the school to remotely monitor the students’ progress. But Betty has a closer relationship with her learning coach and the Hackaton team at school. In the monthly Hackatons Betty gets to work on real-life business problems and demonstrate the achievement of a set of skills-based learning objectives, part of her chosen learning package. The Hackaton team, consisting of learning coaches and senior students alike, shall provide a challenging problem as well as a number of inspirational speakers/workshops/sessions, so as to provide ample opportunity for students to pick up the required set of skills.

After a few months of study Betty has accumulated a few study credits of knowledge-based learning objectives, and she has found a job at a company in Barcelona. She still has access to the learning objectives database but is constrained when it comes to group work and training/testing of skills during the Hackatons. However, she will learn tremendous amounts on real-life business in the real world. Instead of waiting for an internship period in the second semester of her third year, if she was to follow a ‘regular’ program at a Dutch university, she knows up front what skills and experiences the school would like her to acquire, and how it should be demonstrated to school assessors. So she can self-direct her job function towards gaining study credits while progressing through a career at work.

When Betty has attained the necessary 240 study credits, evaluated by the school assessment board, she is awarded a BBA degree. This did not necessarily happen after 4 years or longer.

3.3 Obstacles

Four so far: the social aspect, managing the intelligence, testing the Dutch Law and mindbarriers...

The social aspect is not going to be easy. Students enjoy having to *'go somewhere where everyone will be'*, i.e. the classroom. It somehow provides in their social needs of making new friends, build relationships.. (Sylwester, 1994) Moreover, a sense of community among students is often described as crucial to learning (Siemens, 2005) , but it might prove ephemeral as many students will be traveling or working throughout the world. Can an online community provide solace?

Another challenge lies in the management of the learning objectives, which students will determine themselves, which they might find daunting. A collective intelligence management software package should provide support, aka the learning objectives database. Current LMS packages do not seem to provide the necessary power and functions to allow for the extensive hierarchy of learning objectives, sub-objectives, learning topics and *where-to-get-it* user-generated content. A proprietary LMS-like software package is a point of reflection.

Assessments will also be an issue, as the Dutch law does not really allow much wriggle room for time- and study-path-independent testing. Moreover, the Dutch Education Law prohibits students of Universities of Applied Sciences (UAS) to determine learning programs (objectives) by themselves. A Dutch UAS must educate people towards the execution of a well-defined profession. Dutch educational authorities require schools to demonstrate and prove exactly which – currently existing (!) – profession a program prepares its students for. This goes dead against the objectives of an Unschooled school in Higher Ed at UAS level.

But the most tenacious, constricting barrier lays within the heads of school administrators, teachers, even within the own unschooling team. The current educational model, based on instructivism and its infrastructural consequences (i.e. large building with many rooms called classrooms), appears deeply embedded in career-educators' view on reality. Below, a sample of issues we have encountered:

- *"How are kids going to learn when they are at home alone all the time?"*
  A reaction on the 'no classroom lectures required' policy of unschooling.
  <u>Assumption</u>: students will do nothing at all, all day if not forced to go to classes…
- *"After 2 years, students will choose for a specific degree and fully go for that."*
  A reaction to the choice offered, self-choosing of learning objectives.
  <u>Assumption</u>: students will need to be told when exactly to choose for a specific degree, they cannot contemplate the pros and cons of picking a choice-moment themselves.
- *"School will have to award degrees to students with a 'pretpakket' (Dutch for 'bag of fun', meaning a package of only the funniest and easiest topics/courses)."*
  Another reaction to the choice offered, self-choosing of learning objectives.
  <u>Assumption</u>: Students are driven only by fun and laziness, are not able to identify a study path, optimizing job opportunities or career choices, and assemble the required learning objectives to reach it.
- *"The teacher profession will die"*
  Reaction to the absence of lecturers in an unschooled environment. This might in part materialize with mass adoption of unschooling in Higher Ed.
  <u>Assumptions</u>: Teachers are only lecturers. Education is all about teaching. Teaching leads to learning.

4. An unschooled pilot at Windesheim UAS

On September 3rd 2018 Windesheim UAS opened its first unschooled part of the school, named Windesheim Business School (WBC). It allows about 30 students to work towards graduating with one or more bachelor's degrees, out of a choice of 9 existing business degrees already offered at the university.

- Going to lectures in the 'regular' part of Windesheim (WH) for learning is allowed but not promoted.
- Learning objectives are being recorded and mapped into a database by WBC students as they face them.
- Students still follow the curriculum as offered by WH, thinking in courses rather than learning objectives, as the learning objectives database is as yet incomplete.
- Weekly Learning Café's allow students to help each other map out the learning topics and constraints for the courses at hand.
- Study groups have spontaneously surfaced among students

- Testing will for at least 60-70% still be based on testing within the WH structures, on WH schedule, as the digital testing infrastructure allowing for testing-on-demand is being built.
- At least 2/3rd of student population enrolled in WBC to remediate a failed study career, coming with many study credits (40+) from other programs and other schools.
- At least 1/5th of WBC student population would otherwise not be in higher ed.
- At least 1/10th of student population faces a disability, and have chosen WBC for its flexibility, without any 'special facilitations' for students with a disability…

5. Conclusions

While innovation in (higher) education has gotten plenty of attention it seems like the record of actual progress is limited at best and dismal at worst (Kirkland & Sutch, 2009). Most higher ed institutions still work along instructivist tenets.

Unschooling in higher ed is but one of the myriad of options available in the minefield of education innovation. Windesheim UAS, in it's drive towards more inclusiveness and personal learning paths has chosen the pilot of an unschooled environment like the Windesheim Business College to spearhead progress, with the added purpose of encountering and identifying system- and other barriers impeding said progress.

In its short life of a few months (including prep months April-July), the WBC team members have encountered a lifetime worth of barriers to innovation in general and progress on inclusiveness & personalization in particular. Regardless of a constricting regulatory context in which WBC is forced to operate, it is unquestionably people's mindset that has so far weighed the most on its ability to fulfil promised flexibility to students.

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Message of Aarhus

OOFHEC Conference: "Blended and Online Learning. Changing the Pedagogical Landscape"

12 October 2018

The changing pedagogical landscape

The Changing Pedagogical Landscape studies shows three areas of provision[1] in European universities:

- Degree programmes
- Continuous education and continuous professional development programs (short degrees)
- Open education, including MOOCs and open educational resources

Continuous education (CE), continuous professional development (CPD) and open education (OER, MOOCs) are cornerstones in *lifelong learning*.

They will grow faster, due to the needs of the labour market and of the knowledge society at large. The needs for lifelong learning become even more urgent as demographics of the active population[2] decline and careers become longer.

In large parts of Europe, the current active population doesn't attain qualification levels which match with requirements in the knowledge economy. The participation rates in higher education and in lifelong learning are still failing (ET2020 objectives, the EU Education and Training Monitor)[3]. This is even more the case for disadvantaged and migrant people.

The digital agenda in the Bologna Process

In the Paris Communiqué (29th May 2018), digital education is considered as an opportunity to enhance tertiary education in any respects: "We will enable our education systems to make better use of digital and blended education, with appropriate quality assurance, in order to enhance lifelong and flexible learning, foster digital skills and competences… and remove regulatory obstacles to the provision of open and digital education. We call on the Bologna Follow Up Group (BFUG) to take the issue of digitalisation forward in the next working period".

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[1] Haywood, J., Connelly, L., Henderikx, P., Weller, M. &Williams, K., *The changing pedagogical landscape – New ways of teaching and learning and their implications for higher education policy*, European Commission, Education and Culture, The EU Bookshop, 2015. See: https://publications.europa.eu/en/publication-detail/-/publication/f43a8447-7948-11e5-86db-01aa75ed71a1
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[2] European employment indicators. See: http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_employment

[3] The Education and Training Monitor. See: http://ec.europa.eu/education/policy/strategic-framework/et-monitor_en

EADTU offers support to the BFUG and a dialogue with all stakeholders, based on the large experience and expertise of its members on each of the three areas of provisions, namely on blended degree education; short on line degree programs for continuous education and continuous professional development; and on MOOCs for the European labour market.

EADTU will also support the BFUG with a position paper on international collaborative programs and mobility.

Blended degree education

Blended degree education will become mainstream in European universities. It can be defined as the deliberate integration of face to face and online components of education according to an educational design. A European maturity model for blended degree education, based on research and good practices, is built with university partners[4].

Continuous education and continuous professional development through online short learning programs

A sense of urgency in universities and governments is needed to raise qualifications for the economy of today and even more for the future[5]. Most university initiatives for CE/CPD are still not scalable and not flexible enough to face the ambitions of the EU and to respond to the needs of the economy and of society at large.

Digital continuous education and continuous professional development will upscale continuous education/CPD by online and flexible solutions. EADTU is working on a a concept on online short learning programs. A qualification and recognition framework for short learning programs (credits, certificates, diplomas, …) is needed, that fits to the European Qualification Framework, and will harmonize current diverging qualifications.

MOOCs for the European Labour Market

Universities recognise that MOOCs are an increasingly important area of provision in the higher education system. MOOCs contribute to the digital innovation in higher education by sharing education with all citizens *(open education);* transferring and valorising innovative knowledge to enterprises *(continuing education, CPD)*; integrating MOOCs as an enriching learning experience in blended degree education *(bachelor, master and postgraduate programs).*

Partners in the European MOOC platforms in the EMC (established in 2017, last year, during our Milton Keynes conference, with: Futurelearn, FUN, Miriadax, EduOpen, OpenupEd), and stakeholders in the world of work (public employment services, sectors, companies) will look how to structure a European

[4] See: the European Maturity Model for Blended education, https://embed.eadtu.eu/

[5] See: The renewed higher education agenda, European Commission, 2017, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1496304694958&uri=COM:2017:247:FIN
This is also corresponding with two priorities of the Digital Education Action Plan of the European Commission. See: https://ec.europa.eu/education/policy/strategic-framework/education-technology_en
See also; See analysis Eurostat. : http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_employment

market for continuous education/CPD through MOOCs and the university level short learning programs mentioned.

Partners are preparing a qualification and recognition framework for valorising MOOCs in universities and in the world of work, entering a world-wide discussion on nanodegrees, MicroMasters, credits for MOOCs, and other micro-credentials.

International course and program collaboration and mobility

In the new Erasmus+ programme, the European Commission is promoting physical, blended and online mobility, e.g. by the proposal on “European universities” (European Summit 14/12/2017) and by the establishment of a European hub for innovation, international collaboration and mobility in higher education. In the new vision of the Commission, new flexible and joint curricula will be delivered and a majority of students will benefit from a mobility, be it physical, blended or online.

Since more than ten years, EADTU and other organisations have organized projects on these issues. Recently, EADTU has developed an international collaboration and mobility matrix, defining different types of collaboration and physical, blended and online mobility in a perspective of innovation. EADTU will come forward with an advice paper on international collaboration and mobility in different modes: face to face, blended and online.

The eU.University hub

EADTU and the members plan to participate in the European eU.University hub for innovation, internationalization and mobility, which will be created by the European Commission, starting in 2019. With the experience and the expertise developed by its successive projects, EADTU and the members are able to contribute to a coherent and consistent educational framework for this hub, empowering European universities for innovation, collaboration and mobility and enabling European universities to experiment with new educational models and innovative pedagogies.

A continuous dialogue

In all these areas, EADTU will develop policy recommendations at the institutional, governmental and European level, after a dialogue with all stakeholders. EADTU will offer continued support for universities at institutional and staff level in further innovating education.

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EADTU / www.eadtu.eu
Europe's leading institutional association in online, open and flexible higher education

ISBN: 978-90-79730-35-3

Co-funded by the
Erasmus+ Programme
of the European Union