Universidade de Aveiro Departamento de Economia, Gestão, Engenharia Industrial e Turismo
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CAROLINA SIMÕES DA COSTA

ENSINO/APRENDIZAGEM NUM NOVO CONTEXTO TECNOLÓGICO: UM ESTUDO NO ÂMBITO DO ENSINO SUPERIOR

TEACHING/LEARNING IN A NEW TECHNOLOGICAL CONTEXT: A STUDY IN HIGHER EDUCATION

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Tese apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Doutor em Engenharia e Gestão Industrial, realizada sob a orientação científica da Doutora Helena Maria Pereira Pinto Dourado e Alvelos, Professora Auxiliar e da Doutora Leonor da Conceição Teixeira, Professora Auxiliar do Departamento de Economia, Gestão, Engenharia Industrial e Turismo da Universidade de Aveiro

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palavras-chave

Tecnologias; Moodle; Web 2.0; *Massive Open Online Course* (MOOC); Ensino Superior; Modelo de aceitação de tecnologia (TAM);

resumo

Atualmente, os estudantes do ensino superior são considerados nativos digitais, tendo à sua disposição um conjunto abrangente de tecnologias que utilizam no seu dia a dia nos mais diversos contextos, incluindo o de lazer, de trabalho e académico. Este cenário promove uma mudança de cultura por parte dos principais atores associados ao processo de Ensino/Aprendizagem, o que motivou o desenvolvimento da presente tese que tem por objetivo avaliar o grau de utilização e de aceitação das tecnologias de suporte ao processo Ensino/Aprendizagem nas Instituições de Ensino Superior (IES).

A metodologia utilizada na condução deste estudo, baseou-se inicialmente numa revisão da literatura especializada, tendo-se identificado as três principais gerações tecnológicas de suporte ao processo Ensino/Aprendizagem, mais especificamente os *Learning Management Systems* (LSM), as tecnologias Web 2.0 e os *Massive Open Online Courses* (MOOCs). Seguidamente, as tecnologias reconhecidas como as mais relevantes no âmbito de cada uma destas gerações foram alvo de revisão sistemática da literatura, de análise de conteúdo elaborada sobre as plataformas/tecnologias utilizadas em Instituições de Ensino Superior de referência a nível internacional, e de trabalhos empíricos conduzidos numa Instituição de Ensino Superior Portuguesa. Em particular, no que se refere a estes últimos, procurou-se perceber o comportamento relativo à adoção das tecnologias por parte dos dois principais intervenientes no processo Ensino/Aprendizagem, i.e., estudantes e professores. Desta forma, foram conduzidos estudos acerca (i) da utilização, por parte dos estudantes, das principais tecnologias, (ii) da aceitação, por parte dos estudantes, de algumas dessas tecnologias em contexto Ensino/Aprendizagem e (iii) da utilização e aceitação das tecnologias por parte dos professores.

Os resultados apontaram para o facto de a plataforma Moodle representar o LMS mais utilizado no Ensino Superior sendo, no contexto do caso analisado, utilizado maioritariamente como repositório de conteúdos e canal de comunicação. No que se refere à Web 2.0, o *Video Sharing*, as Redes Sociais e as *Wikis* revelaram-se como as tecnologias mais utilizadas pelos estudantes e pelos professores. Os resultados revelaram, ainda, que as tecnologias em causa são bem aceites, tanto por parte dos estudantes como dos professores, evidenciando, assim, que a sua adoção poderá beneficiar o processo Ensino/Aprendizagem no paradigma tecnológico. Já no que diz respeito às MOOCs, poucos professores evidenciaram conhecer o conceito, não se tendo identificado professores que tivessem criado este tipo de cursos.

Este estudo traduziu-se na elaboração de sete trabalhos científicos com revisão por pares, dos quais cinco artigos publicados/submetidos a revistas científicas internacionais e dois capítulos publicados de livros internacionais, que aqui se apresentam e constituem parte integrante desta tese de doutoramento.

keywords

Technologies; Moodle; Web 2.0; Massive Open Online Course (MOOC); Higher Education; Technology Acceptance Model (TAM);

abstract

Today's students of higher education are considered digital natives. They have a wide array of technologies at their disposal that are used in their day-to-day lives in very different contexts; including recreation, work and academic. This scenario promotes a change of culture by the main actors associated with the Teaching/Learning process. This prompted the development of the present thesis which aims to evaluate the degree of use and acceptance of technologies supporting the Teaching/Learning process in Higher Education Institutions (HEI).

The methodology used when conducting this study was based initially on a review of the specialized literature, identifying the three main technological generations supporting the Teaching/Learning process: Learning Management Systems (LMS), Web 2.0 technologies and Massive Open Online Courses (MOOCs). Subsequently, the technologies recognized as the most relevant within each of these generations have been the subject of (i) a systematic literature review, (ii) a content analysis elaborated on the platforms/technologies used in international Higher Education Institutions, and (iii) an empirical work conducted at a Portuguese Higher Education Institution. Concerning the latter, an understanding of the behavior of the two main players involved in the Teaching/Learning process (students and teachers) was particularly sought after. Therefore, studies were conducted on (i) the students' use of the main technologies, (ii) the students' acceptance of some of these technologies in the context of Teaching/Learning and (iii) the use and acceptance of the technologies by teachers.

The results indicated that the Moodle platform is the LMS most used in Higher Education Institutions. In this context, the platform is mostly used as a content repository and a communication channel. As for Web 2.0, Video Sharing, Social Networks and Wikis were proven to be the technologies most used by students and teachers. The results also revealed that the technologies in question are well accepted by both parties, thus showing that their adoption could benefit the Teaching/Learning process in the new technological paradigm. Regarding the MOOCs, few teachers showed knowledge of the concept and no teachers who had created these type of courses were identified.

This study resulted in the development of seven scientific works with peer review, being five scientific papers published or submitted to international scientific journals and two chapters published in international books. These scientific works constitute an integral part of this doctoral thesis.

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List of abbreviations

ADDIE	Analysis, Design, Development, Implementation, Evaluation
ARWU	Academic Ranking of World Universities
ASU	Actual System Use
ATU	Attitude Toward Using
CMS	Course Management System
CU	Curricular Unit
DE	Distance Education
DEGEI	Department of Economics, Management and Industrial Engineering
DEGEIT	Department of Economics, Management, Industrial Engineering and Tourism
EGI	Management and Industrial Engineering
EV	External Variable
FAQ	Frequently Asked Questions
HE	Higher Education
HEI	Higher Education Institutions
ICT	Information and Communication Technology
ID	Instructional Design
ISD	Instructional Systems Design
IT	Information Technology
LMS	Learning Management System
MIT	Massachusetts Institute of Technology
MOOC	Massive Open Online Course
PEOU	Perceived Ease Of Use
PU	Perceived Usefulness
RSS	Really simple Syndication or Rich Site Summary
SCORM	Sharable Content Object Reference Model
SI	Social Influence
SPOC	Small Private Online Course
TAGI	Technologies Applied to Management Information
TAM	Technology Acceptance Model
THE	Times Higher Education

TL	Teaching and Learning or Teaching-Learning or Teaching/Learning
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UA	University of Aveiro
UK	United Kingdom
USA	United States of America
UTAUT	Unified Theory of Acceptance and Use of Technology
VLE	Virtual Learning Environment

I General introduction

Introduction

Background

Objectives and Methodology

Thesis structure

I.1 Introduction

Teaching-Learning (TL) consists of an interactive process between professors and students that involves communication, information exchange and knowledge building. The goal of any process of TL is to build a learning environment in order to provide students conditions to support learning (Merriënboer, 1997). The instructional process refers to "the combination of all the actions that educators and learners perform to achieve best learning objectives" (Zimnas, Kleftouris, & Valkanos, 2009, p. 367).

Instruction typically can be carried out using two methods – teacher-centered and learner-centered (McGriff, 2000; Reinbolda, 2013). In the case of teacher-centered approach "the teacher unloads the wealth of his or her knowledge and then delivers tests to gauge student recall" while the learner-centered approach "involves designing instruction based on learning objectives and what the student needs to do rather than know" (Reinbolda, 2013, p. 245).

The traditional instructional process involves instructors, learners, and textbooks. "The content to be learned was contained in the text, and it was the instructor's responsibility to "teach" that content to the learners" (Dick, Carey, & Carey, 2014).

The contemporary instruction is a systematic process in which every component, teachers, learners, materials, and learning environment is crucial to successful learning (Dick et al., 2014).

At the present, the use of technologies in the TL process is inevitable in the formal and informal context as well as inside and outside the classroom.

Higher Education Institutions (HEIs) should promote the TL activities through student involvement in the construction of his own knowledge in a more autonomous way, through methods that foster the ability and competence as learning to think with a creative spirit. In this sense, the professor should be seen as a mentor, who provides the support of learning where these functions go beyond the physical classroom space. The technologies can and should be used to support this new paradigm for the benefit of the students and the professor.

Considering that, at this time, almost all the students in universities are considered digital natives and use various Web technologies in their day-to-day lives, it is important to understand and evaluate de degree of usage and adoption of those technologies in TL process.

Therefore, the aim of this thesis is to analyse how Information and Communication Technologies (ICT) have been influencing the TL process in HEIs in order to contribute to its improvement, addressing the needs of the students that belong to the digital native generation.

I.2 Background

I.2.1 The main technological generations in the teaching and learning process

The use of ICT has grown in education allowing a more easily and conveniently access to information. These ICT are not just limited to Technology and Systems Information Management, but also to the technology platforms to support the TL process, which usually are the cause of methods Distance Education (DE). In fact, the diversity of interactive and multimedia equipment and the availability of broadband communication networks make available to participants in the TL process an inexhaustible set of information, as well as teaching methods. Students own and use a diversity of technologies, but institutions and instructors have yet to seize opportunities to create more varied learning experiences (Dahlstrom, Boor, Grunwald, & Vockley, 2011; Epelboin, 2013).

The main technologies used in the TL context can be classified according to the three technological generations supporting the TL process: Learning Management Systems (LMS), Web 2.0 technologies and Massive Open Online Courses (MOOCs). Figure I.1 shows the evolution of those technologies' generations.

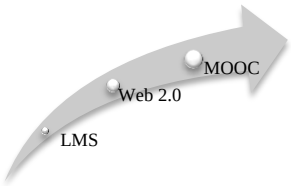

Figure I.1 – Technologies generations' evolution in the teaching/learning context.

Regarding the first generation, LMS are defined by Ekúndayò and Tuluri (2011) as the application of technologies to TL, allowing the use of various methods to impart information, skills and competences. In the LMS context, the referred technologies are usually integrated in platforms which enable educational institutions to manage their educational resources, to complement the traditional way of teaching and/or to support the DE. In most cases these platforms are used as a repository of contents provided by professors and accessed by students in different formats (text, image, sound). However, these platforms also allow the interaction between the actors of the process, via message boards, forums, chats, video-conferences and the interaction with other type of systems.

As a consequence of the new possibilities of interaction with students, professors should not be limited to transmit knowledge using only the traditional methods, but should adapt the methods to the new paradigm, where students are considered as digital natives.

The LMS concept will be detailed in Chapter II, particularizing the case of the Moodle platform.

The technological development has been continuously promoting changes in the usage of the internet, which contributed to the emergence of new models of TL process, such as the Learning 2.0 concept, characterized by the adoption of the Web 2.0 tools in the educational environment.

Web 2.0 is a second generation of Web based on online services, collaboration and sharing and represents a paradigm shift in the way the Internet is used. It involves a more open approach to the Internet, and user generated contents, that are posted using tools such as Blogs, Wikis, Social Networks, Social Bookmarks, RSS and Media Sharing. Web 2.0 applications reflect different ways of promoting interaction between people, supporting social interaction, feedback, conversation and networking.
The Web 2.0 technologies will be addressed with more detailed in Chapters III and IV, and Wikis, in particular, will be analysed in Chapter V.

More recently, a new phenomenon related to the TL process emerged in the United States of America – MOOCs – characterized by being freely available courses offered in a massive scale. MOOCs allow people from all over the world to assist simultaneously online courses and interact dynamically with each other. They provide a structured curriculum around a particular subject, where students are autonomous and manage their own learning. This reality is also present in other countries, where institutions are aware that such tools must be part of the route of student learning.

MOOCs can be seen as an additional support for traditional education. They should promote "pedagogical models based on multiculturalism, diversity of contexts, multilingualism, synthesis of local and global cultures (glocal), and commercial processes" (Aguaded-Gomez, 2013, p. 8). As a result, this concept "changes not only the approaches to teaching but also the perception that the public may have from HEIs. This is politically important in the context of competition between HEIs for their international visibility" (Epelboin, 2013, p. 1). The MOOCs encourage students to work by themselves, so its underlying teaching process is student-centered.

This type of courses requires particular conditions that are not straightforward to be fulfilled by the majority of courses built using the referred previous platforms generations. The requirements are related with (i) human resources skills, including Information Technologies (IT) staff that ensure good level of operation and pedagogical support; (ii) specific equipment, and (iii) high quality documents (the ones acceptable for internal use with a limited distribution, are often not valid in the case of MOOCs).

The MOOC platform is an "integrated application software developed for the purpose of providing direct or indirect support for internet service-based teaching learning processes where a large number of learners mutually participate" (Kim, 2015, p. 224).

The appealing and widespread use of videos (that should not exceed 15 minutes) may have played a role in the boom of MOOCs, prompting a search for new interactive ways to read videos and general contents (Monedero-Moya, Cebrián-Robles, & Desenne, 2015).

The MOOCs concept will be analyzed in more detail in Chapter VII.

It is interesting to note that the technologies that emerged first have been upgraded in order to integrate the concepts related to the more recent ones, and those also make use of the older ones. For example, LMS and MOOCs platforms have incorporated Web 2.0 technologies as Wikis, Blogs, Microblogs, Social Networks, and Video Sharing. Also, the MOOCs participants are encouraged to freely share information with others by means of the just referred technologies.

Regardless what was just referred, the classical LMS platforms (such as Moodle) cannot be used directly in MOOCs, since they have limitations as (i) insufficient sustainability for full functionality - the LMS were not built for tens of thousands of students in the same course and some simply cease to function, and (ii) poor or non-existent social dimension - these new resources are required to work and exchange information between colleagues, to replace the teachers evaluation by peer evaluation (Epelboin, 2013).

In some cases, where the referred limitations can be overcome, LMS may represent good candidates for MOOCs platforms. For example, the LMS platforms can be used for small MOOCs (less than 10 000 students) which are an alternative for courses like Small Private Online Courses (SPOCs) (Bartolomé & Steffens, 2015).

In comparison with other online courses, MOOCs involve largely self-directed learning, which is a very different experience compared to formal education. The viral nature of MOOCs creates a population that is self-selected to be engaged and passionate about this approach to learning. MOOCs demand a certain level of digital literacy from the participants, which has raised concerns on inclusivity and equality of access, particularly in developing states (Nyoni, 2013).

I.2.2 Technologies used by top Higher Education Institutions

In order to understand the current use of the educational resources, an analysis of the main technology platforms used by top HEIs were performed through the content analyses of Websites of those HEI.

The top HEI were first selected using the main rankings (Times Higher Education World University Rankings, Shanghai Rankings, QS World University Rankings, and Web Ranking of Universities) and 13 institutions were used for the referred analysis.

I.2.2.1 Top Higher Education Institutions

There is an increasing interest worldwide in university rankings, which is due to the globalization of Higher Education (HE) (Aguillo et al., 2010). These rankings take into account different parameters including number of publications and citations, student/faculty ratio, percentage of international students, Nobel and other prizes, number of highly cited researchers and papers, articles published in Science and Nature, the h-index and web visibility (Aguillo et al., 2010).

HEIs use rankings as a promotional tool to show their educational and research excellence (Aguillo et al., 2010), as well as to increase their research projects and attract doctoral students and researchers (Aguillo et al., 2010).

The global rankings first appeared in 2003 with the Academic Ranking of World Universities (ARWU), also known as ARWU (Hazelkorn, 2014). The ARWU published by Shanghai Jiao Tong University, and the first ranking was published in 2003 (Hazelkorn, 2014; Houa, Morseb, & Chianga, 2012). This ranking uses internationally recognized academic performance and accomplishments as key indicators to rank thousand universities worldwide (Houa et al., 2012). ARWU "considers every university that has any Nobel Laureates, Fields Medalists, Highly Cited Researchers, or papers published in Nature or Science journals" (ARWU, 2015).

The Times Higher Education/QS World University Rankings (THE-QS) released by the Britain's Times Higher Education Supplement in 2004, covers 200 universities (Houa et al., 2012). This ranking was split in 2009 giving birth to two new rankings: QS World University Ranking (QS ranking) and Times Higher Education (THE) World University Ranking (Hazelkorn, 2014). QS ranking is based on citations data in Scopus, and academic and employer surveys (QS, 2015). THE World University Ranking, has partnered with Thomson Reuters since 2010 (Hazelkorn, 2014) uses "the world's largest invitation-only academic opinion survey" (THE, 2015).

The Webometrics Ranking of World Universities (Web ranking) was published by Cybermetrics Lab, *Consejo Superior de Investigaciones Científicas* in Spain in 2004 (Houa et al., 2012) and provides "reliable, multidimensional, updated and useful information about the performance of universities from all over the world based on their web presence and impact" (Webometrics, 2015).

I.2.2.2 Selection of Higher Education Institutions

The selection of top HEIs to be studied was performed on the basis of the (i) THE World University Rankings, (ii) Academic Ranking of World Universities (Shanghai Rankings), (iii) QS World University Rankings, and (iv) Web Ranking of Universities, as those rankings were considered by Aguillo *et al*. (2010) and Anowar *et al.* (2015) the most popular ones.

An analysis of the rankings according to the list of HEIs published from 2012 to 2015 (THE World University Ranking: 2014/2015, 2013/2014, and 2012/2013; Shanghai Rankings: 2014, 2013, and 2012; QS World University Rankings: 2014/2015, 2013/2014, and 2012/2013; Web Ranking of Universities: January 2014, January 2013, and July 2014) was made and the institutions ranked as top 20 in each ranking are presented in Table I.1. In a first phase, there were selected the HEIs that were present in the three editions of the four rankings, which means that had a total position score value of 12 (14th column – Table I.1):

- Harvard University;
- Massachusetts Institute of Technology (MIT);
- Stanford University;
- University of Cambridge;
- University of Oxford;
- Columbia University;
- Yale University;
- University of Pennsylvania;
- Cornell University.

In a second phase, considered four more HEIs were that had a mean score higher than 8 (15th column – Table I.1):

- California Institute of Technology (Caltech);
- University of California, Berkeley;
- Princeton University;
- University of Chicago.

According to the mean score of Web Ranking of these 13 HEIs (16th column – Table I.1), California Institute of Technology (Caltech), University of Chicago, Princeton University, University of Cambridge, University of Oxford, and Yale University are the universities with less Web presence.

The selected HEIs were subject to a characterization, an identification and some analyses of technology platforms they use.

Table I.1 - Lists of the top global HEIs.

Top 20 – Global	THE World University Rankings			Shanghai Rankings			QS World University Rankings			Web Ranking of Universities			Total position	Mean Score	Mean Score of the Web Presence
Institution	**2014/15**	**2013/14**	**2012/13**	**2014**	**2013**	**2012**	**2014/15**	**2013/14**	**2012/13**	**Jan. 2014**	**Jan. 2013**	**Jul. 2012**			
Harvard University	2	2	4	1	1	1	4	2	3	1	1	1	12	19	20
Massachusetts Institute of Technology (MIT)	6	5	5	3	4	3	1	1	1	2	2	2	12	18	19
Stanford University	4	4	3	2	2	2	7	7	15	3	3	3	12	16	18
University of Cambridge	5	7	7	5	5	5	2	3	2	18	10	20	12	14	5
University of Oxford	3	2	2	10	10	10	5	6	5	17	11	18	12	13	6
California Institute of Technology (Caltech)	1	1	1	7	6	6	8	10	10				9	12	0
Princeton University	7	6	6	6	7	7	9	10	9		16	19	11	11	16
University of California, Berkeley	8	8	9	4	3	4				6	6	4	9	11	2
Yale University	9	11	11	11	11	11	10	8	7	16	11	14	12	10	13
Columbia University	14	13	14	8	8	8	14	14	11	7	5	11	12	10	7
University of Chicago	11	9	10	9	9	9	11	9	8				9	9	0
Cornell University	19	19	18	13	13	13	19	15	14	4	4	8	12	8	16
University of Pennsylvania	16	16	15	16	15	14	13	13	12	10	7	10	12	8	12
University of California, Los Angeles (UCLA)	12	12	13	12	12	12				14	8	5	9	7	
Imperial College London	9	10	8				3	5	6				6	7	
University College London (UCL)			17	20			6	4	4				5	5	
ETH Zürich – Swiss Federal Institute of Technology Zürich	13	14	12	19	20		12	12	13				8	4	
University of Michigan	17	18	20						17	5	20	7	7	4	
Johns Hopkins University	15	15	16	17	17	17	14	16	16		14		10	4	
University of Washington				15	16	16				7		6	5	4	
University of Wisconsin – Madison					19	19				12		14	4	2	
University of California, San Diego				14	14	15							3	2	
University of California, San Francisco				18	18	18					9		4	2	
University of Minnesota										9		9	2	2	
University of Texas Austin										11	13	17	3	2	
University of Toronto	20	20					20	17	19	15			6	1	
Duke University	18	17							20				3	1	
Pennsylvania State University										13		12	2	1	
King's College London (KCL)							16	20					2	1	
University of Edinburgh							17	17					2	1	
Texas A&M University										20	15		2	1	
University of Arizona												13	1	1	
Ecole Polytechnique Fédérale de Lausanne (EPFL)							18	19					2	0	
McGill University									18				1	0	
Northwestern University			19										1	0	
Purdue University										19	19		2	0	
The University of Tokyo						20							1	0	
University of Utah											17		1	0	
University of Florida											18		1	0	
University of British Columbia												16	1	0	

Legend: The 1st column presents the HEIs that are in the top 20 of the three editions of the four rankings. The following 12 columns are the ordinal numbers corresponding the position of each university in each edition of each ranking. The 14th column (Total position) shows the number of times that the university appears in one of three editions of the four rankings (maximum 12). The 15th column (Mean score) is the average score (the score is attributed according to the ranking of top 20, that is, the 1st place corresponds to 20 points and the 20th place corresponds to one point) for each university. The last column corresponds to the average score of the Web ranking.

I.2.2.3 Characterization of Higher Education Institutions

Table I.2 presents some information about the 13 selected HEIs. The institutions were characterized in terms of country, type of system, year of establishment of the HEI, number of students and ratio between number of students and number of teachers.

Table I.2 - Characterization of the selected HEIs.

HEIs	Country	Type of system	Year	Number of students	Ratio student - teacher
California Institute of Technology (Caltech) http://www.caltech.edu/ (20-12-2014)	USA	Private	1891	2 181	3:1
Columbia University (Columbia) http://www.columbia.edu/ (10-12-2014)	USA	Private	1754	29 870	---
Cornell University (Cornell) http://www.cornell.edu/ (11-02-2015)	USA	Private	1865	21 593	---
Harvard University (Harvard) http://www.harvard.edu/ (05-03-2015)	USA	Private	1636	21 000	---
Massachusetts Institute of Technology (MIT) http://web.mit.edu/ (05-03-2015)	USA	Private	1861	11 319	8:1
Princeton University (Princeton) http://www.princeton.edu/main/ (11-02-2015)	USA	Private	1746	7 910	---
Stanford University (Stanford) http://www.stanford.edu/ (05-03-2015)	USA	Private	1891	16 136	4:1
The University of Chicago (UChicago) http://www.uchicago.edu/ (05-03-2015)	USA	Private	1890	15 194	---
University of California, Berkeley (Berkeley) http://www.berkeley.edu/index.html (03-03-2015)	USA	Public	1849	37 581	17:1
University of Cambridge (Cambridge) http://www.cam.ac.uk (26-03-2015)	UK	Public	1209	18 812	---
University of Oxford (Oxford) http://www.ox.ac.uk/ (03-03-2015)	UK	Public	1096	22 000	---
University of Pennsylvania (UPenn) http://www.upenn.edu/ (05-03-2015)	USA	Private	1740	24 806	5:1
Yale University (Yale) http://www.yale.edu/ (05-03-2015)	USA	Private	1701	14 015	---

Legend: --- Not available.

As can be seen in the Table I.2, most of the HEIs are located at the United States (USA), being two of them from the United Kingdom (UK). Oxford, Cambridge, Harvard, Yale, Pennsylvania, Columbia, and Princeton, being founded until XVIII century, these universities are considered as medieval universities (Amaral, 2010; Mora, 2001; Ridder-Symoens, 1996), while the others are considered modern universities, dating from the XIX century (Amaral, 2010).

Regarding the number of students and using the criteria of Harpel-Burk (2006) HEIs that have less than 8 000 students are small-sized, between 8 000 and 13 000 – medium-sized, and over 13 000 – large-sized. Based on this classification, California Institute of Technology (Caltech) and Princeton University are small-sized universities, MIT is medium-sized and the others are considered large-sized HEIs.

I.2.2.4 Identification of technology platforms used by the top Higher Education Institutions

Based on the information available on the websites of the selected HEIs the technology platforms that support the TL process were identified. Table I.3 resumes the information collected.

Table I.3 - Technological platforms used by top HEIs.

Technologies / Universities		Harvard	MIT	Stanford	Cambridge	Oxford	Columbia	Yale	UPenn	Cornell	Caltech	Berkeley	Princeton	UChicago
LMS	Blackboard									✔			✔	✔
	Plone				✔	(*)		(*)				(*)		
	Sakai			✔	✔	✔	✔	✔	✔	✔		✔		
	Canvas	✔							✔			✔		
	Drupal	✔	✔	✔				✔						
	Others	(1)	(2)	(3)	(4)		(5)							
Wikis	MediaWiki		✔	✔	✔									
	Wikispaces						✔							
	Confluence	✔	✔	✔			✔			✔		✔		✔
	PmWiki								✔					
Blogs	WordPress	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	
	Blogger	✔	✔	✔		✔	✔	✔						
	TypePad						✔	✔			✔			
	Edublogs									✔				
	Integrated on the website								✔					✔
Microblogs	Twitter	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Social Networks	Facebook	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	LinkedIn	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Google +	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔
Video Sharing	YouTube	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Vimeo				✔							✔		
Podcasting	ITunesU	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Soundcloud	✔												
Photo Sharing	Flickr	✔		✔	✔			✔			✔			
	Instragram											✔		
MOOC	Coursera			✔			✔	✔	✔		✔		✔	✔
	EdX	✔	✔				✔			✔	✔	✔		✔
	Others		(6)	(7)							(8)			

Legend: (1) ISites; (2) Stellar; (3) Coursework; (4) Falcon; (5) CourseWorks; (6) OpenCourseWare; (7) Venture Lab; (8) TEDx; (*) used by some schools of HEI.

With regard to LMS the platforms identified were: Blackboard, Plone, Sakai, Canvas and Drupal. The Sakai platform is the most used by the HEIs analysed.

Concerning the Wikis, after the survey carried out on the websites of the institutions, the following platforms were identified: MediaWiki, Wikispaces, Confluence and PmWiki. Most of the HEIs use Confluence platform. A Wiki can be used in TL context to provide information on a course, for example, activities calendar, topics, glossary, answer questions or write about a subject, allowing online collaboration between the different actors.

Blogs are used by all HEIs under analysis being the platforms WordPress and Blogger the most used ones. Blogs allow students to engage in activities such as discussions, sharing of information and materials, and can be used as individual student's portfolio.

Regarding Microblogs, the Twitter is the only identified platform and is used by all the institutions.

Social Networks are used by all HEIs, with particular emphasis on Facebook, LinkedIn and Google+. Some of the institutions use them to promote their courses and/or to communicate with their students.

Concerning Video Sharing, it is observed that all HEIs have a YouTube channel. The Vimeo platform is used by only two of them. Regarding Podcasting, it can be seen that iTunesU is used by all the institutions. The Soundcloud is used only by Harvard. Concerning Photo Sharing, Flickr's platform is used by 5 institutions while Instagram is used only by Berkeley.

Regarding MOOC platforms, EdX and Coursera are the most popular, being used by 7 institutions each. Universities of Columbia, Caltech and UChicago use both of them.

In short, it is confirmed that LMS, Web 2.0 technology (Wikis, Blogs, MicroBlogs, Social Networks, Video Sharing, Podcasting and Photo Sharing) and MOOC platforms are strongly used to support the TL process in the world top HEIs.

According to the information available from the Top Universities analysed, it is observed that Caltech doesn´t use LMS, Chicago and Princeton do not use Open Sources LMS and Yale, Caltech, Oxford and Princeton do not use Wikis. Cambridge and Oxford Universities are European, large-sized public from medieval age, and do not use MOOCs. Is can be noted that the referred HEIs are those with less Web presence, according to information from Table I.1.

I.3 Objectives and methodology

The aim of this thesis is to evaluate the degree of use and acceptance of technologies supporting the TL process in HEIs.

The specific objectives are defined as:

- To identify and understand the technologies used in the TL context;
- To analyse the technology platforms used by top universities;
- To analyse the use of technologies by students;
- To evaluate the acceptance of some technologies by students in TL context;
- To explore the main MOOCs platforms used;
- To evaluate the use and acceptance of technologies by professors.

The identification of the main technologies used in TL context was based on the literature review that has been performed throughout all the work.

The identification, selection and characterization of the top HEIs was just presented in the background section, together with the analysis of the technology platforms used by those HEIs.

The last four objectives are related with the way the different actors of the TL process use the specific technological tools.

Figure I.2 summarizes the relationship between the specific objectives and the relevant literature review.

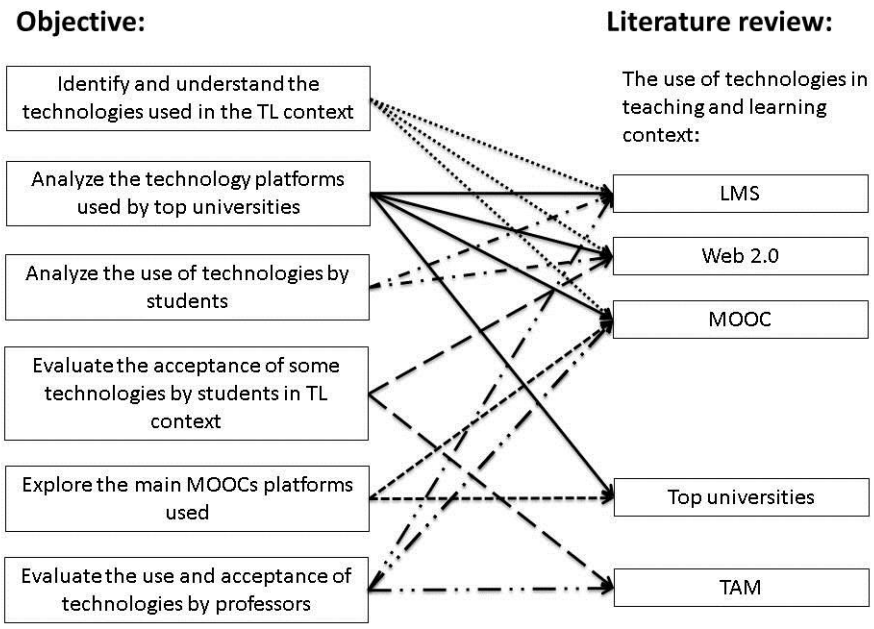

Figure I.2 – Specific objectives and their relation to literature review.

The methodology used consisted on:

- Review of the relevant literature;
- Websites content analysis;
- Pedagogical experiences involving students;
- Acceptance studies on technologies' perceptions of students and professors.

The traditional review of the literature was complemented, in some specific topics, by a systematic literature review, as these two types of reviews are complementary (Saur-Amaral, 2012). The most relevant topics addressed were about the use of technologies in the TL context (LMS, Web 2.0, MOOC), Technology Acceptance Model (TAM) and Top universities.

Figure I.3 presents the relationship among the main topics of the literature revision performed and the several empirical studies carried out in this thesis.

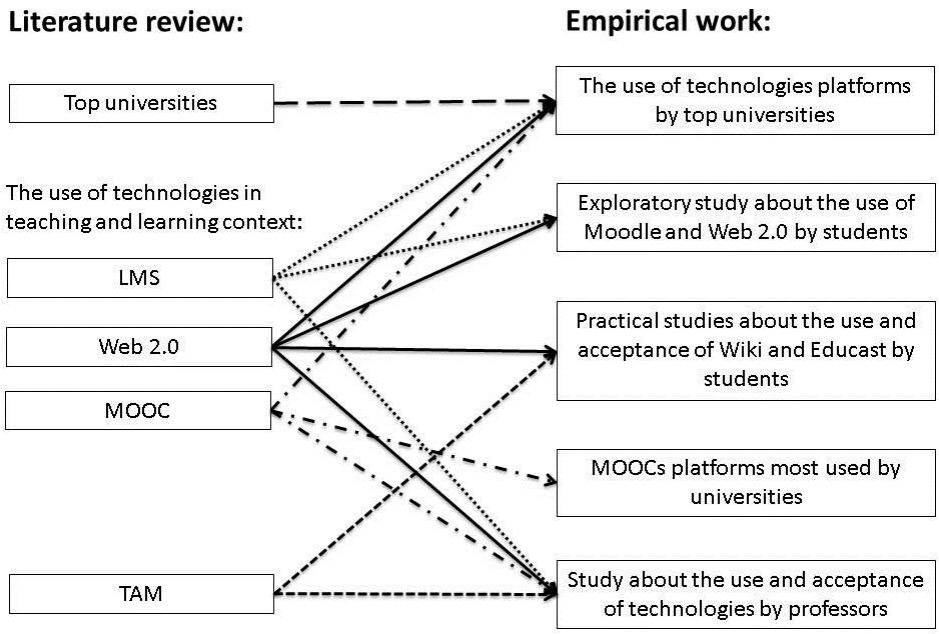

Figure I.3 – Relationship between the literature review and the empirical work.

The empirical work of this thesis was carried out at the University of Aveiro (UA), which has an integrated structure that allows the articulation and harmonization of teaching and research environments and offers a wide range of degree programs in various areas of knowledge, reflecting its multidisciplinary and innovative character with 184 courses (undergraduate and postgraduate), 14,280 students, and 903 professors (UA, 2016). In this institution, the quality issue is a priority and it is part of its mission in each of its three dimensions, namely, Education, Research and Cooperation. In the case of Education, the UA has a broad range of support to its processes of ICT, as well as the respective support services, this is the focus this work. The UA is an institution that has important characteristics to implement successfully this type of models, highlighting, on the other hand, the fact that it has a matrix structure that allows validating the constructed model. The UA structure is based on 16 departments and 4 polytechnic schools, working in different areas, like Life Sciences and Health, Natural and Environmental Sciences, Exact Sciences and Engineering, and Social Sciences and Humanities.

Each of these empirical work studies referred in Figure I.3 had different materials and methods, which will be detailed next.

Content analysis was performed on the websites of the top HEIs, in order to identify the technologies and platforms used by them. The selection of the top HEI was done using the rankings (i) THE World Reputation Rankings; (ii) Academic Ranking of World Universities (Shanghai Rankings); (iii) QS World University Rankings; and (iv) Web Ranking of Universities, which are considered the most popular ones (Aguillo et al., 2010; Anowar et al., 2015).

The data collection of the exploratory study about the use of Moodle and Web 2.0 by students was done through a questionnaire (Appendix I.1) designed based on literature review and validated with an unstructured interview (Appendix I.2) with the administrator of Moodle system at the UA (Moodle@UA). A paper-based questionnaire was developed and applied to students from different courses attending subjects at the Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT). The final questionnaire is a result of the application of a prior version to a pilot sample of 20 students.

The questionnaire is divided into the following three sections:

- Characterization of the participants and the way they use the internet;
- Characterization of the use of the Moodle;
- Characterization of the use of the Web 2.0 tools in the learning and leisure contexts.

There were obtained 278 valid responses on the Moodle and 234 on Web 2.0 tools. The data were analysed using the *IBM SPSS Statistics* software.

A descriptive analysis was performed in order to characterize the behaviour of each variable measured. Paired samples *t*-tests were done to verify if there were statistically significant differences between the average number of monthly accesses to each of the referred Web 2.0 tools in the learning and leisure contexts. The *t*-tests carried out to know if there were statistically significant differences between the importance to each Moodle tools between the groups that use and do not use the tools. Some cluster analyses were also performed in order to identify and characterize groups of users according to their: average number of monthly accesses to the Web 2.0 tools in learning and leisure contexts; profile of importance given to Moodle@UA tools and the mean values of the degree of importance. The methods used in order to perform the cluster analyses were: both hierarchical (with Ward method and Squared Euclidean distance) and non-hierarchical (K-means) ones. The clusters obtained were compared using Kruskal Wallis tests and *t*-tests.

The exploratory study resulted in the works about the use of Moodle (Chapter II) and Web 2.0 (Chapter IV).

The pedagogical experience performed was about the use and acceptance of Wikis and Educast (as Web 2.0 tools). In these two practical studies the Technology Acceptance Model (TAM) was used as it is the most used model that explaines the acceptance of technology by the users (Sharma, Joshi, & Sharma, 2016). This model is based on the Theory of Reasoned Action (TRA) as well as on the Theory of Planned Behaviour (TPB). More recently, the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed based on 8 models, including the TRA and the TAM (Venkatesh, Morris, Davis, & Davis, 2003).

The Wikis' practical study was made in the context of the classroom, and the data were obtained through the application of two questionnaires (Appendix I.3 and Appendix I.4) and analysis of the history of the Wiki created for the activity developed in the classroom.

This work has been carried out in the Curricular Unit (CU) Technologies Applied to Management Information (TAGI), taught to the 2nd Year's degree in Industrial Engineering and Management (EGI), in the UA, and attended by about 60 students spread over 4 groups.

The experience was divided into three phases. The first phase aims to determine the level of previous use and purpose of use of Wikis by the students through paper based questionnaire administration, to students attending the CU. In the second phase, the aim was to evaluate students' participation in an experiment involving the edition of a Wiki (TAGI Wiki). Finally, the third phase aimed to assess students' motivation for using Wikis in the TL process after the experience, applying a second questionnaire to collect the data.

A descriptive analysis was performed to assess the degree of motivation for the use of Wikis by students in the learning context, as well as a hypothesis testing (Mann-Whitney) for comparing the degree of motivation among students who wanted to continue to use the Wiki TAGI in carrying out the work, and those who did not. In these analyses *IBM SPSS Statistics* software was used. This study is presented in Chapter V.

The practical study about Educast was performed with students attending the CU of Entrepreneurship/Innovation and Entrepreneurship taught to several doctoral programs. To carry out this experience the sessions of the classes were recorded, each one divided into two parts. After each class, recordings were made available online in Educast platform organized in seven sessions.

Thus, to evaluate the acceptance by the students of the recordings of academic content (lessons) published in the Educast platform, a questionnaire was applied (Appendix I.5).

The questionnaire was organized into three groups of questions:

- Characterization of the respondents;
- Characterization of the use of Educast platform;
- Collection of a set of data allowing a better understanding of the acceptance of the use of Educast platform in TL context.

A descriptive analysis was performed in order to characterize the participants and the use of Educast platform. Mann-Whitney tests were done to verify whether there were statistically significant differences between the students who viewed at least one video and those that did not view any video. There were 54 valid responses that were analysed using the IBM SPSS Statistics software. This study is presented in Chapter VI.

The study about the current use of MOOCs platforms in HEIs analysis took place in two phases. Firstly, a systematic literature review was performed to (i) identify and classify the published works and the recent developments in this area; (ii) identify the most popular MOOC platforms; and (iii) characterize the most used platforms and courses based in the practical cases reported in the literature is performed. Then, it was carried out an analysis of MOOCs offered by some of the most recognized HEIs to characterize and compare the courses available in the two most popular platforms.

The collected data about courses in Coursera and EdX (the most used MOOCs platforms) was analysed by using the *IBM SPSS Statistics* software. Firstly, a descriptive analysis was performed to characterise the courses, and afterwards independent samples t-tests were carried out in order to understand whether there were statistically significant differences between the duration of the courses, the minimum and maximum number of hours of work per week, and the number of instructors of the courses in Coursera and EdX. This study is presented in Chapter VII.

Finally, the study about the use and acceptance of technologies by professors, was carried out using a questionnaire (Appendix I.6) designed based on the literature review and on the TAM. The questionnaire was developed and applied to professors from diverse departments and schools at the UA. The final questionnaire resulted from the application of a prior version to a pilot sample of 5 professors.

The questionnaire was organized into four groups of questions:

- Characterization of the participants;
- Characterization of the use of technologies;
- Characterization of the acceptance of technologies;
- Characterization of the MOOCs.

The data collected were analysed using the *IBM SPSS Statistics* software. There were 97 valid responses. A descriptive analysis was performed in order to characterize the behaviour of each variable measured. Mann-Whitney and Kruskal-Wallis tests were done in order to verify whether there were statistically significant differences between levels of agreement regarding each variable between some groups of academics. Finally, multiple regressions were used to calculate the influences and the relationships among TAM variables. This study resulted in the work presented in Chapter VIII.

I.4 Thesis structure

This thesis is organized in nine chapters and three appendixes. The Background and the Objectives and Methodology were described in the present chapter. From Chapter II to Chapter VIII, there are presented a set of scientific documents – articles in scientific

journals and international book chapters – which constitute the core of the research developed during the PhD studies. Table I.4 presents the complete reference of each of the referred documents.

Table I.4 – Scientific documents integrated in the thesis.

Chapter of thesis	**Works**
Chapter II	Costa, C., Alvelos, H., & Teixeira, L. (2015). The Moodle platform: a study in a higher education Portuguese Institution. In J. Varajão, M. M. Cruz-Cunha, & R. Martinho (Eds.), *Improving Organizational Effectiveness with Enterprise Information Systems* (pp. 13-30): IGI Global.
Chapter III	Costa, C., Teixeira, L., & Alvelos, H. (2014). The impact of Web 2.0 in the teaching and learning process. In M. M. Cruz-Cunha, F. Moreira, & J. Varajão (Eds.), *Handbook of Research on Enterprise 2.0: Technological, Social, and Organizational Dimensions* (pp. 314-331): IGI Global.
Chapter IV	Costa, C., Alvelos, H., & Teixeira, L. (2016). The use of Web 2.0 tools by students in learning and leisure contexts: a study in a Portuguese Institution of Higher Education. *Technology, Pedagogy and Education, 25*(3), 377-394.
Chapter V	Costa, C., Alvelos, H., & Teixeira, L. (2013). The students' motivation to use the wiki technology: a practical study in higher education. *Educação e Pesquisa, 39*(3), 775-790.
Chapter VI	Costa, C., Alvelos, H., & Teixeira, L. (2018). Students' acceptance of an educational video platform: a study in a Portuguese University. *International Journal of Information Communication and Technology Education, 14*(1), 86-102.
Chapter VII	Costa, C., Teixeira, L. & Alvelos, H. (2018). Exploring the usage of MOOCs in Higher Education Institutions: Characterization of the most used platforms. *International Journal of Information Communication and Technology Education, 14*(4), 1-17.
Chapter VIII	Costa, C., Alvelos, H. & Teixeira, L. (2019). Investigating the use and acceptance of Technologies by professor in a Higher Education Institution. *International Journal of Online Pedagogy and Course Design, 9*(2),.

Each of the documents includes the literature review related to the topic addressed, and the respective empirical work.

Figure I.4 presents the correspondence between the empirical works, which were referred in the Methodology section and summarized in Figure I.3, and the Chapters that describe and use them.

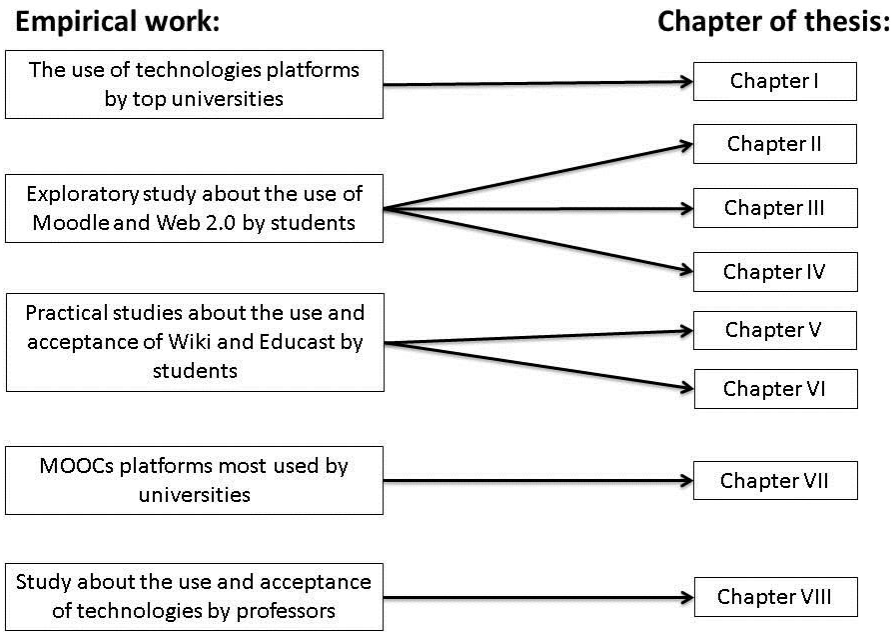

Figure I.4 – Empirical work and chapter of the thesis.

The second chapter presents the book chapter "The Moodle platform: a study in a higher education Portuguese Institution" published in IGI Global and is organized in five sections. The second section reviews the main classification of LMS, and compares different LMSs concerning their utilization and the services they offer. In the third section, the Moodle platform is examined, through a brief description of the modules, a systematization of the activities and a brief discussion about the advantages and disadvantages. The fourth section describes the study carried out at the UA, including a description of the tools incorporated in the e-learning platform adopted by the UA - Moodle@UA, and the results obtained by the empirical study. Finally, in the fifth section, some conclusions and future work are presented.

The third chapter presents the book chapter "The Impact of Web 2.0 in the Teaching and Learning Process" that was published in IGI Global and is organized in five sections. Following the introduction, it starts by analysing the new paradigm in TL processes. Then, the main Web 2.0 tools are presented through a brief description, including their pros and cons. Afterwards authors analyse the use of Web 2.0 in TL process, their advantages and disadvantages and their use by e-learning platforms. Finally, some conclusions and future work are presented.

Chapter IV presents the scientific article "The use of Web 2.0 tools by students in learning and leisure contexts: a study in a Portuguese Institution of Higher Education" published in Technology, Pedagogy and Education journal and is organized in five sections. First, there is an introduction with a brief background of the main Web 2.0 tools. The second section, presents the material and method that were used, the third section presents the results and in the fourth one, the results are discussed. Finally, the conclusions and recommendations are presented.

Chapter V presents the scientific article "The students' motivation to use the wiki technology: a practical study in higher education" published in *Educação & Pesquisa* journal. This article is structured in 6 sections. The introduction is presented in section V.1. In section V.2 there is a brief description of TAM. Section V.3, addresses the role of Wikis in the TL process, presenting some features with the use of this tool in that context. Section V.4 describes the methodology adopted in the case study and in the section V.5 it is provided the analysis and discussion of the main results concerning the motivation for the use of Wikis in the TL process. Finally, in section V.6, conclusions are presented.

Chapter VI presents the scientific article "Students' acceptance of an educational video platform: a study in a Portuguese University" published in the International Journal of Information Communication and Technology Education and is structured in 6 sections. In section VI.2, there is a brief description of some models of acceptance of technology. Section VI.3 addresses the role of educational videos and, in particular the Educast

platform in the higher education. Section VI.4 describes the methodology adopted in the case study, and in section VI.5 the main results concerning the acceptance of the Educast platform are analysed and discussed. Finally, in section VI.6, conclusions are presented.

Chapter VII presents the scientific article "Exploring the usage of MOOCs in Higher Education Institutions: characterization of the most used platforms" accepted for publication in the International Journal of Information Communication and Technology Education. This article is organized in four sections. The MOOC concept is outlined in the introductory section. The characterization of the most popular MOOC platforms through a systematic literature review is described in the second section. The most used MOOC platforms in HEIs characterized through the data collected is described in the third section. Lastly, in the fourth section, some conclusions and future trends are presented.

Chapter VIII presents the article "Investigating the use and acceptance of technologies by professors in a Higher Education Institution" accepted for publication in the International Journal of Online Pedagogy and Course Design. This paper is organized into five sections. The second section performs an overview of the main technologies used in HE and reviews the main models of acceptance of technologies. The third section describes the material and methods used. The fourth section presents the results and the discussion of the study. Finally, the last section presents the main conclusions of the study and recommendations for further research.

Chapter IX presents general conclusion and the further studies' suggestions. This chapter is organized in 3 sections. First, the general conclusion of this thesis is presented. The second section presents the model to develop and implement courses with the use of technologies. Finally, in section IX.3, future works are presented.

I.5 References

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II The Moodle platform: a study in a higher education Portuguese Institution

Reference

Costa, C., Alvelos, H., & Teixeira, L. (2015). The Moodle platform: a study in a higher education Portuguese Institution. In J. Varajão, M. M. Cruz-Cunha, & R. Martinho (Eds.), *Improving Organizational Effectiveness with Enterprise Information Systems* (pp. 13-30): IGI Global

The Moodle platform: a study in a higher education Portuguese Institution

Abstract

This chapter analyzes Learning Management Systems (LMSs) and their main features and compares the most popular LMSs platforms considering their utilization and the services they offer. Additionally, presents a study carried out at the University of Aveiro (UA) that analyses the functionalities and tools of the Moodle platform and their use by students. The data was collected based on content analysis, one non structured interview with the responsible of the Moodle from the UA and a questionnaire applied to 278 students. The results show that the most mentioned purposes of the Moodle@UA were 'Download materials', 'News' and 'Deliver assignments' and that the most used information materials are 'Texts' and 'Slides', showing that despite Moodle has a great potential, it is mainly used as a repository of materials. The results also highlighted the existence of two groups of students distinguished by the degree of importance given to the Moodle tools.

II.1 Introduction

Nowadays, Information and Communication Technologies (ICTs) are present in the teaching and learning process involving the activities of data collection, information processing and knowledge creation. Particularly, Learning Management Systems (LMSs) have a lot of potential for supporting the referred process, provided they are used in their fullness.

The Moodle platform is the LMS most used in higher education (Bremer & Bryant, 2005; Campanella et al., 2008; Costa, 2010; Fernandes, Simões, Santos & Rogado, 2007; Fernandes, 2008; Lms, 2007; Machado & Tao, 2007; Miyazoe, 2008; Tejedor, Muñoz-Repiso & Costa, 2012) and integrates several modules that allow creation, organization, delivery, communication, collaboration and assessment activities.

This chapter analyses the main functionalities and tools available in the Moodle platform and presents the main modules as well as some extended tools that are offered by the University of Aveiro, Portugal (UA). Additionally, it discusses the results of a study carried out in the Department of Economics, Management and Industrial Engineering (DEGEI) through the application of a questionnaire to 278 students with the objective of characterizing the use they make of the Moodle and of its main tools. The questionnaire consisted of the three sections: (i) characterization of the participants, (ii) characterization

of the use of the Moodle' platform in terms of purpose of use and format of information accessed/posted and (iii) characterization of the use of Moodle' tools and quantification of the degree of importance assigned to the use of each tool.

The collected data were analyzed using the *IBM SPSS Statistics 19* software. First, a descriptive analysis was performed, in order to characterize the behavior of each variable measured. Afterwards, *t*-tests were done in order to verify whether there were statistically significant differences between the average importance of each Moodle tools between the groups that use and do not use the tools. Finally, two cluster analyses (one hierarchical and another using *K-means* method) were performed in order to identify and characterize groups of users according to their profile of importance given to Moodle@UA tools and the mean values of the degree of importance assigned by the clusters obtained were compared using t-tests.

This chapter intends to contribute to a systematization of the activities and the respective modules provided by Moodle, as well as to show the results of an exploratory study on the importance in the students' perspective of the Moodle tools use in the teaching/learning process.

This chapter is organized in five sections. The second section reviews the main classification of LMS, and compares different LMSs concerning their utilization and the services they offer. In the third section the Moodle platform is examined, through a brief description of the modules, a systematization of the activities and a brief discussion of the advantages and disadvantages. The fourth section describes the study carried out at the UA, including a description of the tools incorporated in the e-learning platform adopted by the UA - Moodle@UA, and the results obtained in the empirical study. Finally, in the fifth section, some conclusions and future work are presented.

II.2 Learning Management Systems

There are different expressions used to describe educational computer applications, such as Learning Management Systems (LMS), e-learning Systems, Course Management Systems (CMS) or even Virtual Learning Environment (VLE). In this work it will be used the expression Learning Management System.

Ekúndayò and Tuluri (2011) define LMS as the application of technology to learning and teaching, allowing the use of various methods to impart information, skills and competences. Additionally, these platforms enable educational institutions to manage their educational resources, to support their distance education, and to supplement their

traditional way of teaching (Al-Busaidi & Al-Shihi, 2012). LMS can support e-learning activities such as communication, collaboration, learning and information/knowledge transfer (Al-Busaidi & Al-Shihi, 2012). Through the use of these systems, students can access courses' contents in different formats (text, image, sound), as well as interact with teachers and/or colleagues, via message boards, forums, chats, video-conference or other types of communication tools (Sanchez & Hueros, 2010). These platforms provide a set of configurable features, in order to allow the creation of online courses, pages of subjects, work groups and learning communities (Paulsen, 2003). In addition to the pedagogical dimension, they have a set of features for registering, monitoring and evaluation activities of students and teachers, enabling the contents' management via Internet.

It should be highlighted the several studies revealed the existence of strong advantages on using e-learning platforms (Mahmoud, 2008; Mellow, 2005; Moura & Carvalho, 2009). However, their adoption involves some challenges to the institutions as well as an appropriate choice of the technologic platform (Ozkan & Koseler, 2009).

LMS can be classified in several ways, according to their activities (Al-Busaidi & Al-Shihi, 2012; Piotrowski, 2010), features (Piña, 2010) or interaction (Lonn, Teasley & Krumm, 2011).

According to the approach of Piotrowski (2010), an e-learning platform represents a system, which provides integrated support for the six different activities described below:

- Creation - refers to the production of learning and teaching materials by instructors;
- Organization - refers to the arrangement of the materials for educational purposes (e.g., combining them into modules or courses);
- Delivery - refers to the publication and presentation of the materials, so that they can be accessed by students;
- Communication - refers to the computer-mediated communication between students and instructors and among students;
- Collaboration - refers to students jointly working on files or projects; it also includes collaboration between instructors;
- Assessment - refers to the formative and summative evaluation of learning progress and outcomes, including feedback.

According to the classification of Piña (2010) the most common features of a LMS are:

- Content creation - allows teachers to produce course contents within an embedded text/HTML editor, or to upload documents, spreadsheets, presentations, images, animations, audio, video or hyperlinks. Teachers can organize contents into folders and display or hide those folders from students;
- Communication - allows teachers to incorporate student-instructor and student-student interaction into the course. The tools used for this activity can be

asynchronous, like announcements, wikis, blogs, and file sharing or synchronous, like chats;

- Assessment - provides teachers with different ways of testing, surveying and tracking students' achievement and activity in the course;
- Administration - includes control panels which allow (i) to manage the settings for the content creation, communication and assessment tools, (ii) to customize the look of the course, (iii) to make tools, content and resources available or unavailable to users (iv) to manage files and (v) to move or copy contents (Piña, 2010).

LMS can also be classified by the interaction types described below (Lonn et al., 2011):

- Learner-Content interaction - refers to the interaction that a student has with the subject matter presented by the instructor or other students. Recent technological innovations that have expanded this type of interaction go beyond text-based forms of content to include audio and video recordings, computer software, and a variety of interactive multimedia technologies;
- Learner-Instructor interaction – relates to cases where instructors demonstrate skills, model attitudes and values, and coach students on how to interact with contents. Through their interaction with students, instructors stimulate learners' interest and help students utilize course contents. This form of interaction can also include affective aspects of instructor-to-student interactions, such as counseling, support, and encouragement;
- Learner-Learner interaction - refers to any two-way communication among two or more students with or without the presence of an instructor.

In what concerns the platforms actually used by educational institutions, there are some studies that compare the most popular ones concerning their utilization and the services they offer. Table II.1 presents a brief comparison of several LMSs, some of them being commercial solutions and others open-source solutions.

It can be seen in Table II.1 that the Moodle platform is currently the most used one, as well as the most easy to use (Bremer & Bryant, 2005; Campanella et al., 2008; Costa, 2010; Fernandes et al., 2007; Fernandes, 2008; Lms, 2007; Machado & Tao, 2007; Miyazoe, 2008; Tejedor et al., 2012). The number of registered Moodle sites was 73,255 in January 15, 2013, of which 2,197 in Portugal. By the same date, the number of users amounted to 64,325,488 users in 224 countries (Moodle, 2013).

Table II.1 - Comparing LMS: Use and Services.

LMS	Type	Use					Services/Factures offered					Portugal		
												Use		Features
Moodle	Open-source		1st	1st	1st	1st		2nd	1st	1st	1st	1st	1st	4th
Blackboard	Commercial	3rd	2nd	2nd			5th		3rd	4th		2nd		
WebCT	Commercial	1st		5th	2nd				2nd	3rd				
IBM LMS	Commercial			3rd										
Lotus Learning Space	Commercial	6th					1st							
Oracle iLearning	Commercial			4th				4th						
Docebo	Open-source			6th										
Claroline	Open-source			7th				1st						
ATutor	Open-source			8th		2nd					2nd			
uPortal	Open-source			9th										
Plone	Open-source			10th				3rd						
Sakai	Open-source				3rd					2nd				
ClassFronter	Commercial	2nd												
TopClass	Commercial	4th					3rd							
FirtClass	Commercial	5th												
iTutor	Commercial	7th												
LUVIT	Commercial	8th												2nd
CiscoWorks	Commercial						2nd							
Docent	Commercial						4th							
Teleformar	Commercial											3rd		3rd
Teleduc	Open-source													1st
Pedago	Open-source													5th
		(1)	(2)	(3)	(4)	(5)	(6)	(3)	(7)	(4)	(5)	(8)	(9)	(10)

(1) (Paulsen, 2003); (2) (Bremer & Bryant, 2005; Machado & Tao, 2007; Miyazoe, 2008); (3) (Campanella et al., 2008); (4) (Bri, García, Coll & Lloret, 2009); (5) (Aydin & Tirkes, 2010); (6) (Santo, Colace, Santo & Vento, 2003); (7) (Cavus & Momani, 2009); (8) (Fernandes et al., 2007); (9) (Costa, 2010; Fernandes, 2008; Lms, 2007; Tejedor et al., 2012); (10) (Pinheiro & Silva, 2005; Silva & Pinheiro, 2006).

The next section analyzes the Moodle platform through a brief description of the modules it offers and their correspondence with the activities referred above, as well as presenting a discussion on its advantages and disadvantages.

II.3 Moodle platform

Moodle development was started in 1999 by Martin Dougiamas, who was a WebCT administrator at Curtin University of Technology, Perth, Australia, out of dissatisfaction with WebCT. Version 1.0 was released in 2002 (Piotrowski, 2010).

Moodle enables the creation of course websites, ensuring their access only to enrolled students (Cole & Foster, 2008). According to Mehrabi and Abtah (2012), this platform is composed of a simple interface that looks more like a portal of information, allowing the exchange of information among users geographically dispersed, through mechanisms of synchronous (chats) and asynchronous communication (discussion forums). The Moodle platform has three levels of use, with features of differential use and access: (i) administrator (the manager of the platform), (ii) teacher (trainer, facilitator, promoter) and (iii) student (learner, participant) (Mehrabi & Abtahi, 2012). In a functional perspective, it has easily configurable features, allowing the creation of student assessment processes

(quizzes, online tests and surveys), as well as managing their tasks with their timetable (Itmazi, Megías, Paderewski & Gutiérrez, 2005; Legoinha, Pais & Fernandes, 2006; Mahmoud, 2008), besides offering a wide variety of complementary tools to support the teaching and learning process. Furthermore, the Moodle platform allows easy integration with other systems involving Academic Management, based on relational databases and supported by Web services infrastructure (Moura & Bernardino, 2010).

According to the classification presented by Blin and Munro (2008) the Moodle platform is characterized by a set of functionalities grouped in two different classes: resources and modules. Resources are instructional materials that are usually created in digital formats and then uploaded to the platform. Web pages, PowerPoint files, word documents, flash animations, video and audio files represent some examples of these resources. Modules are components created via Moodle in order to provide interaction among students and teachers towards manipulation and content transformation (Blin & Munro, 2008). In this context, the Moodle platform provides several modules, described below:

- Database - allows to build, display and search a bank of record entries about any topic (Moodle, 2013) and allows to share a collection of data (Cole & Foster, 2008);
- Lessons - represent a set of ordered topics summarizing the instructional materials and allow the access to them through the respective link (Cole & Foster, 2008);
- Assignments - allow teachers to collect work from students (Cole & Foster, 2008) and allow teachers to evaluate the student's work and provide feedback including grades, in a private mode (Moodle, 2013) and allow students to upload assignment files (Cole & Foster, 2008; Suvorov, 2010);
- Workshops - represent a peer assessment activity with many options and allow students to submit their work via an online text tool and attachments (Moodle, 2013);
- Chats - allow synchronous conversation (Suvorov, 2010);
- Forums - represent a communication tool where students and teachers can exchange ideas by posting comments (Cole & Foster, 2008; Moodle, 2013);
- News - represent a special forum for general announcements and allow teachers to add posts and to send emails (Moodle, 2013);
- Glossary - allows creating and maintaining a list of definitions and represents a mechanism for collaborative activities that can be restricted to entries made by the teacher (Moodle, 2013);
- Wikis - allow users to edit collaborative Web pages (Cole & Foster, 2008) and provide space for collaborative work (Cole & Foster, 2008; Suvorov, 2010)
- Choice - allows teachers to ask questions and specify multiple choice answers and represents a useful mechanism to stimulate thinking about a topic (Moodle, 2013);

- Quiz - allows teachers to design and build quizzes with a variety of questions, with different types of answers, such as multiple choice, true/false, short answer (Cole & Foster, 2008);
- Survey - allows teachers to gather feedback from students using prepackaged questionnaires (Moodle, 2013);
- Feedback - allows teachers to create surveys to collect feedback (Moodle, 2013);
- SCORM (Sharable Content Object Reference Model) - represent specifications that enable interoperability, accessibility and reusability of the learning content (Moodle, 2013) and represent tools that enable SCORM packages to be included in the course (Cole & Foster, 2008);
- External tools - enable interaction with compliant learning resources (eg. Learning Tools Interoperability) and activities on other Web sites and provide access to new activities' types or materials (Moodle, 2013).

Table II.2 presents the correspondence between the activities of the learning platforms classified by Piotrowski (2010) and previously mentioned, with the modules just described.

Table II.2 - Activities and modules of the Moodle platform.

Activity	**Module**
Creation	Database
Organization	Lessons
Delivery	Assignments
	Workshops
Communication	Chats
	Forums
	News
Collaboration	Glossary
	Wikis
Assessment	Choice
	Quiz
	Survey
	Feedback
Reusability*	SCORM
	External tools

* This term is not included in the classification by Piotrowski (2010).

The usage of Moodle platform can offer many benefits, as was being referred throughout this chapter, but also has some drawbacks that should be considered in order to avoid them or overcome their effect. Table II.3 summarizes the main advantages and possible disadvantages according to some authors.

Table II.3 - Main advantages and disadvantages of the Moodle platform.

Advantages
- it is an open source system (Mehrabi & Abtahi, 2012);
- allows saving time and money (Paragina, Paragina, Jipa, Savu & Dumitrescu, 2011);
- increases efficiency and usage flexibility (Aydin & Cagiltay, 2007; Paragina et al., 2011);
- provides a flexible schedule and a good monitoring activity (Paragina et al., 2011);
- allows releasing class time usually taken for assessments (Aydin & Cagiltay, 2007);
- statistics used for diagnostic purposes can be automatically compiled, facilitating the development or revision of instruction (Aydin & Cagiltay, 2007);
- allows to revise, to develop and to share materials (Aydin & Cagiltay, 2007);
- allows to adjust homework to the students' levels of knowledge (Paragina et al., 2011);
- offers opportunities for teleworking (Paragina et al., 2011).
Disadvantages
- it may not be easy to assess some students' skills (Aydin & Cagiltay, 2007);
- it can be difficult to control access to resource materials when students are being assessed online (Aydin & Cagiltay, 2007);
- students can feef lack of contact with instructors (Aydin & Cagiltay, 2007);
- it is necessary some knowledge to begin using the platform (Paragina et al., 2011);
- possible lack of control over the students' motivation (Paragina et al., 2011);
- involves the danger of lack of students' initiative (Paragina et al., 2011).

The next section presents a study about the Moodle platform adopted by the University of Aveiro and its use by students are analyzed.

II.4 The case of the Moodle platform at the University of Aveiro

II.4.1 The Moodle of the UA

The Moodle is the e-learning platform adopted by the University of Aveiro (Moodle@UA) and was characterized through a content analysis complemented with an interview with the responsible for this platform at the UA.

The Moodle@UA incorporates a set of tools that can be classified in two groups: (i) The configured modules from the standard Moodle platform that provide interaction among students and teachers namely Assignments/Workshops, Chats, Forums, News and Quiz/Survey and (ii) the external tools that are incorporated in the platform, in particular Blogs UA, Wikis UA, Questionnaires and Video-conference. These extended tools are characterized in Table II.4, together with a brief description of the functionalities and software used to support them.

Table II.4 - Extended tools of Moodle@UA.

Extended tool of Moodle@UA	**Description**	**Software used**
Blogs UA	allow to discuss, share ideas and answer questions;	WordPress
Wikis UA	represent services used by teachers, students or researchers, within the activities, projects or research;	MediaWiki
Questionnaires	represent services to implement and deliver online questionnaires, used to collect data in activities of teaching and research;	LimeSurvey
Video-conference	allows real time communication;	BigBlueButton

WordPress is an open source software that allows publishing Blogs (WordPress, 2012). It comes with a set of features designed to make publishing on the Internet easy and

appealing. It is compatible with the main standards, and has a customizable core (WordPress, 2012).

MediaWiki is a free software open source that enables creating Wikis, originally created for Wikipedia (MediaWiki, 2012) that can manage image and multimedia files.

LimeSurvey is an open source survey application that allows (i) unlimited number of surveys at the same time, (ii) 28 different question types, (iii) integration of pictures and movies, (iv) creation of printable versions; (v) re-usable editable answer sets, (vi) ready-made importable questions, (vii) assessment surveys; (viii) import and export functions to text, PDF, SPSS, R, XML and MS Excel formats (LimeSurvey, 2012).

BigBlueButton is an open source web conferencing system. Participants can take part in a group chat which is viewed by everyone within the conference, or select a user and begin a separate private conversation. Teachers can easily upload multiple PDF's or Office documents and the participants can see the slides as the presenter moves through the presentation (BigBlueButton, 2012).

II.4.2 Characterization of the use of Moodle of the UA

In this sub-section the usage of the Moodle platform by the students of the UA is considered, through the analysis of the results obtained from a questionnaire applied to 278 of them. Respondents were attending to subjects of the responsibility of the DEGEI and were 150 female and 128 male with an average age of 21.8 years (s=3.42). The participants were mainly (87%) from 5 areas (Management and Industrial Engineering, Economy, Management, Tourism and Languages and Business Relations) at undergraduate level (77%). A more detailed characterization of the participants, as well as of the questionnaire itself can be found in Costa, Alvelos and Teixeira (2012).

The purposes of use of the Moodle were studied and the results reveal that the main ones are 'Download materials', mentioned by about 98% the respondents and 'See news', mentioned by about 84% of them. 'Deliver assignments', 'Communicate with teachers' and 'Ask questions', in this order, are much less mentioned (see Figure II.1).

These results can be interpreted as the Moodle being mainly used as a repository of materials and information. This hypothesis is reinforced by the analysis of the results presented in Figure II.2, where it can be observed that the most used materials' formats that respondents access/post are 'Texts' and 'Slides'. 'Databases/Worksheets', 'Videos' and 'Images' are also referred, but much less used than the first ones. Six of the students identified 'Audio' as another format used in the Moodle.

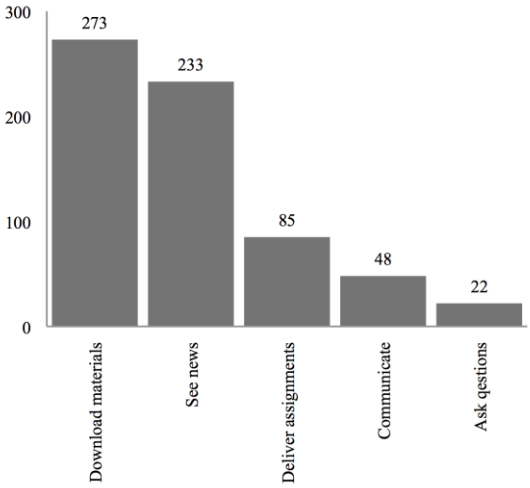

Figure II.1 - Bar chart of the number of respondents using each purpose of Moodle.

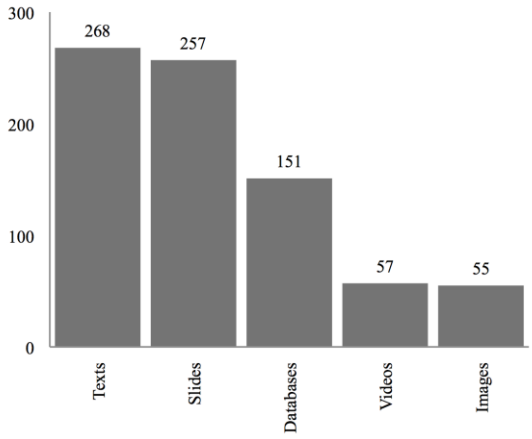

Figure II.2 - Bar chart of the number of respondents using each format.

The tools referred in the previous sub-section were evaluated through (i) their use (or not) by the respondents and (ii) the degree of importance respondents assign to their use as a means of promoting the success of the teaching/learning process. Table II.5 presents some descriptive statistics of the respective degree of importance evaluated in a scale of 1 (unimportant) to 5 (very important).

Table II.5 - Descriptive statistics of the importance level and p-value of the t-tests for each tool.

	N_{valid}	Mod	Mean	*s*	N_{Yes}	$Mean_{Yes}$	N_{No}	$Mean_{No}$	*t* value	*p*-value
Assignments/Workshops	174	5	4.15	1.02	103	4.40	71	3.79	3.717	0.000
Chats	110	1	2.45	1.19	18	3.34	92	2.25	4.165	0.000
Forums	157	3	2.97	1.15	76	3.01	81	2.93	0.473	0.637
News	214	4[a],5[a]	3.90	1.01	162	4.01	52	3.56	2.861	0.005
Quiz/Survey	112	3	3.10	1.31	20	4.10	92	2.88	5.227	0.000
Blogs UA	137	1	2.36	1.17	39	2.82	98	2.17	2.713	0.009
Wikis UA	127	3	2.80	1.18	35	3.40	92	2.57	3.727	0.000
Questionnaires	148	3	3.05	1.13	68	3.32	80	2.83	2.734	0.007
Video-conference	97	1	2.21	1.17	4	4.50	93	2.11	---	---

Legend: N_{valid} – Number of respondents that answered the question; Mod – sample Mode; [a] – Two modes; Mean – sample mean; s – sample standard deviation; N_{Yes} – Number of respondents that use the tool; N_{No} – Number of respondents that do not use the tool.

The Moodle@UA tools can be grouped considering the level of importance assigned to them. Actually, those considered most important were 'News' and 'Assignments/Workshops' (1st group), followed by 'Quiz/Survey', 'Questionnaires', 'Forums' and 'Wikis UA' (2nd group), with an intermediate level of importance, and finally those considered less important which were 'Chats', 'Blogs UA' and 'Video-conference'.

It should be noted that the Moodle tools studied only include the modules and not the resources of the platform. Thereby, the most mentioned purpose of the Moodle – 'Download materials' (see Figure II.1) – is not reflected in this analysis.

In order to understand if the importance given to each tool is related with its use, for each tool the sample was divided in two groups: those who use the tool and those who do not use it. A *t*-test (with significance level of 5%) was performed for each tool with the objective of analyzing if the differences between the means of the two groups were statistically significant. The results of these tests, as well as the means for each group are also presented in Table II.5. It can be observed that the differences are statistically significant at a level of 5% for all the tools except the 'Forums', meaning that the students who use the tools give more importance to their implementation in the teaching/learning process than those who do not use them.

II.4.3 Identification of groups of respondents based on the importance given to the Moodle tools

In order to identify and characterize groups of respondents based on their profile of importance given to Moodle@UA tools, there were performed two cluster analyses: a hierarchical clustering using *Ward* method and *squared Euclidean distance*, and a non-hierarchical one using *K-means* method. It should be noted that the number of respondents is less than the total, because there were only considered the students that answered the questions for all the studied tools (85).

The hierarchical analysis pointed out two clusters, composed by 45 and 40 cases, respectively. From the non-hierarchical analysis performed for two clusters it could be observed that the first one (C1) was composed by 51 cases and the second one (C2) was composed by 34 cases. It can be observed that 84% of the cases are classified in the same clusters by the two methods.

The mean values of the importance of each tool were compared between the resulting clusters from the *K-means* method, using *t*-tests.

Table II.6 presents the average values of the variables included in the cluster analyses for each cluster (*K-means* method) and for all cases (Total). The *t* and *p* values that result from the *t*-tests performed are also presented.

Table II.6 - Clusters' means of degree of importance of each Moodle tools (K-means).

	Cluster		**Total**	***t*-tests**	
	C1	**C2**			
Degree of importance	**N=51**	**N=34**	**N=85**	***t* value**	***p-value***
	Mean	**Mean**	**Mean**		
Assignments/Workshops	4.22	3.68	3.95	2.070	0.044
Chats	2.78	1.62	2.20	5.556	0.000
Forums	3.76	2.12	2.94	8.559	0.000
News	4.31	3.41	3.86	4.083	0.000
Quiz/Survey	3.35	2.18	2.77	4.827	0.000
Blogs UA	2.76	1.50	2.13	6.727	0.000
Wikis UA	3.31	1.88	2.60	7.014	0.000
Questionnaires	3.37	2.21	2.79	5.318	0.000
Video-conference	2.49	1.68	2.09	3.414	0.001

The cluster C1 is composed by 60% of the respondents being the cluster C2 composed by the remaining 40%. From the results presented in the table it emerges the fact that respondents from C1 assign a higher degree of importance than those from C2 to all the Moodle tools. Those differences are all statistically significant at a level of 5%.

II.5 Conclusions and future work

Learning Management Systems (LMSs) are applications used in the teaching/learning process that allow the use of various methods to impart information, skills and competences (Ekúndayò & Tuluri, 2011). These systems integrate a set of activities as content creation, content organization, content delivery, communication, collaboration or assessment.

This chapter analyzed the main classifications of LMSs and presented a comparison between the most popular LMSs platforms concerning their utilization and the services they offer. As the Moodle platform is the most used open-source LMS in higher education, the chapter characterizes it and presents its main modules and activities as well as the main advantages and possible disadvantages of its usage according to some authors.

The University of Aveiro (UA) is one of the institutions that use Moodle (Moodle@UA) in order to support the teaching/learning process. In addition to the tools incorporated in the Moodle platform, UA also integrates other tools (external tools), as Blogs UA, Wikis UA, Questionnaires and Video-conference.

The analysis of the students' answers to the applied questionnaire revealed that the most mentioned purpose of the use of the Moodle@UA were 'Download materials', 'News' and 'Deliver assignments' and that the most used information materials are 'Texts' and 'Slides'. Additionally, students gave more importance to 'News' and 'Assignments/Workshops'. These results are compatible with the hypothesis that the Moodle@UA is being used mainly as a repository of materials and information.

Besides, it can be noticed that students that use the tools typically assign more importance to them, being the differences statistically significant at 5% (except for Forums).

From the cluster analysis performed emerged two groups clearly distinguished by the degree of importance given to all the Moodle tools studied. The students from the first group assigned a higher importance than those from the second one to all the Moodle tools studied, being all the differences statistically significant at a level of 5%.

As future work it is considered important to perform a careful analysis of the underlying reasons for the use, or not, of the e-learning tools by the academic community, as well as to investigate on how these tools can help promoting the success of the teaching and learning process.

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II.8 Key Terms & Definitions

Teaching and Learning Process is the process that involves the interaction between teacher and students to share information and knowledge.

Learning Management Systems (LMSs) are technologic systems used to support distance education and to supplement the traditional way of teaching, allowing creation, organization, delivery, communication, collaboration and assessment activities.

E-learning platform is a technologic framework used to create online courses that usually allow to register, monitor and evaluate activities and to manage contents, as well as to exchange information among geographically dispersed users through synchronous and asynchronous communication.

Moodle is an open-source Learning Management System.

Moodle@UA is the e-learning platform adopted by the University of Aveiro that incorporates a set of configured modules from the standard Moodle and some external tools like Blogs UA, Wikis UA, Questionnaires and Video-conference.

III The impact of Web 2.0 in the teaching and learning process

Reference

Costa, C., Teixeira, L., & Alvelos, H. (2014). The impact of Web 2.0 in the teaching and learning process. In M. M. Cruz-Cunha, F. Moreira, & J. Varajão (Eds.), *Handbook of Research on Enterprise 2.0: Technological, Social, and Organizational Dimensions* (pp. 314-331): IGI Global

The impact of Web 2.0 in the teaching and learning process

Abstract

The Web 2.0 represents the second generation of the Web applications, based on online services collaboration and sharing, that promote different ways of interaction between people. These applications provide several collaboration and communication opportunities, like social interaction, feedback, conversation and networking, thus being a perfect environment for the teaching and learning context. The main goal of this chapter is to present the most used Web 2.0 tools, their major advantages and disadvantages, and their specificity when used in the teaching and learning process. It is believed that their use can greatly improve the teaching and learning process and, consequently, the need to adjust the traditional practice to the new technological paradigm emerges.

III.1 Introduction

In recent years, the use of Information and Communication Technologies (ICTs) has grown drastically in education, providing access to information in an easier and more convenient way. These ICTs support the process of teaching and learning, and are the usual source of the modalities of Distance Education (DE). The diversity of interactive multimedia equipment, as well as the existence of the broadband communication networks, provide students with a set of endless information and education arrangements underpinned by new ICTs. On the other hand, the evolution of Web technologies from Web 1.0 to Web 2.0 has also been an important factor for the study of new models of teaching and learning. Nowadays, teachers must not only transmit knowledge using traditional methods, but must use appropriate methods adapted to the new learning standards of new students, called digital natives (Prensky, 2001a). This new phenomenon is not intended to underestimate the role of teachers in the classroom, but rather to adjust the traditional approaches to the new technological paradigm, in order to contribute to the improvement of teaching and learning process. In this context, ICTs in education are able to highlight the role of education platforms or Learning Management Systems (LSM) (such as Moodle) as tools to support the teaching and learning process. In most cases, these platforms are used as a repository of documents available for consultation by teachers and students.

Web 2.0 is a second generation of Web based on services online, collaboration and sharing and represents a paradigm shift in the way the Internet is used. It involves a more open approach to the Internet, and user generated contents, that are posted using tools such as Blogs, Wikis, Social Networks, Social Bookmarks, RSS and Media Sharing. Web 2.0

applications reflect different ways of promoting interaction between people, supporting social interaction, feedback, conversation and networking.

The Web 2.0 tools have great in the educational context, improving the teaching and learning process, and consequently contributing to the adjustment of the traditional approaches to the new technological emergent paradigm. The main goal of this chapter is to present the most used Web 2.0 applications related to the teaching and learning activity and to discuss their major advantages and disadvantages.

It starts by analyzing the new paradigm in teaching and learning processes. Next, the main Web 2.0 tools are presented through a brief description, including their pros and cons. Afterwards the authors analyze the use of Web 2.0 in teaching and learning process, their advantages and disadvantages and their use by e-learning platforms. Finally, some conclusions and future work are presented.

III.2 Teaching and learning process: The new paradigm

Most students today in higher education are considered digital natives. The fact that on their day-to-day live, students are native users of the Web tools facilitates greater interactivity (Collis & Moonen, 2008). According to Prensky (2001a, 2001b) digital natives are everybody that was born after 1980, and those who were born before that year are considered digital immigrants. The digital natives think and process information differently from their predecessors (Prensky, 2001a). Therefore, teachers today can not assume that students learn the same methods that they learned. ICTs that emerged in the 1990's caused a shift in the way of communicating and data transmission, and have also caused changes in the people own thought patterns and how they learn the content (Prensky, 2001a).

Currently, universities have these new students and therefore, they should adapt teaching methods, which include the adoption of ICTs for the transmission of knowledge. In fact, digital natives and students of technical subjects used more technology when compared to digital immigrants and student of non-technical subjects (Margaryan, Littlejohn, & Vojt, 2011). However, despite the facts showing a clear need for the adoption of ICTs in new teaching methods, the decisions of teachers and administrators should not be based exclusively on students' preferences and on the trends in technology. There must be an understanding of the educational value of these technologies, in order to improve the process and learning outcomes. In this sense, it is necessary to explore the different technologies in teaching, to evaluate their effectiveness in practice within each institution (Kennedy, Judd, Churchward, Gray, & Krause, 2008; Margaryan, *et al*., 2011), and based on this, adopt them in a prudent and progressive way.

In general, universities are concerned about motivating students based on methodologies of teaching and learning using the ICTs, as well as attracting other students based on a paradigm of DE. In this sense, the choice of a methodology that promotes the study autonomy, could provide a more student-centered education and thus promote the creation of students' own knowledge. ICTs and the variety of tools that characterize the Web 2.0 can be used to support this new paradigm for the benefit of students, teachers and institutions.

III.3 The Web 2.0 technology: the main tools

The concept of "Web 2.0" emerged in a brainstorming session between O'Reilly and MediaLive International in October 2004, being presented as "a revolution" in the business of the computer industry. It was caused by the change of the Internet as a platform for content management (O'Reilly, 2005). Besides being motivated by technology, it portrays a social phenomenon that involves an approach to content generation and distribution, characterized by open communication, decentralization of authority and freedom to share and reuse information (Alexander, 2006). The aim is to create applications that take advantage of network effects to get better benefits for people who use it. According to O'Reilly (2006) the Web 2.0 means "*harnessing the collective intelligence*" is referred as the social use of the Web that allows people to collaborate and to have an active involvement in content creation, in order to generate knowledge and sharing information (Grosseck, 2009).

The Web 2.0 tools support social interaction, feedback, conversation and networking, but these are also endowed with a flexibility that enables collaboration. This paradigm redefines the interaction between Internet and users, allowing building virtual applications using data and functionality from a number of different sources.

III.3.1 Brief description of the main Web 2.0 tools

Blogs, Wikis, Social Networks, Social Bookmarks, Syndication of Contents through RSS and Media Sharing are some of the most popular tools, and therefore a brief description of each of them is presented in this section.

III.3.1.1 Blogs

Blogs represent one of the most used Web 2.0 tools and the first one appeared in the late 1990s (Top, Yukselturk, & Inan, 2010), before the appearance of the Web 2.0 concept. The term Weblog was named by Jorn Barger in December 1997 and in early 1999, Peter Merholz shortened it 'Blog' (Blood, 2000). Blog refers to a simple Webpage consisting of brief paragraphs of opinion, information, personal diary entries in the form of text, images,

video, audio, or links, called *posts*, arranged chronologically with the most recent first (Anderson, 2007; Franklin & Harmelen, 2007; Grosseck, 2009; Halic, Lee, Paulus, & Spence, 2010; Virkus, 2008). It allows users to express their opinion about a subject or a topic as well as to create a topic and document it (Sousa & Gomes, 2010), and allows feedback from the audience by means of successive comments on the main entry, with the possibility to preserve the old posts in addition to new entries (Grosseck, 2009; Halic, *et al*., 2010; Top, *et al*., 2010). More and more people are publishing in Blogs and in 28 September 2011, there were 172,360,000 identified Blogs in http://www.blogpulse.com/. There are various formats and the most popular is Blogger.com (Williams & Jacobs, 2004).

Blogs allow to keep the interaction with external environments using, for instance, videos, photos, bookmarks, and network (Kim, 2008). In this context the RSS technology can be useful to help users in managing contents (Kim, 2008).

III.3.1.2 Wikis

The concept of Wiki was created by Ward Cunningham in 1995 (Zeinstejer, 2008), and represents a system that allows to build up a corpus of knowledge in a set of interlinked WebPages, using a process of creating, writing and editing pages (Franklin & Harmelen, 2007; Grosseck, 2009; Kear, Woodthorpe, Robertson, & Hutchison, 2010). These pages can be created and modifed by any user utilizing simple text editing facilities (Kear, *et al*., 2010), and any person can see and / or modify the information of the document (De Pedro *et al*., 2006). The philosophy of Wiki is one of complete openness, with any Web user being able to modify the content, as mentioned by Kear, *et al.* (2010): "*Wikis allow for web documents to be structured and organized in different ways, and to be updated regularly*".

According to Lai and Ng (2011), Wikis are one of the many popular Web 2.0 tools that facilitate collaborative work, being the Wikipedia the most popular Wiki.

The concepts of Blogs and Wikis are different (Zeinstejer (2008). However, the concept of Bliki, also known as wikiLog, conceived in 2003 by Martin Fowler and Ward Cunningham, combines features and advantages of Blogs and Wikis (Huang & Yang, 2009; Wan & Zhao, 2007) and is defined by Fowler (2003) as "*a cross between a wiki and a blog*". The same author refers "*Like a blog, it allows me to post short thoughts when I have them. Like a wiki it will build up a body of cross-linked pieces*".

III.3.1.3 Social Networks

Social Networks are tools that support collaboration, knowledge sharing, interaction and communication of users from different places with a common goal (Franklin & Harmelen, 2007; Grosseck, 2009; Usluel & Mazman, 2009). The Facebook, MySpace and LinkedIn

represent the most popular examples of Social Networks, allowing the creation of a personal 'space' (Anderson, 2007).

Dwyer, Hiltz and Passerini (2007) characterize features the Social Networks as present in the following statement: "*When people join social networking sites, they begin by creating a profile, then make connections to existing friends as well as those they meet through the site. A profile is a list of identifying information. It can include your real name, or a pseudonym. It also can include photographs, birthday, hometown, religion, ethnicity, and personal interest. Members connect to others by sending a "friend" message, which must be accepted by the other party in order to establish a link. "Friending" another member gives them access to your profile, adds them to your social network, and vice versa. Members use these sites for a number of purposes. The root motivation is communication and maintaining relationships. Popular activities include updating others on activities and whereabouts, sharing photos and archiving events, getting updates on activities by friends, displaying a large social network, presenting an idealized persona, sending messages privately, and posting public testimonials*."

III.3.1.4 Social Bookmarks

A social bookmarking service provides users the ability to record WebPages and consequently to tag those records with meaningful words that describe the pages recorded (Anderson, 2007; Franklin & Harmelen, 2007; Grosseck, 2009). These tools allow users to create lists of favorites, to store and to share them with other users (Anderson, 2007), and may be tagged with keywords. There is an important difference from the traditional categorization based on favorite's lists in the browser (Anderson, 2007) as Social Bookmarks allow users to explore connections between their own bookmarks and the others' ones, and thus enable discovering of new items and people with similar interests (Rethlefsen, 2007).

The social bookmarking phenomenon was launched by Joshua Schacter with *del.icio.us* Website (Anderson, 2007). Ma.gnolia and BlinkList, represent other examples of this tool (Rethlefsen, 2007). These tools allow to build up reading lists and resource lists, using of multiple tags and structured into sub-categories (Anderson, 2007). Groups of users with a common interest can team together using the same service to bookmark items of common interest (Anderson, 2007). Social bookmarking systems allow individuals to discover what others find interesting and useful, without spending too much effort on it (Gray, Parise, & Iyer, 2011). With this service it is possible to check what other people are reading in two ways: searching on a certain tag to find what bookmarks others have associated with it or seeing the complete set of tags and bookmarks created by another person. This allows coming across information that may be interesting and relevant but which users may not have known to search for directly. Theses online resources visited by the user are

influenced by the prior actions of others (Gray, *et al*., 2011). A bookmark can be made visible to others if a user chooses to make it public, otherwise the act of accessing a bookmark in contemporary social bookmarking systems is not visible to others at all (Gray, *et al*., 2011).

III.3.1.5 Syndication of Content through RSS

Really Simple Syndication (RSS) or Rich Site Summary is a format for delivering regular changing Web content (http://www.whatisrss.com/) (Anderson, 2007). RSS feeds can potentially replace traditional email lists, reducing email overload and to keep specific WebPages current and relevant (Grosseck, 2009).

It allows users to find out about updates to the content of RSS-enabled sites, Blogs or Podcasts without actually having to go and visit the site (Anderson, 2007). A feed reader (sometimes called an aggregator) has to be used in order to centralize all the recent changes in the sources of interest of the user (Franklin & Harmelen, 2007).

III.3.1.6 Media Sharing

Media Sharing is a service store of user-contributed media that allows sharing for and displaying contents. Users can create their personal recourses for trading and networking (Anderson, 2007). Media Sharing tools can be divided into four categories: Podcasting (audio), Video Sharing (video) Photo Sharing (photo) and Slide Sharing (presentation), as described next.

Podcasting refers to the publication of audio content on the Internet and may be available to download for aggregators such as iTunes (the most popular) or other mobile devices such as mobile phones and iPods, allowing hearing regardless of place and time (Usluel & Mazman, 2009).

The Video Sharing enables the sharing of videos as clips from movies, television programs, video clips, and amateur content. YouTube is the most popular sharing service.

The Photo Sharing allows creating, manipulating and disseminating images. There are dozens of photographic applications on the Web and Flickr represents one of the most innovative (Sadik, 2009). Flickr is a Website to host and share images, drawings, illustrations and photographs and allows the creation of albums to store, organize and sort out photos, which can be seen in different parts of the world (Cress & Kimmerle, 2008; Grosseck, 2009).

The Slide Sharing allows sharing presentations posting this material available anywhere, anytime and for any person (Grosseck, 2009).

In the next section the main advantages and disadvantages of the just referred tools are presented.

III.3.2 Advantages and disadvantages of the different Web 2.0 tools

Table III.1 - Advantages/Disadvantages of Web 2.0 tools.

Advantages	Web 2.0 tools					
	Blogs	**Wikis**	**Social Networks**	**Social Bookmarks**	**RSS**	**Media Sharing**
-They are open system	5	*	*	*	*	*
-Do not depend on the used platform (a computer with browser and Internet connection is enough)	12	12	12	12	12	12
-Allow anytime-anywhere access	4	*	*	*	*	*
-It is easy to create and use contents (user-friendly)	1, 2, 4, 5, 12	6, 8, 12	12	12	12	12
-Allow communication on the Web in an interactive way	1, 2, 3		*			
-Provides fast access to information		12		*	*	
-Allow joint, de-centered authorship / Enable contents sharing and creative collaboration	2	7	15			
-Allow creating digital contents	*	*	*			12
-Enable sharing accumulated experiences	12	12	*			12
-Make possible organizing and presenting ideas and information		7, 11				
-Allow controlling access to resources by authenticated users	12	12	12	12	12	12
-Allow the redistribution of the effort, so that less and less time and energy are spent on the search and information management				12, 14	12, 13	
-Enable the notification of the updates of the pre-selected sites					13	
-Allow the individual evaluation of the participation in group works		9, 10				
-Allow easy visualization of the changes introduced in a document		10				
-It is possible to recover contents that have been erased or modified		10				
-Allow access to the historic information of the content (who, when and what)		10				
-Facilitate meeting people, finding like minds			15			
Disadvantages / Obstacles						
-Dependence on Internet connection	12	12	12	12	12	12
-Dependence on JavaScript activation	12	12	12	12	12	12
-Limited security	12	10, 12	12	12	12	12
-Possibility of different interpretations according to browser in use	12	12	12	12	12	12
-Difficulty of some users on moving from passive readers to active contributors of information	16	*	*	*	*	*
-Hard to get an overview of all the provided information	16	*	*	*		*
-Difficulty on filtering and organizing contents	*	6	*			*
-Difficulty on understanding the contents posted by others	*	6	*			*
-Time consuming on reading, understanding, selecting, organizing and maintaining contents	*	6	*			*
-Lack of clear contributions ownership and possibility of users to change each others' contributions		7				
-Lack of functionality / Time consuming to learn to use the editing tools		7, 10, 9				
-Fear of other people seeing the non-finished work		10				
-Do not allow discussion		1				

Legend: 1 - (Meyer, 2010); 2 - (Brescia & Miller, 2006); 3- (Williams & Jacobs, 2004); 4- (Huffaker, 2005); 5 – (Kim, 2008); 6 - (Lai & Ng, 2011); 7 - (Kear, *et al*., 2010); 8 - (Wan & Zhao, 2007); 9 - (Chu, 2008); 10 - (De Pedro, *et al*., 2006); 11 - (Grace, 2009); 12 - (Grosseck, 2009); 13 - ("What Is RSS? RSS Explained,"); 14 - (Gray, *et al*., 2011); 15 - (Anderson, 2007); 16 - (Divitini, Haugalokken, & Morken, 2005); * - Extension.

The literature presents a set of benefits and weaknesses related to usage of the Web 2.0 tools. There are more essays and studies about Blogs and Wikis than about the other tools. In this sense, it is difficult to find literature referring to the advantages and disadvantages of the other tools for people and organizations. Table III.1 presents the advantages and the disadvantages of the main Web 2.0 tools. The numbers in the table represent the studies where the advantages/disadvantages are referred. As some of the studies only analyze few tools, the extension of the advantages/disadvantages of those tools to the others, was considered and are represented by symbol '*'.

As it can be seen in Table III.1, the Web 2.0 tools are very easy to use as they are intuitive and user-friendly. They can be accessed "anytime-anywhere", they are open systems, they present high level of interactivity and they promote creative collaboration and the possibility of sharing digital contents. They also allow communication and collaboration, as well as experiences sharing. Some of the obstacles to the use of the tools are the basic requirements needed, such as Internet connection and JavaScript activation. The need of time for using, updating and organizing the contents as well as for selecting sources is also a constraint that should be marked.

III.4 Teaching and learning through the use of Web 2.0 tools by e-learning platforms

III.4.1 Web 2.0 tools in the educational context

Today's teaching and educational institutions don't need huge budgets to develop a global educational program, in the technological context (Jabbour, 2011). The Web 2.0 tools and the expansion of its capabilities, provide opportunities for teaching and learning (Jabbour, 2011).

Connection, collaboration, and engagement can be achieved instantly to remote devices virtually anywhere in the world. Technology solutions can support learning experiences in different ways (Jabbour, 2011), facilitating the education processes. For example, the students and teachers can publish content, create knowledge from scratch or combine online content and then share and exchange their ideas. On the other hand, the technology tools, in a specific class, can involve more people than traditional forms of classroom interaction (Jabbour, 2011).

Once connected to the internet, any user can share and explore ideas, thoughts and knowledge. Web 2.0 software is an open-ended tool that provides a lot of opportunities to explore new forms of teaching and learning (Jabbour, 2011). Web 2.0 aims at reducing barriers to entry and may influence diverse cultural environments with strong implications on education (e.g. on teaching in the classroom or on individual learning) (Alexander,

2006). Specific technologies and services such as Blogs, Wikis, identification of content through RSS, Social Bookmarking (favorites or bookmarks online), Media Sharing (Podcasts, videos, photos, presentations) and Social Networks can contribute to the creation of new models of teaching and learning (Anderson, 2007; Dabbagh & Reo, 2010; Franklin & Harmelen, 2007; Grosseck, 2009).

The top management of the educational institutions has the responsibility of creating and maintaining an appropriate environment for the use of these tools (Divitini, *et al*., 2005). Besides, it is believed that the positive impact on the teaching and learning process outcomes is greater the greater the Web 2.0 paradigm is present in the organizational culture.

The following paragraphs briefly analyze the possible use of each of the tools referred in the previous section in the educational context.

Teachers seem to have adopted the use of Blogs for class assignments, but few studies have been completed on educational uses of Blogs (Meyer, 2010). There are several ways by which teachers use Blogs as a teaching and learning tool (Paulus, Payne, & Jahns, 2009). Some teaching and learning activities in higher education make use of Blogs due to their popularity among young people (Halic, *et al*., 2010). When the teacher knows and acknowledges the barriers and constraints of students he / she can use the Blog as a starting point for finding ways to break through the identified barriers (Paulus, Payne, & Jahns, 2009). The Blog conversations offer opportunities to reflect on concepts related to the lessons outside of the class and share different perspectives on the lessons material (Halic, *et al*., 2010). Unanswered questions in Blog conversations are a valuable source of information for teachers as they provide a means for gathering information about what is known and not yet understood. Furthermore, teachers can create more learning environments based on the needs expressed by students and verified through blog conversations (Paulus, *et al*., 2009). In large classes, there is usually not enough time for students to answer or participate in the discussions but when performing a content analysis of a simple conversation on the blog the teacher can get information on the themes and the frequency of discussion of the students (Paulus, *et al*., 2009). In fact, the students recognized the beneficial effect of the blog activity on their overall learning (Halic, *et al*., 2010). The Blog appears to be an effective tool when included in the e-learning environment (Lin, *et al*., 2006).

Wikis help to create a dynamic and collaborative learning environment where, through open discussion and exchange of ideas and opinions, students can have an active participation in the creation and consolidation of knowledge (Meyer, 2010; Su & Beaumont, 2010). Wikis provide a valuable way for groups of students and their teachers to collaboratively develop learning resources offering, at the same time, a way for learning

in a more student centered system and in a more democratic logic (Kear, *et al*., 2010). The Wiki-based activities give teachers a new way of teaching that can be an alternative or a supplement to traditional classroom-based learning (Lai & Ng, 2011).

Social Networks allow students to participate in an informal and creative learning. At the same time, allows developing their digital literacy (McLoughlin & Lee, 2007). As an example of Social Networks, it can be noted that *Elgg* is an open source social networking system designed specifically for teachers and students that plays nicely with LMS like WebCT and Moodle (Rethlefsen, 2007). "*Elgg is an award-winning social networking engine, delivering the building blocks that enable businesses, schools, universities and associations to create their own fully-featured social networks and applications*" (Elgg, 2011).

Using Social Bookmarks, teachers and students can create a set of sites' references that can be accessed by any computer connected to the internet (Anderson, 2007; Grosseck, 2009. Teachers can use these tools to save helpful Web resources, search for other Web resources with similar tags and share those resources with students and other instructors (Luo, 2009), as well as helping students on deciding the usefulness of resources.

RSS are a useful tool that can help on having the information in teaching area updated allowing sharing work with other educators (Grosseck, 2009). Feeds can be used to keep specific courses' WebPages up to date. They can be created from search engines, bringing the most current information (such as text, images, audio or video) on a topic and are, thus, a useful research tool for class studies and projects (Rosen & Nelson, 2008).

Media Sharing services represent a valuable educational resource (Franklin & Harmelen, 2007). For example, in the teaching and learning process, the Podcasts are not considered a synchronous activity, but can help students connecting to learning communities, which can be pedagogically appropriate in specific contexts, enabling students to create their own Podcasts (Beldarrain, 2006). The TeacherTube, useful for teachers, educators and schools (Cress & Kimmerle, 2008) represent a kind of Video Sharing tool, using the educational potential inherent in the Web. The use of YouTube as a supplement to learning is not necessarily a new phenomenon, allowing a more active participation of students and improving their visual literacy (Smith & Peck, 2010). The Photo Sharing, other type of Media Sharing tool, allows teachers sharing images that can be used on developing visual literacy through critical analysis and visual information (Sadik, 2009). With Slide Sharing, students can post presentations to an audience and get feedback from around the world (Grosseck, 2009).

III.4.2 Advantages and disadvantages of the use of the Web 2.0 tools in the teaching and learning process

In addition to the advantages/disadvantages of these Web 2.0 tools listed in Table III.1, there are a set of benefits and weaknesses on the use of these tools on the teaching and learning context, that are summarized in Table III.2.

Table III.2 - Advantages/Disadvantages of Web 2.0 tools in the teaching and learning process.

Advantages	**Web 2.0 tools**					
	Blogs	**Wikis**	**Social Networks**	**Social Bookmarks**	**RSS**	**Media Sharing**
-Reduction of costs and reliability in continuous usage, when used over an extended period of time	12	12	12	12	12	12
-Compatibility with the elements of the educational field and the existing contextual dynamics	12	12	12	12	12	12
-Democratic nature	*	1	*	*	*	*
-Provide students with an e-learning environment and allow motivating their continuous participation	17	*	*	*	*	*
-Leverage teaching and learning outside class hours	2, 4	*	*	*	*	*
-Students can comment and ask questions outside the classroom and can be tasked to provide contents	2, 3		*			
-Can be used to track students' behavior	2	*				
-Allows the easy and fast follow-up by the teaching staff of the development of the collective work		10				
-Heighten learning and help students integrating theory into practice	1	*	*			
-Allow the existence of a database of topics and the integration of class materials	5					
-Possibility to follow up the experts' work	*		*	*	*	
Disadvantages / Obstacles						
-The process execution presuming teacher's good organization	18	*	*	*	*	*
-Difficulty for some teachers to get familiar with the tool	18	*	*	*	*	*
-Difficulty on selecting the technology to be used among the large offer	12	12	12	12	12	12
-Possibility of teachers' and students' expectations about course objectives and learning processes not being aligned	16	*	*			*
-Low quality of some contents	12	12	12	12	12	12
-Demands specific students' abilities as self-learning, self-control, collaborating and communicating	18	*	*	*	*	*
-Difficulty in aligning the assessment criteria with the learning process	16	*	*			
-Final product may not be representative of all students' perspectives because of failure to participate by some of them		7				
-Texts with very complex formats are difficult or impossible to put online		9, 10				
-Cannot be edited by several students simultaneously		1				
-Can give a false idea of the level complexity of the information	*	*	*			*

Legend: 1 - (Meyer, 2010); 2 - (Brescia & Miller, 2006); 3 – (Williams & Jacobs, 2004) ; 4 - (Huffaker, 2005); 5 - (Kim, 2008); 7- (Kear, *et al*., 2010); 9 - (Chu, 2008); 10 – (De Pedro, *et al*., 2006); 12 - (Grosseck, 2009); 16 - (Divitini, *et al*., 2005); 17 - (Lin *et al*., 2006); 18 - (Paulus, *et al*., 2009); * - Extension.

The Web 2.0 tools allow costs reduction and students motivation. Some examples of their most positive aspects are the democratic nature which allows building on opinions and research by students. The possibilities of sharing contents and collaborate outside class hours. Besides, it should be stressed that sometimes the Web 2.0 tools are used by students on the leisure and the learning contexts simultaneously, what can cause loss of attention and of concentration in the learning tasks. To overcome some of the constraints presented,

it should be noted that the successful use of the Web 2.0 in these teaching and learning context critically depend on the teachers having knowledge about the tools, being aware of how they should be used and being capable of organizing all the communication process.

III.4.3 E-learning Platforms and Web 2.0 tools

The Distance Education (DE) is a practice that demonstrates the power resources and new capabilities, providing complementary ways of teaching and learning through the use of new ICTs. Despite the various definitions presented in the literature, the concept of Distance Education (DE) can be understood as a planned educational experience, using ICTs, in order to encourage interaction in the teaching and learning (Deperlioglu & Kose, 2010; Greenberg, 1998).

E-learning is one of several ways of DE that involves the Internet as the main channel to mediate the teaching and learning support process. Several studies reved the existence of strong advantages on using e-learning platforms (Mahmoud, 2008; Mellow, 2005; Moura & Carvalho, 2009). However, their implementation involves some challenges that require clear and effective answers from the institutions that intend to adopt them, as well as an appropriate choice of the technologic platform.

The e-learning platforms, also known as Learning Management Systems (LMS), provide a set of configurable features, in order to allow creating courses online, pages of subjects, work groups and learning communities (Paulsen, 2003). In these systems, students can access course content / course unit, as well as interact with teachers and / or colleagues. In addition to the pedagogical dimension, such systems also have features for registration, monitoring and evaluation activities of students and teachers, enabling the contents' management via Internet.

There are different types of LMS, some of them are commercial, such as Blackboard or WebCT, and others represent open source solutions, as Moodle. In addition, there are proprietary solutions developed by the institutions themselves, called self-development technologic solution.

In the literature, some studies present the classification of platforms according to same characteristics and type of users (Alexander, 2006; Bremer & Bryant, 2005; Campanella *et al*., 2008; Cavus & Momani, 2009; Coates, James, & Baldwin, 2005; Machado & Tao, 2007; Miyazoe, 2008; Paulsen, 2003; Santo, Colace, Santo, & Vento, 2003). In the referred studies, the Moodle (Modular Object-Oriented Dynamic Learning Environment) emerges as an easy to use platform, as well as the most used in secondary and higher education, with 55,000 registered sites in June 2011 (Moodle, 2011).

The Moodle is a platform for content management, distribution free (Open Source), and allows the exchange of information among geographically dispersed users through

synchronous (chat and discussion rooms) and asynchronous communication (e-mail and discussion forums). In addition, this platform have features easily configurable, allowing the creation of student assessment processes (quizzes, online testing, and surveys) as well as the system management tasks and calendar (Itmazi, Megías, Paderewski, & Gutiérrez, 2005; Legoinha, Pais, & Fernandes, 2006; Mahmoud, 2008). Furthermore, the Moodle platform allows easy integration with other systems involving Academic Management, based on relational databases and supported by Web services infrastructure (Moura & Bernardino, 2010).

Based on the Websites available from the service providers of some e-learning platforms (referred, for example by (Bremer & Bryant, 2005; Coates, *et al*., 2005; Khan, 2010; Machado & Tao, 2007; McLoughlin & Lee, 2007; Miyazoe, 2008)), it was performed a content analysis in order to verify the existence or not of the more common Web 2.0 tools. Table III.3 presents the results of the content analysis.

Table III.3 - Web 2.0 tools in the e-learning platforms.

E-learning platforms		**Web 2.0 tools**								
	Open-source	**Blogs**	**Wikis**	**Social Networks**	**Social Bookmarks**	**RSS**	**Podcasting**	**Photo Sharing**	**Slides Sharing**	**Video Sharing**
ATutor (1)	✔	✔		✔			✔			
Blackboard (2)		✔	✔			✔	✔	✔	✔	✔
Claroline (3)	✔		✔							
Dokeos (4)	✔		✔	✔			✔			
Moodle (5)	✔	✔	✔							
Sakai (6)	✔	✔	✔				✔			

Legend: (1) http://atutor.ca/atutor/; (2) http://www.blackboard.com/; (3) http://www.claroline.net/; (4) http://www.dokeos.com/; (5) http://moodle.org/; (6) http://sakaiproject.org/ (accessed in October 2011).

The results reveal that Social Bookmarks tools do not exist in any platform, RSS is only present in the Blackboard platform and Photo Sharing, Slides Sharing and Video Sharing are present in Blackboard.

Halic, *et al*. (2010), Lai and Ng (2011), Meyer (2010), and Pop (2010) present studies on the practical application of the Web 2.0 tools in teaching and learning context that reveal a very positive impact on the motivation of the students and on their participation on the activities and assignments proposed by the teachers. It is though obvious that e-learning platforms should incorporate the maximum number of Web 2.0 tools that is possible, namely those the students are used to use in their day-to-day lives. It can be noticed that

the open-source platforms (more used by the education institutions) incorporate less tools than some of the commercial ones.

III.5 Conclusion and future research directions

The Web 2.0 became more mature and popular in education, thus it is imperative to develop further and new strategies and methodologies. The functionalities of the Web 2.0 (construction, interaction, collaboration, communication) provide users with the mechanisms to create digital contents and assessment materials. Blogs, Wikis, Social Networks, Social Bookmarks, Syndication of Contents through RSS, and Media Sharing represent some of the most popular tools. The Web 2.0 tools allow, on the one hand, the reduction of costs and reliability in continuous usage, when used over an extended period of time. On the other hand, these tools are compatible with the elements of the educational field and existing contextual dynamics.

Blogs are a good way to provide direct student/teacher communication, allowing students to place their doubts, and the teacher to answer them. The Wiki is extremely valuable for sharing accumulated experiences, providing a repository to place common solutions, FAQ (Frequently Asked Questions) answers, etc. Social Networks facilitate content sharing, while social bookmarking offers extensive opportunities of information and collaboration. The RSS features allows the redistribution of effort, so that less and less time and energy are spent during the search and information management process. Media Sharing also facilitates the creation of digital content.

In a nutshell, the use of the Web 2.0 tools can be an extremely valuable asset for learning and can be encouraged by the students' motivation, which is a very important factor for the successful use of these tools in the teaching and learning process.

Regarding future work, we intent to promote a pilot study, where the Web 2.0 tools can be tested and evaluated in a real context of teaching and learning. The procedure of introducing the tools requires analyzing studies and essays, and, accordingly, the positive aspects highlighted in these studies, should be incorporated in the project, and the less positive aspects have to be overcome considering the reality of teachers and students in the case study.

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III.8 Key Terms & Definitions

E-learning: it is one type of Distance Education that involves the Internet as the main channel to mediate the teaching and learning process.

Learning Management Systems (LMS) / e-learning platforms: they represent platforms used to create courses online; to register, monitor and evaluate activities and content management; as well as to exchange of information among geographically dispersed users through synchronous and asynchronous communication.

Web 2.0: represents the second generation of the Web applications, based on online services collaboration and sharing, that promote different ways of interaction between people.

E-learning 2.0: is the combination of e-learning and Web 2.0 concepts.

Blog: it is a Web 2.0 tool that represents a Webpage with brief paragraphs of opinion, information, personal diary entries in the form of text, images, video, audio, or links, called *posts*, arranged chronologically with the most recent first.

Wiki: it is a Web 2.0 tool that allows one or more people to build up a corpus of knowledge in a set of interlinked WebPages, using a process of creating, writing and editing pages.

Social Networks: it is a Web 2.0 tool that supports collaboration, knowledge sharing, interaction and communication of users from different places with a common goal.

Social Bookmarks: it is a Web 2.0 tool that provides users the ability to record WebPages and consequently to tag those records with significant words that describe the pages recorded.

Really Simple Syndication (RSS): it is a Web 2.0 tool that allows delivering regular changing Web contents to the user.

Media Sharing: it is a Web 2.0 tool that allows to store, search, display and share media' files.

IV The use of Web 2.0 tools by students in learning and leisure contexts: a study in a Portuguese Institution of Higher Education

Reference

Costa, C., Alvelos, H., & Teixeira, L. (2016). The use of Web 2.0 tools by students in learning and leisure contexts: a study in a Portuguese Institution of Higher Education. *Technology, Pedagogy and Education*, *25*(3), 377-394.

The use of Web 2.0 tools by students in learning and leisure contexts: a study in a Portuguese Institution of Higher Education

Abstract

This study analyzes and compares the use of Web 2.0 tools by students in both learning and leisure contexts. The data was collected based on a questionnaire applied to 234 students from the University of Aveiro (Portugal) and the results were analyzed by using descriptive analysis, paired samples t-tests, cluster analyses and Kruskal Wallis tests. The results show that the tools most used by students in a learning context are Video Sharing, Social Network Sites and Wikis and that in a leisure context students use Social Network Sites and Video Sharing more. The profiles of the groups resulting from the cluster analyses performed reveal that 42% of the students do not use the Web 2.0 tools intensively in either one of the contexts. However, findings from comparing the clusters of both contexts showed that students who more frequently use the tools in the leisure context are occasional users in the learning context and vice versa. This study contributes to a better knowledge of the student profiles concerning the use of Web 2.0 tools in learning and leisure contexts which can help teachers direct their strategies to the use of the most appropriate tools thus improving the success of the teaching-learning process.

Keywords

Higher Education; Learning Process; Leisure; Web 2.0 tools; Cluster analysis;

IV.1 Introduction

There is evidence that people who adopt Information and Communication Technologies (ICTs) for extrinsic motivations like job and willingness to share contents/opinions are more likely to be intensive users of those technologies than people who are motivated by other people's suggestions or advertising (Corrocher, 2011). This fact is discussed in several studies carried out by different authors and it should be taken into account in the higher education context when the use of technologies is concerned.

Cavus (2009) studied the use of technology by students at the Cyprus Near East University and concluded that students were aware that their Departments had very close links with the recent technological developments, that they used those technologies and as a result of the study students were given advice on how they can use the data communication tools more frequently in education.

Collis and Moonen (2008) refer that it should not be technology driving changes in higher education and that a change in mindset is needed. The authors point out that the stimulation, by organizations, of participatory pedagogies and the effective use of

technology for collaboration, co-designing, contributing, and learning from others should be the first step towards this change (Collis & Moonen, 2008).

Salinas (2008) emphasizes that the successful use of technologies in higher education implies the implementation of major changes in the way that both the technology and the classroom are viewed. The same author highlights the importance of understanding and accepting that the future classroom and the role of the teacher in it have to be very different from what they are now in order to provide students with technological and creativity skills. In this perspective, teachers play an important role and should be trained to manage both the new classroom and the new technology.

As changes in today's society are interconnected with technology, particularly network technology (Collis & Moonen, 2008), the Web 2.0 concept plays an important role in this context.

The internet has undergone changes as a platform for content management; it is from this change that the Web 2.0 emerged (O'Reilly, 2005). It is a social phenomenon that involves an approach to content generation and distribution, characterized by open communication, decentralization of authority and the freedom to share and reuse information (Alexander, 2006). Web 2.0 redefined the interaction between the Internet and users, allowing for the creation of virtual applications using data and functionalities from a number of different sources. Interactivity, collaboration, communication and sharing of digital contents are some of the features associated with this concept (Bennett, Bishop, Dalgarno, Waycott, & Kennedy, 2012).

The Web 2.0 tools provide several functionalities such as social interaction, feedback, conversation and networking in addition to being endowed with a flexibility that enables collaboration by users. These tools can support learning experiences in different ways, facilitating the teaching process and contributing to the creation of new teaching and learning models (Anderson, 2007; Dabbagh & Reo, 2011; Fonseca & Ernesto, 2011; Franklin & Harmelen, 2007; Grosseck, 2009; Jabbour, 2011; Lei, Krilavicius, Zhang, Wan, & Man, 2012; Virkus, 2008).

These technologies, when used in the teaching and learning context, can provide a lot of opportunities for the exploration of new forms of teaching and learning (Albion, 2008; Anderson, 2007; Dabbagh & Reo, 2011; Fonseca & Ernesto, 2011; Franklin & Harmelen, 2007; Grosseck, 2009; Jabbour, 2011).

Bennett *et al.* (2012) emphasize that Web 2.0 technologies are becoming more popular in the everyday lives of students. Furthermore, according to Rosen and Nelson (2008), Web 2.0 tools can be used in order to promote user participation and knowledge production, having the potential to transform classes from teacher-centric to student-participatory approaches and from individual-focused pedagogies to learning community approaches.

However, the same authors argues that these tools may distract educators from teaching and learning objectives and thus, research is needed to determine how specific Web 2.0 tools can help transform learning.

The fast dissemination of Web 2.0 tools and their dynamics in society does not guarantee a similar reaction in learning practices in higher education. In this regard, Collis and Moonen (2008) state that "Given the many mismatches in quality perspectives, as well as the difficulties in carrying out new pedagogies in higher education, it can, unfortunately, be predicted that the empowerment offered by Web 2.0 tools and processes will not be able to overcome the inertia in higher education institutions when it comes to the mainstream uptake of new views of learning facilitated by new technologies".

As Hew and Cheung (2013) emphasize, the use of Web 2.0 technologies appears to have a generally positive impact on student learning, but this positive effect is not necessarily due to the technologies per se but to the way those technologies are used. The same authors emphasize that at the moment it is not possible to determine causal effects of Web 2.0 technologies on gains in student achievement, although scientific studies do not report a detrimental or inferior effect on learning. Ajjan and Hartshorne (2008) state that the use of Web 2.0 technologies has significant potential to support and enhance in-class teaching and learning in higher education and Hew and Cheung (2013) provide information to help teachers and instructors with actual classroom ideas to implement Web 2.0 technologies with their students.

Nevertheless, while some generalized analyses of the benefits of Web 2.0 for the higher education sector can be found in literature (Ajjan & Hartshorne, 2008; Collis & Moonen, 2008; Grosseck, 2009; Meyer, 2010), discussion of the potential of Web 2.0 in teaching are rarely found (Brown, 2012). The study by Hew and Cheung (2013) strengthens the same idea, referring that evidences regarding the efficacy of Web 2.0 technologies are fairly weak and actual causal effects of Web 2.0 technologies on the gains in student achievement, due to various methodological concerns, cannot be yet determined.

According to Dahlstrom *et al.* (2011), students own and use a diversity of technologies, but institutions and instructors have yet to seize opportunities to create more varied learning experiences outside the classroom. However, before adopting any technology for the learning context, such as Web 2.0 tools, the institution should collect and analyse data on their students and also on the way they use technologies (Diaz, 2010). In this context, it is important to know what tools students use in both leisure and learning contexts and how they use them in order to adequate motivational strategies to student profiles. When it is intended to introduce Web 2.0 in the teaching and learning process, it is important to keep in mind that students are not a homogenous group (Rosen & Nelson, 2008). In fact, some authors (Cabada, Estrada, Sánchez, Sandoval, Velazquez, & Barrientos, 2009) present an

approach for modeling learning styles of students in Web 2.0 collaborative learning systems based on their profile.

The most popular Web 2.0 tools (Social Networks, Blogs, Wikis, Media Sharing, Social Bookmarks, Syndication of Contents through Really Simple Syndication (RSS) and Data Mash-up) and their use in the educational context are briefly analyzed in the following paragraphs.

Blog conversations offer opportunities to reflect on concepts related to the lessons outside the classroom and share different perspectives on the lesson material (Brescia &, Miller, 2006; Halic, Lee, Paules, & Spence, 2010; Meyer, 2010; Williams & Jacobs, 2004). Teachers can create more learning environments based on the needs expressed by students and verified through blog conversations (Paulus, Payne, & Jahns, 2009) which are especially useful when there are large classes where there is usually not enough time for students to answer or participate in the discussions (Paulus et al., 2009). Some teaching and learning activities in higher education make use of Blogs due to their popularity among young people (Halic et al., 2010).

Wikis can facilitate collaborative work through open discussion and the exchange of ideas and opinions, Wikipedia being the most popular (Lai & Ng, 2011; Meyer, 2010; Su & Beaumont, 2010). These tools offer a valuable way for groups of students and their teachers to collaboratively develop learning resources while offering a way of learning in a more student centered system and in a more democratic logic (Kear, Woodthorpe, Robertson, & Hutchison, 2010). The Wiki-based activities provide teachers with a new way of teaching that can be an alternative or a supplement to traditional classroom-based learning (Lai & Ng, 2011).

Social Networks can support collaboration, knowledge sharing, interaction and communication among users from different places with a common goal (Franklin & Harmelen, 2007; Grosseck, 2009; Usluel & Mazman, 2009; Veletsianos & Navarrete, 2012). *Elgg* is an example of an open source social networking system designed specifically for teachers and students (Rethlefsen, 2007; Veletsianos & Navarrete, 2012).

Media Sharing allows for the sharing and displaying of contents and is divided into four categories: Podcasts, Video Sharing, Photo Sharing and Slide Sharing. Hew and Cheung (2013) state that Podcasts can be used to provide supplementary information or material to students rather than merely repeating what is already covered in lectures. The use of *YouTube* (the most popular Video Sharing tool) as a supplement to learning, not necessarily a new phenomenon, allows for a more active participation of students while improving their visual literacy (Smith & Peck, 2010). The *TeacherTube*, useful for teachers, educators and schools (Cress & Kimmerle, 2008) is an example of a Video Sharing tool that uses the educational potential inherent in the Web. The Photo Sharing can

help teachers share images that can be used in developing visual literacy through critical analysis and visual information (Sadik, 2009). Slide Sharing allows for the sharing of presentations, posting the material available anywhere and anytime and for any person, enabeling students to post presentations to an audience and to get feedback from around the world (Grosseck, 2009).

Teachers and students can use Social Bookmarks to create a set of sites references that can be accessed by any computer connected to the internet (Anderson, 2007; Grosseck, 2009). Teachers can use these tools to save helpful Web resources, search for other Web resources with similar tags and share those resources with students and other instructors (Luo, 2009), as well as help students on deciding the usefulness of resources.

Really Simple Syndication (RSS) is useful in having the information in the teaching area updated, allowing educators to share work with other educators (Grosseck, 2009) and keeping specific course Webpages up to date. These tools can be created from search engines, bringing up the most current information (such as text, images, audio or video) on a given topic and are thus useful for class studies and projects (Rosen & Nelson, 2008).

Data Mash-up applications combine contents, data and functionalities from more than one Web site into integrated experiences (Cho, 2007; Lamb, 2007). Several colleges and universities have developed Mash-ups for administrative, informational and educational purposes (Cho, 2007). Teachers can develop customized Mash-ups to illustrate the concepts taught. The power of Mash-ups for education lies in the way they help to reach new conclusions or discern new relationships which, in addition, allows for the unifying of a large amount of data in a manageable way (Cho, 2007; Lamb, 2007).

In short, Web 2.0 tools are open systems that provide a high level of interactivity, promoting the sharing of digital contents and creative collaboration and can be accessed "anytime-anywhere". Their use in the teaching and learning context has been studied by some authors like Dahlstrom and Reo (2011), Rosen and Nelson (2008) and Salaway, Caruso, Nelson, *et al.* (2008), wherein researching students' technology needs and preferences are one of the main issues that contribute to a better integration of technology into courses.

This study, carried out at the University of Aveiro (UA) - Portugal, aims to analyze and compare the use of Web 2.0 tools by students in learning and leisure contexts, its main objectives being: (i) to identify the Web 2.0 tools most used in learning and leisure contexts; (ii) to define groups of students based on their profile of use of the Web 2.0 tools for each context; (iii) to compare the profiles of the groups of students identified in the learning and leisure contexts.

IV.2 Material and methods

In order to accomplish the objectives just described, a paper-based questionnaire was developed and applied to 234 students from diverse courses attending subjects at the Department of Economics, Management and Industrial Engineering (DEGEI) at the UA, during May 2012.

The UA has an integrated structure that permits the articulation and harmonization of teaching and research environments and offers a wide range of degree programs in various areas of knowledge reflecting its multidisciplinary and innovative character with about a hundred courses and 15,000 students. The DEGEI, one of the university's largest departments, was selected for this study due to the diversity of its students' profiles.

The final questionnaire resulted from the application of a prior version to a pilot sample of 20 students. Minor improvements were introduced, mainly related to the understanding of some terms used. The questionnaire is composed of 30 questions and is divided into the following two sections:

- Characterization of the participants and of the way they use the internet (gender; age; course and degree attended, type of device used to access the internet, type of network used to access the internet and average time of internet use per day in learning and leisure contexts).
- Characterization of the use of the Web 2.0 tools (Blogs, Wikis, Social Networks, Social Bookmarks, Podcast, Video Sharing, Photo Sharing, Slide Sharing, RSS and Data Mash-up) in learning and leisure contexts. The participants were asked the average number of times per month that they accessed each of the tools in both learning and leisure contexts.

The collected data were analyzed using the *IBM SPSS Statistics 19* software. First, a descriptive analysis was performed in order to characterize the behavior of each variable measured. Afterwards, paired samples *t*-tests were done in order to verify whether there were statistically significant differences between the average number of monthly accesses to each of the referred Web 2.0 tools in the learning and in the leisure contexts. In a subsequent phase, some cluster analyses were performed in order to identify and characterize groups of users according to their average number of monthly accesses to the same tools in both contexts. The methods used in order to perform the cluster analyses were both hierarchical (with Ward method and Squared Euclidean distance) and non-hierarchical (K-means) ones. The mean rank values of some relevant variables were compared between the resulting groups using Kruskal Wallis tests. Finally, the clusters found in both contexts were compared to each other.

IV.3 Results

The results are presented on the following four sub-sections: (i) the characterization of the participants, (ii) the characterization of the use of the Web 2.0 tools in learning and leisure contexts, (iii) the comparison of the use of the Web 2.0 tools between each context, and (iv) the identification and characterization of the types of users of Web 2.0 tools in both contexts.

IV.3.1 Characterization of the participants

Participants were 125 female and 109 male and the average age of respondents was 21.8 years old (*s*=3.42). Most of the participants were undergraduate students (78%). Table IV.1 presents the degrees attended by the respondents. It can be observed that most of them were from Management and Industrial Engineering at both undergraduate (34%) and master (53%) levels.

Table IV.1 - Number of respondents attending the courses and degrees.

	Undergraduate	**Master**
Management	36	---
Tourism	18	12
Economy	37	---
Management and Industrial Engineering	61	27
Languages and Business Relations	18	---
Others	11	12
Total	**181**	**51**

When analyzing how long participants use the Internet per day, findings show that, on average, respondents use the Internet about 1.4 hours per day (*s*=1.17) and 2.3 hours per day (*s*=1.40), for learning and leisure purposes, respectively. Figures IV.1 and IV.2 present the histograms of the referred variables concerning both learning and leisure contexts.

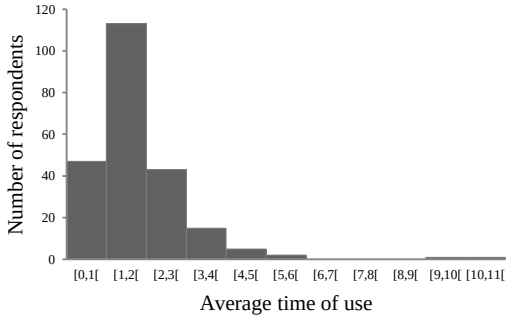

Figure IV.1 - Histogram of the average time of internet use per day – learning.

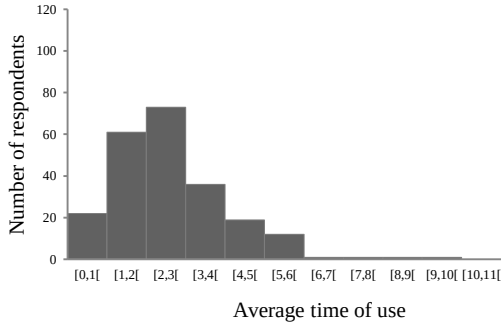

Figure IV.2 - Histogram of the average time of internet use per day – leisure.

From the histograms it can be observed that respondents use the internet more in the leisure context than in the learning one but also that answer distribution is more disperse in the leisure context.

In the next sections, the answers about the use of Web 2.0 tools from Undergraduate students and Master students were processed together, since there were performed independent samples Mann-Whitney-Wilcoxon non parametric tests (Sheskin, 2003) and none of the differences between the medians of the two samples were shown to be statistically significant at the level of 5%.

IV.3.2 Characterization of the use of the Web 2.0 tools on learning and leisure contexts

Table IV.2 presents the descriptive statistics of the participants' answers about the frequency of monthly usage of each studied tool, in both learning and leisure contexts.

The minimum and the mode of the number of monthly accesses are not presented as they are equal to "0" for all of the tools in both contexts.

Table IV.2 - Descriptive statistics of the number of accesses per month to the Web 2.0 tools in both contexts.

	Learning context							**Leisure context**						
	Mean	*s*	Max	Q_1	M	Q_3	r_s	Mean	*s*	Max	Q_1	M	Q_3	r_s
Blogs	5.2	15.16	150	0	0	2.25	5.48	16.3	40.28	300	0	0	8	4.26
Wikis	12.7	24.76	150	0	4	12	3.46	7.9	25.22	288	0	0	4	7.12
Social Networks	13.2	28.03	210	0	0	30	3.26	80.2	105.27	600	8.75	43.5	90	2.64
Social Bookmarks	2.7	13.46	150	0	0	0	7.75	5.8	36.67	450	0	0	0	9.67
Podcasts	2.1	9.07	60	0	0	0	4.75	7.0	18.35	120	0	0	1	3.41
Video Sharing	21.1	102.19	1470	0	1	10.5	12.56	65.2	80.10	560	8	30	90	2.23
Photo Sharing	1.7	9.74	120	0	0	0	9.22	5.8	20.48	150	0	0	1	5.39
Slide Sharing	5.3	15.79	150	0	0	4	5.53	1.4	8.09	78	0	0	0	7.23
RSS	1.5	8.00	90	0	0	0	7.41	1.6	8.19	60	0	0	0	5.76
Data Mash-up	4.2	21.44	300	0	0	1	11.75	3.3	7.43	60	0	1	3.25	4.03
Total	69.7							194.5						

Legend: Mean - sample mean; *s* – sample standard deviation; Max – maximum; Q_1 - first quartile; M – median; Q_3 - third quartile; r_s – skewness

Considering the total number of accesses, it can be noticed that students access the tools about 2.8 times more in the leisure context than in the learning one (194.5 vs. 69.7). The disparity between the average values concerning Social Networks – leisure (80.2) and Video Sharing – leisure (65.2) and the following most accessed one – Video Sharing – learning (21.1) suggests that the former tools are very widespread among students.

The most accessed tools in the learning context are Video Sharing, Social Networks and Wikis, while in the leisure context the most accessed tools are Social Networks, Video Sharing and Blogs. In fact, the 4 referred tools are responsible for 84% of the total number of monthly accesses in both contexts.

It can also be noticed that only 3 of the 10 studied tools have an average number of accesses higher in the learning context than in the leisure context. Those tools – Wikis, Slide Sharing and Data Mash-up, seem to be perceived by the students as more suitable for learning purposes than for leisure ones.

The standard deviations have rather high values for all variables, being particularly high in the case of Video Sharing (Learning) and Social Networks (Leisure) and denoting a large dispersion in the distribution of the answers.

The skewness coefficient presents positive high values for all variables which point out the strong right-tailed asymmetry of the distributions (the rule of thumb suggested by Bulmer (1979) was applied, which considers the distribution as highly skewed if the skewness coefficient is less than −1 or greater than +1).

For the analyses presented henceforth, the decision was made not to consider the variables where the third quartile presented a value of "0", because, in those cases, the number of participants using the respective tool was less than 60 out of 234. Therefore, the tools Social Bookmarks and RSS were not considered in any of the contexts, Podcasts and Photo Sharing were not considered in the learning context and Slide Sharing was not considered in the leisure context.

IV.3.3 Comparison of the use of the Web 2.0 tools between the learning and leisure contexts

In this section, a comparison of means between the number of monthly accesses to each tool in both contexts using paired samples *t* tests is performed.

The tools considered were those that meet the criterion described ($Q_3>0$) for both contexts, namely, Blogs, Wikis, Social Networks, Video Sharing and Data Mash-up; for each of which severe outliers were removed (severe outliers were considered to be values exceeding $Q_3+3*IQR$, where $IQR=Q_3–Q_1$ (Inter-Quartile Range) (Bradley, 2007)).

Table IV.3 presents the results of the tests as well as some descriptive statistics of the variables considered. Note that the number of respondents (*N*) corresponds to the number of cases common to each pair of variables analyzed (outliers removed). It was considered that, as N is greater than or equal to 188 for all the tools, the central limit theorem can be applied (Bradley, 2007).

Table IV.3 - Paired samples *t*-tests for the number of monthly accesses in learning/leisure contexts.

		Statistic			**Test**	
Tool / Pair		*N*	Mean	*s*	*t*	*p*-value
Blogs	Learning	188	0.9	1.85	-4.51	<0.001
	Leisure	188	3.6	8.09		
Wikis	Learning	197	6.0	8.14	7.50	<0.001
	Leisure	197	1.5	3.33		
Social Networks	Learning	226	11.7	21.66	-10.79	<0.001
	Leisure	226	70.6	77.45		
Video Sharing	Learning	212	6.0	10.62	-11.95	<0.001
	Leisure	212	67.2	75.06		
Data Mash-up	Learning	203	0.6	1.13	-5.61	<0.001
	Leisure	203	1.6	2.30		

Legend: *N* – Number of respondents; Mean – sample mean;
s – sample standard deviation

Findings show that all of the differences between the average number of accesses in both contexts are statistically significant (*p*-values are all lower than 0.001) and that students access more Blogs, Social Networks, Video Sharing and Data Mash-up in the leisure context than in learning, while Wikis are accessed more for learning than for leisure.

IV.3.4 Identification and characterization of groups of users of Web 2.0 tools

This section aims to identify and characterize clusters of respondents based on their profile of how often they access Web 2.0 tools per month using cluster analyses. The analyses were performed separately for each of the contexts studied – learning and leisure.

The variables considered were again those that meet the criterion described ($Q_3>0$) and for each context two cluster analyses were done: a hierarchical clustering using *Ward* method and *squared Euclidean distance* and a non-hierarchical one using *K-means* method. The mean rank values of the variables were compared between the resulting clusters using Kruskal Wallis tests.

IV.3.4.1 Learning

In order to perform the cluster analyses in the learning context the following six tools were considered: Blogs, Wikis, Social Networks, Video Sharing, Slide Sharing and Data Mash-up.

The hierarchical analysis pointed out three clusters composed of 196, 19 and 13 cases respectively. From the non-hierarchical analysis performed for the 3 clusters, it could be observed that the first one (C1-learn) was composed of 189 cases, the second (C2-learn) was composed of 22 cases and the third (C3-learn) consisted of 17 cases. It should be noticed that 96% of the cases are classified in the same clusters by the two methods used. Nevertheless, the elements that did not belong to the same clusters in both analyses were examined and it was concluded that they could be considered borderline cases.

Table IV.4 - Clusters' means rank of number of monthly accesses and Kruskal Wallis tests' results (learning).

	Cluster			Kruskal Wallis test	
	C1-learn	C2-learn	C3-learn	*Chi-Square*	
	N=189	N=22	N=17		
Number of accesses per month	Mean rank	Mean rank	Mean rank	value	*p*-value
Blogs	112.0	120.3	135.1	2.81	0.246
Wikis	105.5	113.0	216.8	46.25	<0.001
Social Networks	104.3	202.5	114.1	60.10	<0.001
Video Sharing	102.9	206.3	124.4	54.51	<0.001
Slide Sharing	110.9	120.8	147.0	6.00	0.050
Data Mash-up	109.7	132.9	144.5	8.36	0.015
Total	645.3	895.8	881.9		
Time (h/day) spent on internet (learning)	113.5	113.3	120.9	0.23	0.892

Table IV.4 presents the means rank of the variables included in the cluster analyses and the daily time spent on the internet for learning purposes for each cluster. The Chi-Square and *p*-values that result from the Kruskal Wallis tests performed are also presented.

The cluster C1-learn is composed of 83% of the respondents. The mean rank of accesses of each of the tools is less (or much less) than that verified in the cases of the other clusters. This cluster can be called "occasional users group - learning".

The cluster C2-learn is composed of 10% of the respondents. The tools most accessed by this cluster are Video Sharing and Social Networks. These respondents more often use tools that correspond to a more interactive and social way of communicating, thus the cluster being called "social intensive group - learning".

The cluster C3-learn is composed of 7% of the respondents that access Web 2.0 tools slightly less than in the case of C2-learn. The tool most accessed by this cluster is Wikis. Assuming that respondents use Wikis only in a consulting perspective, and not in an editing one, this cluster is called "information consumers group - learning".

Analyzing the differences between the three clusters just characterized in each of the tools (see Kruskal Wallis tests' results in Table IV.4), it can be noticed that there are statistically significant differences between all of them ($p<0.05$) for all the tools except for Blogs. Regarding the variable *Time spent on internet for learning purposes*, it is noted that there are no statistically significant differences between the three clusters.

IV.3.4.2 Leisure

In order to perform the cluster analyses in the leisure context, the following seven tools were considered: Blogs, Wikis, Social Networks, Podcasts, Video Sharing, Photo Sharing and Data Mash-up.

The process of hierarchical cluster analysis was performed in four phases which resulted in the removal of extreme cases that emerge isolated or in very small groups. The final hierarchical solution pointed out four clusters, the first one being composed of 63 cases, the second of 74 cases, the third of 68 cases and the fourth of 11 cases. From the non-hierarchical analysis performed for 4 clusters it could be observed that the first cluster (C1-leisure) was composed of 12 cases, the second (C2-leisure) of 22 cases, the third (C3-leisure) consisted of 113 cases, and the fourth (C4-leisure) 69 cases. It should be noticed that 68% of the cases are classified in the same clusters by the two methods used. As the correspondence between the clusters obtained by the two methods was not as straightforward as in the case of the learning context, the differences between the clusters were thoroughly analyzed. It was found that the profiles of the clusters obtained by the two methods were quite similar and that the *K-means* method better clarified the use of Blogs; the results from the last analysis were considered in the subsequent phases of the study.

Table IV.5 presents the means rank of the variables included in the cluster analyses and the daily time spent on the internet for leisure purposes for each cluster. The *Chi-Square* and *p* values that result from the Kruskal Wallis tests performed are also presented.

Table IV.5 - Clusters' means rank of number of monthly accesses and Kruskal Wallis tests' results (leisure).

	Cluster				Kruskal Wallis test	
	C1-leisure	C2-leisure	C3-leisure	C4-leisure	*Chi-Square*	
	N=12	N=22	N=113	N=69		
Number of accesses per month	Mean rank	Mean rank	Mean rank	Mean rank	value	*p*-value
Blogs	208.4	104.1	97.8	110.1	41.78	<0.001
Wikis	113.0	106.2	98.5	124.9	11.45	0.010
Social Network	151.7	204.1	76.1	123.5	93.73	<0.001
Podcast	124.5	97.3	100.6	122.3	10.99	0.012
Video Sharing	92.2	115.2	68.6	174.5	124.99	<0.001
Photo Sharing	125.9	113.7	99.1	118.5	9.58	0.023
Data Mash-up	122.0	131.4	99.5	113.5	7.03	0.071
Total	937.7	872	640.2	887.3		
Time (h/day) spent at internet (leisure)	153.7	145.8	86.0	121.8	33.17	<0.001

The cluster C1-leisure is composed of 6% of the respondents. The tools most accessed by this cluster are Blogs and Social Networks. As these respondents use more tools that correspond to communicating, this cluster is called "communication group - leisure".

The cluster C2-leisure is composed of 10% of the respondents and the main characteristic of this cluster is the large number of times students access Social Networks, thus this cluster is called "social group - leisure".

The cluster C3-leisure is composed of 52% of the respondents that access the studied tools in the leisure context is much less than those in the other clusters, being this cluster called "occasional users group - leisure".

The cluster C4-leisure is composed of 32% of the respondents that access the tools in the leisure context slightly less than in the case of C1-leisure. The tool most accessed by this cluster is Video Sharing. Due to its characteristics, this cluster can be called "sharing information group - leisure".

When analyzing the differences between the four clusters just characterized in each of the tools (see Kruskal Wallis tests' results in Table IV.5), findings show that there are statistically significant differences between all of them ($p<0.05$) for all the tools except for Data Mash-up. Regarding the variable *Time Spent at Internet for Leisure Purposes*, it is noted that there are statistically significant differences between the four clusters and that the clusters that spend more time on the internet (C1-leisure and C2-leisure) while those who spend less time on the internet (C3-leisure) are the same as those who access the tools less frequently per month.

IV.4 Discussion

The results of this study reveal that students access the internet, on average, 25.9 hours per week (3.7 hours per day), a value that is very close to the one presented in the study from Popescu (2010) – 25.83 hours.

Regarding the use of Web 2.0 tools, the present study showed that Social Networks, Video Sharing, Blogs and Wikis were the most accessed, again in line with the results from Popescu (2010). Similar findings were reported by Corrocher (2011), where Video Sharing and Social Networking services were referred as the most popular applications. The same author states that as those tools are the most used by students they will probably be the more acceptable to integrate into activities in the learning context. Another study that reveals similar results (Connolly, Hainey, Baxter, Stansfield, Gould, Tsvetkova, Kusheva, Stoimenova, Penkova, Legurska, & Dimitrova, 2011) mentioned Facebook, Wikis and Blogs as the most popular Web 2.0 tools that students would like to see used for educational purposes.

Concerning the comparison between the use of the Web 2.0 tools in the leisure and learning contexts, the results of this study reveal that students access the tools more often in the leisure context (on average, 194.5 accesses per month) than in the learning context (on average 69.7 accesses per month), which is in accordance with the study carried out by García-Martín and García-Sánchez (2013).

Levy and Hadar (2010) show similar results. In fact, they refer that students are either partially or not familiar with the variety of the Web 2.0 concepts and tools, and even more so in the context of the working environment and that while about half of them use different, though limited, Web 2.0 applications for leisure purposes, they hardly use any of these in their work. As for the particular tools, it can be verified that the results of the present work reveal that the tools most accessed in the learning context are Video Sharing, Social Networks and Wikis, while in the leisure context the tools most accessed are Social Networks, Video Sharing and Blogs. Analogous findings are also referred to in the study from Levy and Hadar (2010), where it is mentioned that students use the internet in the work context mostly for communicating (which are heavily performed using Social Networks) and for searching for and reading information and documentation (where Wikis play an important role). In regards to leisure, the same study refers to activities like communication and entertainment (e.g., downloading music or movies) where Social Networks, Blogs and Video Sharing are frequently used.

The cluster analysis performed in the learning context pointed out 3 groups of users: (i) the occasional users, composed of the majority of the students and that access the tools less frequently than the others; (ii) the social group, comprised of the students that access

Social Networks and Video Sharing intensely and (iii) the information consumers, corresponding to students that access Blogs, Wikis and Slide Sharing more.

The cluster analysis performed in the leisure context pointed out 4 groups of users: (i) the occasional users, as in the previous case, composed of the majority of the students who access the tools less than the others; (ii) the social group, comprising of the students that intensely access Social Networks, (iii) the communication group, corresponding to students that access Blogs more and (iv) the sharing information group, comprising of the students that intensely access Video Sharing.

With regards to the variable *Time spent on internet for learning purposes* and *Time spent on internet for leisure purposes*, it is noted that in the first case there are no statistically significant differences between the three clusters (Table IV.4, section IV.3.4.1), while in the second there are statistically significant differences between the four clusters (Table IV.5, section IV.3.4.2).

While the results for the leisure context are coherent with the mean rank of accesses of the Web 2.0 tools per month, the results for the learning context are quite surprising. It was expected that those students that access the tools more would spend more time on internet and it was found that this was not the case. Two possible explanations for this apparent contradiction were identified. The first explanation being that the students of clusters C2-learn and C3-learn spend less on the internet when using the tools. The other is that students can have difficulty in estimating the time they spend on the internet.

Table IV.6 - Comparison between leisure and learning clusters.

		Learning			
		C1-learn Occasional users group	C2-learn Social intensive group	C3-learn Information consumers group	**Total**
Leisure	C1-leisure Communication group	9	1	2	12
	C2-leisure Social group	20	0	2	22
	C3-leisure Occasional users group	89	14	6	109
	C4-leisure Sharing information group	58	5	6	69
	Total	176	20	16	212

In order to have a better knowledge of the profiles of the students, the crossing between the results of the clusters analysis in both contexts was performed. Table IV.6 presents the number of respondents of each learning cluster (in columns) that are common to each leisure cluster (in lines). The highest number in the table is that of the "occasional users" in both contexts – 89 cases, which corresponds to 82% of the "occasional users" in the leisure context and to 51% of the "occasional users" in the learning context. The remaining "occasional users – learning" are distributed among the other leisure clusters, mostly in the "sharing information" (33%).

It is interesting to note that 91% / 84% / 75% of the students that intensively use Social Networks / Video Sharing / Blogs in the leisure context are occasional users in the learning context. On the other hand, 70% of the students that use more Social Networks in the learning context are occasional users in the leisure context.

The results point out that there are an important proportion of students (about 42%) that do not use Web 2.0 tools intensively in either context. Nevertheless, those who use the tools more in the leisure context are occasional users in the learning one and vice versa.

IV.5 Conclusions and recommendations

This article described a study carried out at the University of Aveiro (UA), Portugal that aimed to analyze the use of Web 2.0 tools by students in the learning and leisure contexts. The most frequently used Web 2.0 tools in learning and leisure contexts were identified and groups of students were defined based on their profile of use of the Web 2.0 tools in each context. Those groups were compared between the learning and leisure contexts.

The results show that students access the Web 2.0 tools more than twice as much in the leisure context than in the learning one and that the tools they use more in the learning context are Video Sharing, Social Networks and Wikis while in the leisure context the tools more often used are Social Networks and Video Sharing.

The cluster analysis performed in the learning context pointed out 3 groups of users which were named “occasional users”, “social group” and the “information consumers”. In the leisure context, the cluster analysis pointed out 4 groups of users which were named “occasional users”, “social group”, “communication group” and “sharing information group”.

The comparison between the clusters’ profiles among the learning and leisure contexts reveals that 42% of the students do not use the Web 2.0 tools intensively in either context. However, those who use the tools more in the leisure context are occasional users in the learning context and those who use the tools more in the learning context are occasional users in the leisure context.

These findings point out that strategies in using Web 2.0, in order to improve the teaching and learning process, should attract the occasional users of both contexts to the learning activities and shift the non-occasional users of the leisure context to the learning one.

Since the use of Web 2.0 technologies appears to have a general positive impact on student learning and this effect is not necessarily attributed to the technologies *per se* but to how the technologies are used (Hew & Cheung, 2013), it is important that the use of these types of tools by the institutions and in particular by teachers is researched as a low adherence of

these entities may be a strong obstacle to their utilization as a means of promoting the improvement of the quality in the teaching and learning process.

Moreover, the strategies employed in order to improve the process should be global and integrated and directed to institutions, teachers and students, as Salinas (2008) points out: "by using technology not as an aid to teaching or as a sophisticated toy, but as a fully integrated educational tool, will our students learn not only know how to read, write, and do math, but also how to explore, create new knowledge, and solve the problems that certainly await them in the 21st century".

As a limitation of this study it should be pointed out that the sample was composed of students that attend classes at Department of Economics, Management and Industrial Engineering. Further research should extend the study to students from other areas of knowledge in order to understand if there are some relationships between the use of the tools and the knowledge background of the students. Another suggestion for future work is to explore the causes of the differences between the clusters found and understand the type of usage that students make of the Web 2.0 tools.

As highlighted by many authors cited throughout this work, there is a lack of studies that research the causal effects of the use of Web 2.0 technologies on the academic success of students. In this way, another recommendation for future research is to identify how students effectively use each of the Web 2.0 tools in the learning context (e.g. when and for what they use Video Sharing or Wikis) in order to allow institutions and teachers to promote appropriate strategies in line with students' actual practices.

IV.6 References

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V The students' motivation to use the wiki technology: a practical study in higher education

Reference

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The students' motivation to use the wiki technology: a practical study in higher education

Abstract

Within the teaching-learning (TL) process, the wikis help to create a dynamic and collaborative learning environment through communication, exchange of ideas and sharing of knowledge. The present work is part of a project whose aim is to evaluate the acceptance of the use of this technology as a means to promote the quality of the TL process. In particular, the study described in this article has as its objective to assess the motivation for the use of the wikis by a group of students from the technological area of higher education, and to carry out a comparison between students that intend to continue making use of this tool in future activities and those that do not plan to use this technology. This experience was made in the context of a classroom, and the data were obtained through the application of two questionnaires and analysis of the history of the wiki created for the activity developed in the classroom. The results showed that the students, despite knowing the tool, did not know in practice about its editing mode. The features of the wikis better classified by the students are related to the perceived ease of use and with the usefulness of the tool, in so far as it promotes learning through contents placed in it by others and through the conduction of group work relying neither on the physical presence of the members nor on their schedules. It has also been observed that the motivation for the use of the wikis turned out to be, in some items, significantly different among the groups compared.

Keywords

Wikis; Teaching-Learning process; Higher Education; TAM model;

V.1 Introduction

The skills that students must achieve in their learning process can be improved or facilitated through pedagogical methods that use new Information and Communication Technologies (ICT). However, when you want to use any technology in the Teaching-Learning (TL) process, the teacher must take into account their integration in a pedagogical perspective so that their use is the most appropriate possible.

Wiki is considered a useful technology in the TL process, allowing to help create a dynamic and collaborative environment through communication, exchange of ideas and knowledge sharing. The acceptance, in general, of technologies, is usually evaluated through theoretical models such as the TAM model - Technology Acceptance Model.

This work is part of a project that aims to evaluate the acceptance of the Wiki technology as a means to improve the quality of the TL process. In methodological terms, this work was divided in three phases and the data was obtained through questionnaires and the

analysis of the Wiki history created in the context of the activity carried out with the students. In particular, the study described in this article aims to evaluate the motivation of a group of students in a Curricular Unit (CU) of the technological area of the 2nd cycle of the University of Aveiro (UA) to use Wikis, and compare it among students that intend to continue to use technology in future activities and the ones who do not intend to use it.

This article is structured in 6 sections. In section V.2, there is a brief description of Model TAM (Technology Acceptance Model), one of the most used models in the evaluation of the motivation for the use of technologies. Section V.3, addresses the role of Wikis in the TL process, presenting some features with the use of this tool in that context. Section V.4, describes the methodology adopted in the case study, followed, in section V.5, by the analysis and discussion of the main results concerning the motivation for the use of Wikis in learning. Finally, in Section V.6, conclusions are presented.

V.2 Motivation of users to the use of technology

There are several theoretical models that evaluate the acceptance of technologies by users of the various tools, such as e-mail (Davis, 1989), Web 2.0 (Mei-Ying et al, 2008;. Huang and Yoo, 2010; Ulrich and Karvonen, 2011), social networks (Kwon and Wen, 2010), YouTube (Yang et al., 2010) or Wikis (Wesley and Yu-Hao, 2011).

In this context, one of the most widely used model is the Technology Acceptance Model (TAM) developed by Davis (1986), which in turn provided the basis for the development of others, for example, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

According to TAM, the motivation of users for the use of technology is determined by three variables: Perceived Ease Of Use (PEOU), Perceived Usefulness (PU) and Attitude Toward Using (ATU) which, in turn, are influenced by other external variables (X1, X2 and X3) and contribute to the Actual System Use (ASU) (Davis, 1986), as is shown in Figure V.1.

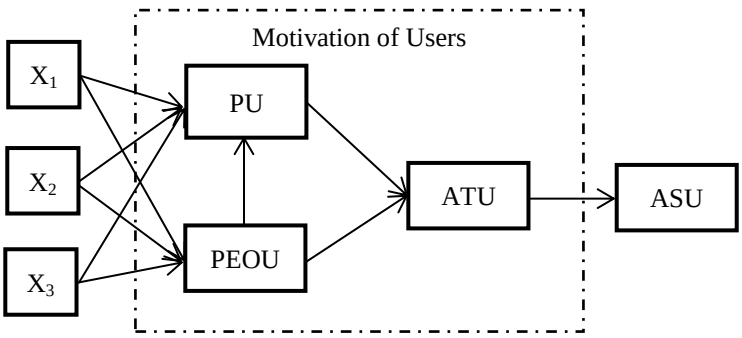


Figure V.1 - Model TAM adapted from Davis (1986).

The Perceived Ease Of Use (PEOU) is defined as the degree to which an individual believes that use of the system is intuitive and does not require great effort (Davis, 1986; 1989), it may be influenced by external variables.

The Perceived Usefulness (PU) is defined as the degree to which an individual believes that use of the system contributes to increase the performance of their work (Davis, 1986; 1989; Davis et al., 1989). It may be influenced by external variables and the PEOU, since technologies perceived as easier to use tend to be perceived as more useful.

Attitude Toward Using (ATU) is defined as a positive or negative sense of an individual on the use of the system (Davis, 1986; 1989; Davis, Bagozzi et al, 1989) and is influenced by the two previous variables.

Finally, according to the model, the Actual System Use (ASU) depends on the individual's motivation to use it, through his attitude, expressed by the ATU variable.

V.3 Wikis in the Teaching-Learning process

The Wiki is a Web 2.0 technology that enables the construction of knowledge repositories based on a set of interlinked Web pages (Franklin and Harmelen, 2007; Grosseck, 2009; Kear et al, 2010) and can be viewed, created, edited and modified by any user using a text editor (De Pedro et al., 2006; Kear et al., 2010). This concept was created by Ward Cunningham in 1995 (Zeinstejer, 2008) and his philosophy is to maintain a completely open space on the Web, where any user can modify, structure and organize documents in various ways (Kear et al., 2010).

In addition to the collaborative editing functionality on the same page, a Wiki typically has an area where participants can discuss their current content. This discussion space can also be used by participants to test their ideas (Pifarré and Staarman, 2011). There is also the option to view the Wiki history, with the ability to retrieve content that has been previously or accidentally deleted by the participants (Lai and Ng, 2011).

In the Teaching-Learning (TL) process, Wikis help to create a dynamic and collaborative learning environment, through open discussion and exchange of ideas and opinions, where students can take an active part in the creation of knowledge (Meyer, 2010; Su and Beaumont, 2010; Lai and Ng, 2011). Wikis provide new ways of learning in a democratic and student-centered logic (Kear et al., 2010). Thus, the Wiki is regarded as a useful tool in the TL process, by promoting collaborative writing and learning, while enhancing the creativity of each user (Cress and Kimmerle, 2008).

When the teacher chooses activities with Wikis he may promote a new way of teaching, as an alternative, or complement, to traditional methods and learning tools (Lai and Ng, 2011). Different authors (Raitman et al., 2005; De Pedro et al., 2006; Wan and Zhao, 2007;

Chu, 2008; Grace, 2009; Grosseck, 2009; Oner, 2009; Kear et al, 2010; Meyer, 2010; Lai and Ng, 2011) have been studying the impact of the use of Wikis in the TL process, and some of them have contributed to the identification of a set of advantages and disadvantages.

Some of the advantages of using Wikis in the TL context are: (i) to allow for joint collaboration and promote the sharing of content (Grosseck, 2009; Kear et al., 2010), (ii) to control access to resources through authentication of users (Grosseck, 2009; Kear et al., 2010), (iii) to enable the evaluation of individual participation of each user (De Pedro et al, 2006; Chu, 2008), (iv) to enable the visualization of changes introduced and the recovery of removed or modified content (de Pedro et al., 2006) and (iv) to provide access to content history (who put what and when) (De Pedro et al., 2006).

The disadvantages of using wikis referred to by some authors are: (i) to be sometimes difficult to understand the contents edited by others (Lai and Ng, 2011), (ii) to be necessary to know the text editing tools (De Pedro et al, 2006; Chu, 2008; Kear et al, 2010), (iii) the existence of fear that other people see the work that is not finished (De Pedro et al, 2006), and (iv) to be sometimes difficult to assess the quality of some content (Grosseck, 2009).

To overcome some of the limitations provided, it should be considered that the use of Wikis in the TL process depends, largely, on teachers and their knowledge on the use and organization of activities with the tool. Note that this tool is typically most used by students to view content (Costa et al., 2011), being, however, its greatest potential in editing component.

Wikis can be used by all involved in the TL process, particularly students and teachers, to support certain educational activities. Some authors have been analyzing these activities, which are described, then briefly.

- The bibliographic analysis can be used when you want to edit summaries of the reflections on readings made (Duffy and Bruns, 2006);
- The evaluation can be made based on activities developed in Wikis (Duffy and Bruns, 2006; Kane and Fichman, 2009);
- The brainstorming can be applied to create projects in which students are invited to add articles or reviews (Gokcearslan and Ozcan, 2011), thus allowing to create a network of linked resources on certain subjects (Duffy and Bruns, 2006);
- The communication feature consists in publishing resources that can be edited and commented directly in the document, so that everyone can view it (Duffy and Bruns, 2006);
- The portfolios can be created for the construction of a repository of personal or group projects (IT-User Services, 2008; Gokcearslan and Ozcan, 2011), where students can present content and review them later (Duffy and Bruns, 2006);

- The list of links in addition to organizing information, enables you to create lists of files that were uploaded (IT-User Services, 2008; Kane and Fichman, 2009; Gokcearslan and Ozcan, 2011);
- The concept maps can be used to create a dictionary of terms (Duffy and Bruns, 2006);
- The organization of information through Wikis enables you to summarize the contents at the top of the page, facilitating navigation and categorization of content (IT-User Services, 2008; Kane and Fichman, 2009; Gokcearslan and Ozcan, 2011);
- Students can use a wiki to develop research projects, with the wiki serving as ongoing documentation of their work (Duffy and Bruns, 2006);
- Using a wiki pulls the group members together and enables them to build and edit the document on a single wiki page. (Duffy and Bruns, 2006).

When planning an activity there are some aspects that must be taken into consideration in order to obtain favourable results to the TL process. Table V.1 lists six aspects to guide the teacher in planning activities with Wikis, according to Foord (2007) and Gokcearslan and Ozcan (2011).

Table V.1 - Guidelines for the activities planned with Wikis (Foord, 2007; Gokcearslan and Ozcan, 2011).

Specification of the overall goal	- The aim should be clear, simple and self-explanatory, and the benefits in contributing to editing the Wiki or the final product should be made explicit; - The aim should be understood by all; - The Wiki should present the specific objectives for which it was created; - Students should be informed when the work in the Wiki is subject to evaluation;
Deadlines	- The time of the different stages of use must be defined; - The deadline should be established;
Ownership	- The space should be appropriate to the participants in order to foster competition between groups, providing a challenge for everyone, so that everyone can feel ownership of the Wiki;
Restriction of the aim	- The structure of the Wiki must be what is intended for the page; - Starting points for students to edit the Wiki should be established and these should be linked to the Wiki structure;
Rules of engagement	- One should strengthen those who can edit the Wiki; - The guidelines should be clear and established so that students know what parts they can edit; - The guidelines can provide information on the acceptable and unacceptable use;
Browsing	- The Wiki moderator can create the structure for participants to follow; - Browsing should be clear and simple and should not take many steps to find a particular part of the Wiki.

There are several studies describing the use of Wikis in the TL context. Some of these studies aim to:

- Analyze the reflections of students about their collaborative experiences in Wikis (Raitman et al., 2005);
- Analyze and evaluate the essential aspects for the successful implementation of a Wiki (Su and Beaumont, 2010);
- Identify and understand the factors that influence the use, usefulness and intention to use wikis in the future (Guo and Stevens, 2011);
- Sharing and describe experiments using Wikis (Cole, 2009; Oner, 2009);

- Investigate the ease of communication based on a structured discussion and its relation to participation in the Wiki (Wichmann, 2012);
- Explore the potential uses (Chao, 2007), collaborative forms (Coutinho and Junior, 2007; Forte and Bruckman, 2007) and participatory forms using Wiki technology (Coutinho and Junior, 2007);
- Provide a framework for the TL process based on the use of Wiki (Cubric, 2007).

The main results of these studies are presented in Table V.2.

Table V.2 - Main results of studies on the use of Wikis in the TL context.

Results	Authors
- Wikis are easy to use;	(Raitman *et al.*, 2005; Chao, 2007; Coutinho and Junior, 2007; Cubric, 2007; Su and Beaumont, 2010)
- The use of Wiki allowed to ease way to group work;	(Oner, 2009)
- The activity with Wikis has helped the learning process;	(Coutinho and Junior, 2007; Cubric, 2007)
- The use of Wiki facilitated the sharing of ideas (regardless of time and place) where the student can play a more active role in group work, since all communication and contributions are visible to everyone and the opinions of colleagues can improve the overall quality of work;	(Cubric, 2007; Oner, 2009)
- The level of Wiki use is influenced by the level of experience and previous knowledge of the students;	(Guo and Stevens, 2011)
- The use of Wikis enables the display of messages and work colleagues, allowing to acquire new knowledge;	(Coutinho and Junior, 2007; Oner, 2009)
- Wiki is a good tool for project collaboration;	(Chao, 2007)
- Students prefer to participate in pre-defined activities;	(Cole, 2009)
- Teacher's comments to student contributions is a motivating factor for participation in the activity with the Wiki, improving the quality of work;	(Coutinho and Junior, 2007; Cubric, 2007)
- There is a need for additional support for editing the wikis by students;	(Wichmann, 2012)
- The use of Wikis raise several concerns about the possibility of plagiarism and content vandalism;	(Oner, 2009)
- Cultural and institutional factors influence the adoption of wikis in the classroom;	(Forte and Bruckman, 2007)
- The educational experiences should prepare students to become cautious and critical participants and competent in knowledge building activities;	(Forte and Bruckman, 2007)
- Students feel some discomfort in synchronous / simultaneous use of sections of Wikis;	(Raitman *et al.*, 2005)
- The availability of a discussion forum allows greater contributions to the Wiki;	(Wichmann, 2012)
- Students intend/recommend using Wikis in future projects.	(Chao, 2007; Cubric, 2007; Guo e Stevens, 2011)

V.4 Methodology

This work falls within the scope of a project that aims to evaluate the acceptance of Wiki technology as a means to improve the quality of the TL process, having been carried out in a Curricular Unit (CU) named Technologies Applied to Management Information (TAGI), taught to the 2nd Year's degree in Industrial Engineering and Management (EGI), in the University of Aveiro (UA), and attended by about 60 students spread over 4 classes.

The project was divided into three phases. The first phase aims to determine the level of previous use and purpose of use of Wikis by the students through paper-and-pencil questionnaire administration, to students attending the CU.

In the second phase, the aim was to evaluate student participation in an experiment with editing a Wiki (TAGI Wiki), created specifically for this activity. Considering that part of the CU evaluation consisted in a group project, the TAGI Wiki was used by students to communicate to other colleagues and the CU teacher the formation of groups and the theme chosen for the project. In this context, it was intended that students, through the Wiki, would discuss and share ideas for the project to develop, indicate the main features that they intended to implement, refer their expectations and specify the objectives they intended to achieve with the project. The participation of students in this activity was analyzed based on the history of the TAGI Wiki.

Finally, the third phase aimed to assess students' motivation for using Wikis in the TL process after the experience, and it was used a second questionnaire in which questions were asked relating to the three variables of the TAM model referred to above and measured on a scale of 1 (Strongly disagree) to 5 (Strongly agree).

The variable Perceived Ease of Use (PEOU) represents the degree to which students believe that using Wikis is intuitive and does not require great effort, while Perceived Usefulness (PU) represents the degree to which students believe that using Wikis enhances their performance. Attitude Towards Use (ATU) represents the positive or negative feelings of students towards the use of Wikis in the learning context. Table V.3 presents the set of questions that were asked to students for each of the variables.

Table V.3 - Questions asked to students to assess the motivation to use Wikis in the TL process.

Variable	Item
Perceived Ease of Use (PEOU)	PEOU1 – It is often necessary to consult the script support/help icon to use Wikis. PEOU2 – The icons and texts associated to Wikis are easy to understand. PEOU3 - It is easy to remember how to perform the tasks related to editing Wikis. PEOU4 – I get confused when I use a Wiki. PEOU5 – I often make mistakes when I use a Wiki. PEOU6 – Learning how to use Wikis is easy. PEOU7 – Overall, I think Wikis are easy to use.
Perceived Usefulness (PU)	PU1 – Using Wikis improves my learning results. PU2 – Using Wikis enables me to better organize my work. PU3 – Using Wikis are time-saving tools. PU4 – Wikis as communication tools allow me to learn using other people's content. PU5 – Wikis allow students to do group work without depending on the physical presence of other group members. PU6 - Wikis allow you to do group work without being dependent on the schedules of other group members. PU7 – Overall, I find Wikis useful for my learning.
Attitude Towards Use (ATU)	ATU1 - I like the idea of being able to participate in activities that use Wikis. ATU2 - If there is the possibility of using Wikis in my learning, I intend to do so. ATU3 – I recommend using Wikis in the TL process. ATU4 – Overall, I have a positive attitude towards using Wikis in the TL process.

Finally, students were asked whether, if possible, they intended to use the tool to prepare the work specified in the Wiki. Based on the collected data, it was made a descriptive

analysis to assess the degree of motivation for the use of Wikis by students in the learning context, as well as an hypothesis testing (Mann-Whitney) for comparing said degree of motivation among students who wanted to continue to use the Wiki TAGI in carrying out the work, and those who did not. In these analyzes we used the IBM SPSS Statistics 19 software.

V.5 Results and Discussion

In this section, the results of phase 3 of the study are presented and analyzed, stressing that students, prior to the experience with the Wiki TAGI, had never edited a Wiki. It was also found that the editing experience was very dynamic, in that the students interacted in and out of its working groups, showing thus motivation on the collaborative nature works. Students introduced information concerning their group work, and some were found to have gone beyond the established goals, structuring the Wiki and using various formats of text, tables and images in order to enrich the work.

Then, the results concerning the motivation of students to the use of Wikis in the learning context and the comparison of motivation to use Wikis between students who wanted to continue using this tool to the CU project, and those who did not intend to, are presented.

V.5.1 Student motivation to use Wikis

Table V.4 presents the absolute frequencies and measures of central tendency on the responses from the main questions in the questionnaire based on the TAM, to which 47 students replied.

The items displayed evaluate several aspects of the motivation for the use of Wikis in the learning process, on a scale from 1 (Do not agree at all) to 5 (Fully agree).

In general, students expressed a positive attitude for the various items related to the Perceived Ease of Use (PEOU), Perceived Usefulness (PU) and Attitude Towards Use (ATU) Wikis in the TL process.

The highest rated items by students refer to the Perceived Ease of Use, as the items PEOU2, PEOU3, PEOU6 and PEOU7 directly reflect the ease of use of Wiki technology and between 62% and 94% of students gave a rating of 4 or 5. Items PEOU1, and PEOU4 PEOU5 present low levels of agreement, representing, however, equally favourable responses, since the questions were made using sentences in the negative form, and between 57% and 94% of students specified level 1 or 2.

Table V.4 - Frequencies and measures of central tendency on items related to student motivation for using Wikis.

	Level of agreement					N_{total}	Mean	Median	Mode
	1	2	3	4	5				
PEOU1 – It is often necessary to consult the script support/help icon to use Wikis.	8	19	15	3	0	45	2.3	2	2
PEOU2 – The icons and texts associated to Wikis are easy to understand.	0	3	7	31	6	47	3.9	4	4
PEOU3 - It is easy to remember how to perform the tasks related to editing Wikis.	0	2	16	20	9	47	3.8	4	4
PEOU4 – I get confused when I use a Wiki.	19	25	3	0	0	47	1.7	2	2
PEOU5 – I often make mistakes when I use a Wiki	8	24	11	3	0	46	2.2	2	2
PEOU6 – Learning how to use Wikis is easy.	0	0	9	27	11	47	4.0	4	4
PEOU7 – Overall, I think Wikis are easy to use.	0	1	2	38	6	47	4.0	4	4
PU1 – Using Wikis improves my learning results.	1	6	19	15	5	46	3.4	3	3
PU2 – Using Wikis enables me to better organize my work.	2	4	14	21	5	46	3.5	4	4
PU3 – Using Wikis are time-saving tools.	3	5	18	18	3	47	3.3	3	3 e 4
PU4 – Wikis as communication tools allow me to learn using other people's content.	0	1	18	19	9	47	3.8	4	4
PU5 – Wikis allow students to do group work without depending on the physical presence of other group members.	1	6	8	19	13	47	3.8	4	4
PU6 - Wikis allow you to do group work without being dependent on the schedules of other group members.	1	4	9	20	13	47	3.9	4	4
PU7 – Overall, I find Wikis useful for my learning.	1	1	13	24	7	46	3.8	4	4
ATU1 - I like the idea of being able to participate in activities that use Wikis.	0	6	19	17	4	46	3.4	3	3
ATU2 - If there is the possibility of using Wikis in my learning, I intend to do so.	0	5	18	18	4	45	3.5	3	3 e 4
ATU3 – I recommend using Wikis in the TL process.	0	7	13	20	5	45	3.5	4	4
ATU4 – Overall, I have a positive attitude towards using Wikis in the TL process.	1	2	18	21	5	47	3.6	4	4

With regard to items assessing the Perceived Usefulness, it was found that the highest rated items by students are PU2, PU4, PU5, PU6 and PU7, and it can be seen that between 57% and 70% of them specified levels 4 or 5. In particular, item PU4 is one of the items with a lower dispersion (only 2% of students indicated level 1 or 2), revealing that, in general, students consider "Wikis as communication tools allow me to learn using other people's content" to be one of the most useful features of this technology. The positive response to items PU5 - "Wikis allow students to do group work without depending on the physical presence of other group member," and PU6 - "Wikis allow you to do group work without being dependent on the schedules of other group members", confirm the results of Oner's study (2009).

It is further noted, that the responses to the improvement in learning results (PU1) and to time-saving as a tool (PU3) weren't as positive as the previous.

Regarding items assessing Attitude Towards Use, it can be seen, that "I recommend using Wikis in the TL process" (ATU3) and "Overall, I have a positive attitude towards using Wikis in the TL process" (ATU4) had 55% of students indicating levels 4 or 5 of agreement. Concerning the items "I like the idea of being able to participate in activities

that use Wikis (ATU1)" and "If there is the possibility of using Wikis in my learning, I intend to do so (ATU2)", had 40% of students indicating level 3 and 46% and 48%, respectively, indicating levels 4 and 5. This less favourable result can be explained by the fear that some students expressed to expose the work they were developing, because of the possibility that some colleagues could take advantage of their ideas. The fact that anyone can modify and / or delete the contents that someone else edited, may also have influenced the answers to this question, as shown by the comment of one respondent "(...) anyone can change what I wrote, and they can delete important things."

On the use of Wikis to develop the evaluation work of the CU, 67% of students answered that they intend to do it.

It was found, from the results of the questionnaire, that in general, students were satisfied regarding ease of use, usefulness and attitude towards using Wikis in the TL process.

V.5.2 Comparing the motivation towards using Wikis between two groups of students

In order to verify if the level of agreement given to each item of the questionnaire by the students that intend to do the work using Wiki is greater than the level of agreement of those who do not intend to do so, Unilateral Mann Whitney tests were performed with a significance level of 5%.

Mann Whitney test is a nonparametric test, as an alternative to Student's *t*-test, in which two independent samples are compared and whose null hypothesis corresponds to the situation in which the two samples come from populations with the same distribution (or from the same population) (Murteira, 1990). In case this hypothesis isn't rejected, it is assumed that the distributions of the two populations are equal.

As shown in Table V.5, for items that assess the Perceived Ease of Use, the distributions of the two groups studied have turned out not to be significantly different.

In items that assess the Perceived Usefulness and Attitude Towards Use, it can be seen that the distributions for the two groups for each item are significantly different in most cases - 71.4% of the total items in the case of Perceived Usefulness and 50 % for Attitude Towards Use, with items PU2, PU4, ATU1 and ATU4, not showing significant differences.

Table V.5 - Mann Whitney tests for the comparison between the two groups of students, of items related to the motivation towards using Wikis.

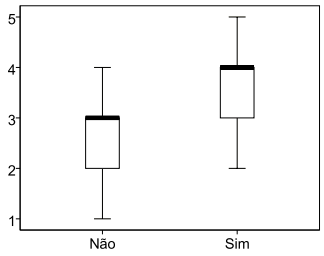
	N_{No}	N_{Yes}	*p-value*
PEOU1 – It is often necessary to consult the script support/help icon to use Wikis.	15	29	0,241
PEOU2 – The icons and texts associated to Wikis are easy to understand.	15	31	0,188
PEOU3 - It is easy to remember how to perform the tasks related to editing Wikis.	15	31	0,195
PEOU4 – I get confused when I use a Wiki.	15	31	0,529
PEOU5 – I often make mistakes when I use a Wiki	15	30	0,084
PEOU6 – Learning how to use Wikis is easy.	15	31	0,124
PEOU7 – Overall, I think Wikis are easy to use.	15	31	0,289
PU1 – Using Wikis improves my learning results.	15	30	0,002
PU2 – Using Wikis enables me to better organize my work.	15	30	0,236
PU3 – Using Wikis are time-saving tools.	15	31	0,046
PU4 – Wikis as communication tools allow me to learn using other people's content.	15	31	0,381
PU5 – Wikis allow students to do group work without depending on the physical presence of other group members.	15	31	0,044
PU6 - Wikis allow you to do group work without being dependent on the schedules of other group members.	15	31	0,033
PU7 – Overall, I find Wikis useful for my learning.	15	30	0,004
ATU1 - I like the idea of being able to participate in activities that use Wikis.	15	30	0,162
ATU2 - If there is the possibility of using Wikis in my learning, I intend to do so.	15	29	0,021
ATU3 – I recommend using Wikis in the TL process.	15	29	0,021
ATU4 – Overall, I have a positive attitude towards using Wikis in the TL process.	15	31	0,136

It is stressed that for the PU4 item, given the fact that the statement that translates it, reveals the nature of the tool, this may explain its highest score and its internalisation, equally, by students of both groups.

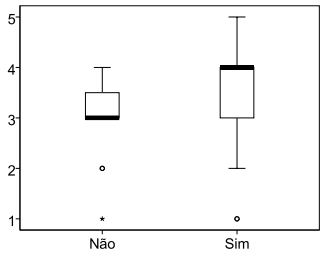
In items ATU1 and ATU4 the absence of differences between distributions, can be explained by student satisfaction regarding this experience and their overall positive attitude towards a tool.

Figure V.2 shows the box plot of the level of agreement in items for which the differences found were statistically significant (PU1, PU3, PU5, PU6, PU7, ATU2 and ATU3) given by the respondents of both groups (students who intent to do the evaluation work using Wiki and those who do not intend to do so).

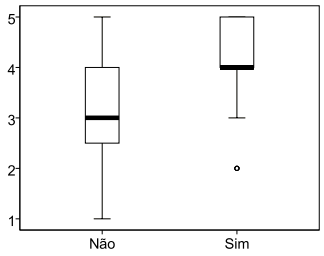
In Figure V.2 it can be seen that, although the distribution of answers is located at higher levels for the group of students that intend to do their work using Wiki than for the group that did not intend to do so, for all the items, the cases where such differences are greater are stressed - PU1 ("Using Wikis improves my learning results") and PU7 ("Overall, I find Wikis useful for my learning"). Note that such differences may reflect the fact that students intending to use the tool in the short term, have a greater belief in the benefits that it can bring to their individual learning.



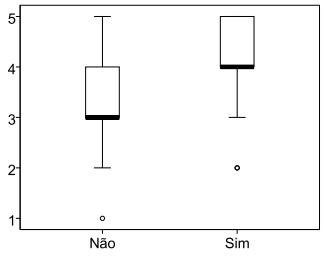
PU1 – Using Wikis improves my learning results.



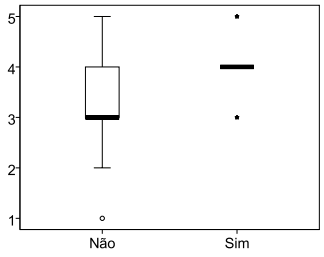
PU3 – Using Wikis are time-saving tools.



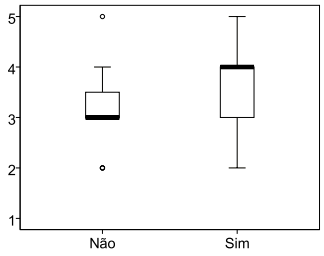
PU5 – Wikis allow students to do group work without depending on the physical presence of other group members.



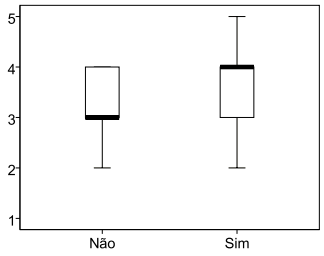
PU6 - Wikis allow you to do group work without being dependent on the schedules of other group members.



PU7 – Overall, I find Wikis useful for my learning.



ATU2 - If there is the possibility of using Wikis in my learning, I intend to do so.



ATU3 – I recommend using Wikis in the TL process.

Figure V.2 - Parallel box plots of the level of agreement of each item for students who do not intend to do the evaluation work using the Wiki (No) and those who intend to do so (Yes).

V.6 Conclusions

Wiki is a Web 2.0 technology that, according to several studies, it presents different advantages when used in the Teaching-Learning (TL) context, allowing his actors to exchange experiences through editing, organizing and sharing content. This study aimed to evaluate the motivation to use the tool, by a group of students in the technological area, in the context of a Curricular Unit in higher education and compare it among the students who intend to use the tool to do a given work with those who do not intend to do so.

It was also found that, although they had never edited a Wiki prior to the experience carried out in this project, the majority of students didn't feel difficulties using it, considering the tool useful for their learning process.

In particular, the data showed a positive attitude on the part of respondents when asked about their motivation to use Wikis in the TL process. Items on the Perceived Ease of Use

were, in general, the highest rated. It should be emphasized the fact that the items related to the Perceived Usefulness which were best rated were (i) the promotion of learning through the content posted by others, (ii) the non-dependence of the physical presence or the schedules of all to carry out group work, and (iii) the general usefulness of the tool.

Items on the Attitude Towards Use were, overall, rated with lower levels than the others, which may be connected with the fear, expressed by some students, to expose the work they are developing to colleagues who face the same challenge. The fact that anyone can modify and / or delete content that someone else has edited may also have influenced the answers to these questions. Thus, it is considered the possibility of the existence of inhibition towards the use of an open space such as Wiki for sharing content which, by their nature, can have their ideas copied. Teachers should therefore be careful in selecting the type of activities to develop using Wikis and it is suggested that Wikis are organized and structured in sections as well as the clear establishment of the objectives of the activities and rules of engagement with students.

In addition, the results show that, with regard to Perceived Ease of Use, there were no significant differences between the group of students who intend to do the evaluation work with the Wiki and the group that did not intend to do so. In the items that assess Perceived Usefulness and Attitude Towards Use, it can be seen that the distributions for the two groups for each item are significantly different in most cases - 71.4% of the total of the items in the case of Perceived Usefulness and 50% for Attitude Towards Use.

It should also be noted that this study was conducted with a group of students from the technological area with solid knowledge in HTML language, which puts them, therefore, in a favorable position with regard to learning on editing Wikis, which may have influenced the results. This way it is intended, as future work, to expand this study to a population of students from other less technological areas and without previous knowledge of Wiki editing language in order to compare the results with those presented here and also validate the acceptance of Wiki technology. The aim is also to promote and disseminate this means of sharing content and knowledge in the academic community as part of some educational activities, when the sharing of knowledge is appropriate.

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VI Students' acceptance of an educational video platform: a study in a Portuguese University

Reference

Costa, C., Alvelos, H., & Teixeira, L. (2018). Students' acceptance of an educational video platform: a study in a Portuguese University. *International Journal of Information Communication and Technology Education*. *14*(1), 86-102.

Students' acceptance of an educational video platform: a study in a Portuguese University

Abstract

The Educast is an educational videos' platform that captures simultaneously video and digital support materials. This paper presents a study on the acceptance of Educast, by students, using the Technology Acceptance Model–TAM. The data was collected through a questionnaire applied to 54 students which results were analyzed using descriptive analysis and non parametric tests. It was concluded that students expressed a positive attitude towards the variables Perceived Ease Of Use, Perceived Usefulness and Attitude Toward Using. The comparison between ratings assigned to the questionnaire items by the students who viewed video recordings and those that did not was performed, and it was found that the former showed higher levels of agreement with the referred items than the latter. It is considered that introducing some training before students have contact with Educast should be taken into account. The result of this work can be valuable not only for researchers on the Education area, but also for teachers that intend to use educational videos in their teaching/learning environment.

Keywords

Educast; Educational video; Higher Education Institutions; TAM;

VI.1 Introduction

The Educast is a platform of educational videos made available to the Higher Education Institutions (HEI) in Portugal. This platform captures simultaneously the live classroom recording in video and the digital support material displayed by the instructor on the computer. In the present study, an experience of the use of this platform is described, in the context of the Curricular Unit (CU) of 'Innovation and Entrepreneurship', taught to several doctoral programs at the University of Aveiro (UA).

This work is part of a project that aims to evaluate the acceptance of technologies as a means to improve the quality of the Teaching/Learning process. The data was obtained through the application of a questionnaire. In particular, the study described in this article aims to evaluate the acceptance of Educast by a group of students from the UA, through the Technology Acceptance Model (TAM) (Davis, 1986). Additionally, a comparison between the ratings assigned to the items by students that have seen at least one recording and those who have not seen any videos was performed.

VI.2 Models of Technologies Acceptance evaluation

There are several models that explain the acceptance of technology by the users, being the TAM one of the most used (Sharma, Joshi, & Sharma, 2016). This model is based on the Theory of Reasoned Action (TRA), in which the Theory of Planned Behavior (TPB) is also based. More recently, the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed based on 8 models, including the TRA and the TAM (Venkatesh, Morris, Davis, & Davis, 2003).

VI.2.1 Theory of Reasoned Action

The TRA model was introduced by Fishbein and Ajzen in 1975, being widely used in social psychology, when the determinants of behavior (Davis, Bagozzi, & Warshaw, 1989) are concerned. This model is a very general model and should be adapted when the objective is to study the determinants of the computer technology's use behavior (Davis et al., 1989). It consists of the variables (i) Actual Behavior, (ii) Behavioral Intention, (iii) Attitude Toward Behavior, (iv) Subjective Norm, (v) Beliefs and Evaluations, and (vi) Normative Beliefs and Motivation to Comply. The behavior of the user (Actual Behavior) is determined by the Behavioral Intention, which in turn is influenced by the Attitude Toward Behavior and the Subjective Norm. The Attitude Toward Behavior is influenced by the Beliefs and Evaluations, and the Subjective Norm by Normative Beliefs and Motivation to Comply (Figure VI.1).

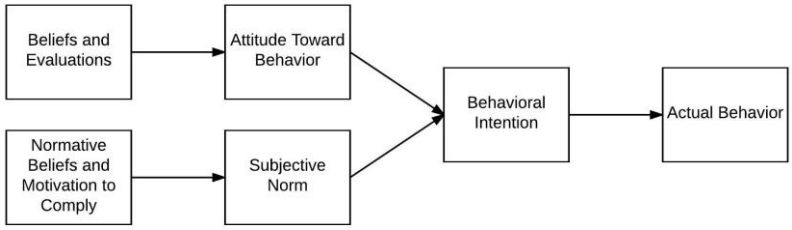

Figure VI.1 - TRA model (Davis et al., 1989).

According to Tan and Ramayah (2014), this model has been effectively applied in numerous studies in areas like knowledge management, medical studies, social psychology and information technology adoption.

VI.2.2 Theory of Planned Behavior

The TPB model is a theory that explains individual behavior and was developed based on the TRA. This theory suggests that individual behavior is driven by intention that depends on three factors: (i) Attitude Toward the Behavior, (ii) Subjective Norms, and (iii) Perceived Behavioral Control, which, in turn, influence each other (Ajzen, 1991).

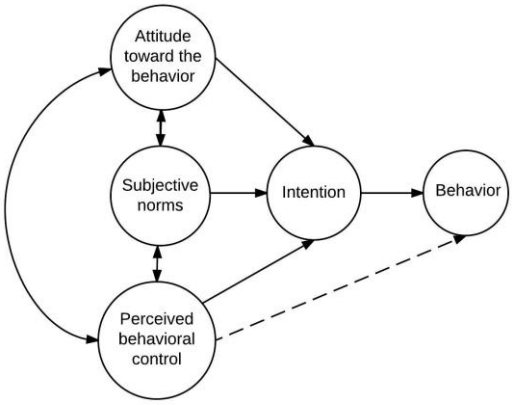

Figure VI.2 - TPB model (Ajzen, 1991).

The TPB has been applied in various contexts including technology (Davis, 1989, Chang, 1998), and specifically applied to the use of mobile devices in higher education (Cheon, Lee, Crooks, & Song, 2012).

VI.2.3 Technology Acceptance Model

The TAM, developed by Davis (1986), is the most widely used model whenever it is intended to evaluate the acceptance of a particular technology (Venkatesh et al., 2003).

According to TAM (Figure VI.3), the Actual System Use (ASU) of the technology being analyzed is determined by the Attitude Toward Using (ATU) that is influenced by two variables: Perceived Ease Of Use (PEOU) and Perceived Usefulness (PU) which, in turn, are influenced by other external variables (X1, X2 and X3) (Davis, 1986). The number of external variables depends on the type of study performed. For example, the study from Oum and Han (2011) used six external variables and the one from Kwon and Wen (2010) used four.

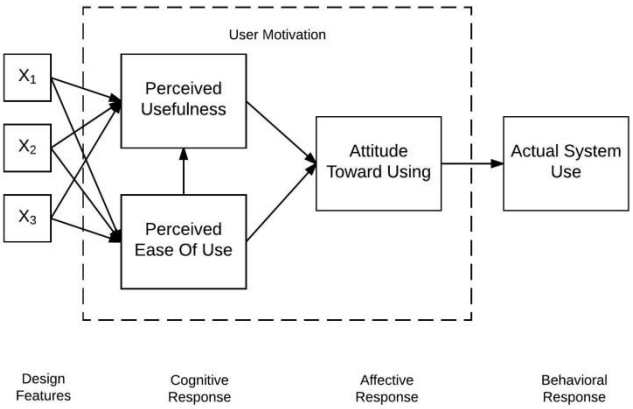

Figure VI.3 - Technology Acceptance Model (Davis, 1986).

PEOU is defined as the degree to which an individual believes that the use of a particular system is intuitive and does not require great effort (Davis, 1986; Davis, 1989). PU is

defined as the degree to which an individual believes that use of the system contributes to increase the performance of his/her work (Davis, 1986; Davis, 1989; Davis et al., 1989). It may be influenced both by external variables or the PEOU, since technologies perceived as easier to use tend to be perceived as more useful. ATU is defined as a positive or negative sense of an individual on the use of the system (Davis, 1986; Davis, 1989; Davis et al., 1989) and is influenced by PU and PEOU variables. The users' motivation is determined by the three variables PEOU, PU and ATU.

The TAM used in practical cases is commonly an adapted version of the original model where external variables are added according to the specific characteristics of the analyzed technology (Oum & Han, 2011). Those models evaluate the acceptance of technologies by users of various tools, such as YouTube (Yang, Hsu, & Tan, 2010), Webcast (Lust, Elen, & Clarebout, 2012), Video podcasting (Sanchez-Fernandez, Jimenez-Castillo, & Marin-Carrillo, 2013), or instructional Video (Donkor, 2011).

VI.2.4 Unified Theory of Acceptance and Use of Technology

The UTAUT, developed by Venkatesh *et al*. (2003) and represented in Figure VI.4, is based on other conceptual models of technology acceptance. This model consists of four constructs: (i) Performance Expectancy, (ii) Effort Expectancy, (iii) Social Influence, and (iv) Facilitating Conditions; and also by 4 moderating variables: (i) Gender, (ii) Age, (iii) Experience, and (iv) Voluntariness of Use.

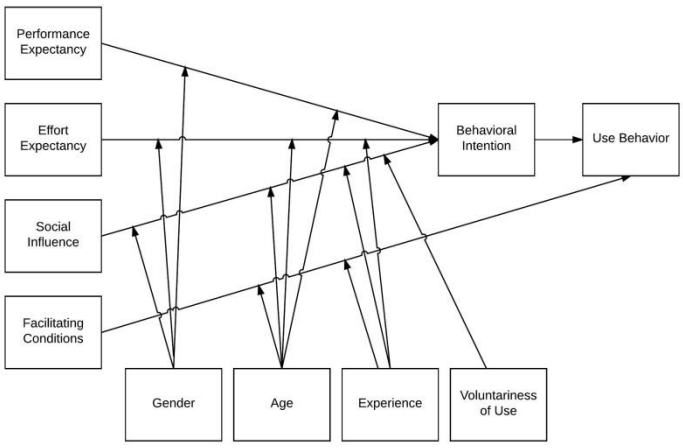

Figure VI.4 - UTAUT model (Venkatesh et al., 2003).

The Performance Expectancy is defined as "the degree to which an individual believes that using the system will help him or her to improve job performance" (Venkatesh et al., 2003, p.447). This construct evolved from other models' constructs, like, for example, the PU of TAM (Venkatesh et al., 2003). The Effort Expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p.450). This construct includes the PEOU of the TAM (Venkatesh et al., 2003). The Social Influence is defined as "the degree to which an individual perceives how important it is for other people to use

the system" (Venkatesh et al., 2003, p.451). The Facilitating Conditions are defined as "the degree to which an individual believes that an organizational and technical infrastructure exist to support the system" (Venkatesh et al., 2003, p.453). The first three constructs (Performance Expectancy, Effort Expectancy, and Social Influence) influence the Behavioral Intention and the last (Facilitating Conditions) influences the Use Behavior.

VI.2.5 Comparisons of the models that predict the intention to use technology

The TPB model is an extension of the TRA that adds the variable Perceived Behavioral Control, defined as the perception of a person on the ease or difficulty of the practice of a particular behavior (Venkatesh & Speier, 1999). According to the result of the study of Chang (1998), TPB is better than TRA in predicting behavior from intention in information systems area (Mathieson, 1991).

The TAM and TPB models predict intention to use an information system quite well, with TAM having a slight empirical advantage. TAM is easier to apply, but only supplies very general information on users' opinions about a system. TPB provides more specific information that can better guide development (Mathieson, 1991). TPB is more difficult to apply across diverse user contexts than TAM, as TAM's constructs are measured in the same way in all situations and TPB requires a pilot study to identify relevant outcomes, reference groups, and control variables, in each different context in which it is used (Mathieson, 1991).

TAM assumes that beliefs about usefulness and ease of use are always the primary determinants of user decisions (Mathieson, 1991). This model explains attitude towards using an information system much better than TPB, and may be the model of choice when ATU is of particular interest (Mathieson, 1991). TAM provides a quick and inexpensive way to gather general information about individuals' perceptions of a system and can be used to measure general levels of satisfaction across a range of users with diverse interests. TPB delivers more specific information, giving more insight regarding why an individual or group might be dissatisfied. However, it is costlier to apply (Mathieson, 1991).

The UTAUT model is a more recent instrument based on eight models (Ling, Downe, Ahmad, & Lai, 2011), including TRA, TPB and TAM. This model includes the Social Influence variable which is not taken into account in TAM (Ling et al., 2011). Mathieson (1991) considers that the fact of TAM not including explicitly any social variables can represent a disadvantage of this model.

VI.3 Educational video

The videos are important educational resources that enable students to get knowledge more efficiently and intuitively than text-based educational resources (Yu, Pedrinaci, Dietze, & Domingue, 2012).

During the last decades, videos have been widely known and frequently used in many HEI to convey contents in the teaching/learning context (Lujan-Mora, 2012; Fernandez et al., 2011).

Educational videos can be divided into three categories depending on their use and purposes: demonstration videos, narrative videos and recorded lecture sessions (Caspi, Gorsky, & Privman, 2005).

Demonstration videos show and explain a procedure. This category of educational videos can have two aims: (i) allowing students to assist to procedures that otherwise are not available to them or (ii) recording students' performance for feedback purposes (Caspi et al., 2005). This type of videos is used in medical context, since many clinical situations are unavailable to students (Caspi et al., 2005). Demonstration videos are a really good tool to allow and improve autonomous learning, becoming much more effective than other methodologies based on more traditional methods, such as books and written manuals or oral explanations (Caspi et al., 2005).

Narrative videos correspond to the recording of situations where instructors speak about a subject. These videos are commonly used to learn languages, and are "useful and effective because they present the learner with a full communicative and cultural context of language alongside its lexical and grammatical aspects" (Caspi et al., 2005, p.32). Admiraal and Berry (2016) describe the use of narrative video as a way to assess students that are being prepared to be teachers in the future, in terms of the relationships among their teaching competencies, the way those competencies are used in practice and their development over time.

Recorded lecture sessions consist of videos where a lecture is recorded and can afterwards be reproduced by the user. In this type of communication, instructors present the subject as they do in class (Caspi et al., 2005). These videos have been the most commonly used educational videos during the last decades (Fernandez et al., 2011).

The video recorded lectures have been mainly useful for the following purposes (Canessa, Fonda, & Zennaro, 2009; Palmer, 2007):

- to review/revise missing points and concepts;
- to clarify handwritten notes;
- to recover missed classes;
- to understand concepts when lecturers went too fast;

- to prepare for exams;
- to avoid writing notes and concentrate on the blackboard;
- to help students remember key concepts;
- to help to understand the issues.

These videos have been least useful when they are too long or contain too much information (Fernandez et al., 2011; Palmer, 2007).

Educational videos are used as instructional material in online learning (Yu et al., 2012). According to Purcell (2010), among Internet Users, almost 70% of adults (≥18 years old) watch or download videos frequently, being young adults (between 18 and 29 years-old) the heaviest consumers of online videos (84%).

A wide range of educational videos is available on online video services, like YouTube, Vimeo, Khan Academy, TED and PBS (Lujan-Mora, 2012). When trying to use the video in e-learning, the following recommendations should be considered (Filipe & Dias, 2013):

- use a small introductory video for each topic;
- produce short videos to encourage the learning of content and enable a connection between teacher and student;
- start the course with a welcome message, where the lecturer presents himself/herself and the course to students.

The educational videos, especially in the online courses are very well accepted by the students, because the students like to see the visual expression of the teacher in their relationship with the contents (Filipe & Dias, 2013). However, Fernandez *et al*. (2011) argue that educational videos must be incorporated into the rest of the course materials, thus promoting a more diverse learning environment.

VI.3.1 The Educast platform

The Educast is a Portuguese service used to manage educational videos from recording to distribution of academic contents (Filipe & Dias, 2013; Martins, Ribeiro, Ribeiro, & Dias, 2012). This service is based on a technology platform for production, editing and distribution of videos that allows the user to have full autonomy throughout the process (Martins et al., 2012). The educational videos become available to students through the Internet (Filipe & Dias, 2013).

This service is a partnership between the Portuguese Foundation for National Scientific Computing-FCCN (Portuguese manager of the National Research and Education Technology technological network), SWITCH (Swiss manager of the National Research and Education Technology technological network) and the University of Porto (Filipe & Dias, 2013; Martins et al., 2012). It "… provides to all HEI's in Portugal an integration into a professional structure to support the level of production of audiovisual content for

e-learning and blended learning. This structure relies on the support of professionals to ensure high levels of service and, consequently, a great confidence to the teachers and other audiovisual content producers in the various academic communities in Portugal…" (Martins et al., 2012, p.2).

The platform was launched in March 2011 (Filipe & Dias, 2013) with the adherence of 15 HEIs in Portugal. The data after one year indicated that 28 HEIs have joined the project with 1607 videos produced integrated in 311 channels. After two years, there were 37 HEIs using Educast, 5882 available videos in 748 channels (Martins, Ribeiro, Ribeiro, & Dias, 2013).

Following, the main features of this platform are listed (FCCN, 2016):

- to produce cultural, informative, or entertaining video educational contents;
- to capture simultaneously the video of the physical action and the slides eventually shown;
- to manage the educational content from classes recorded;
- to publish the final video in different formats;
- to integrate videos in e-learning systems, portals and websites;
- to restrict the access to the contents.

Although the record of lectures is the main use of this platform, it can also be used in demonstration or narrative videos. The technical requirements necessary for recording a lecture are: Apple Mac computer, Firewire (H)DV camera and tripod, microphone or other audio source and Epiphan device to capture the slides from another computer (FCCN, 2016).

VI.4 Methodology

This article aims to evaluate the acceptance, by a group of students of the UA, of the recordings of academic content (lessons) published in Educast, as a means of promoting the improvement of teaching/learning process. As TAM was specifically designed for being applied in technology acceptance evaluation, and has been extensively used and easier to apply than other models, it was decided to use TAM in this particular study.

The practical work described below was carried out in the context of the CU 'Innovation and Entrepreneurship', taught to several doctoral programs at the UA, with 70 students enrolled. This CU was structured in 7 lessons of 3 hours each, divided into two parts. All the lessons of this CU were recorded in two videos, one for 1st part and another for the 2nd one, and were made available to the students using the Educast.

The acceptance of Educast was evaluated through the use of a questionnaire, organized into three groups of questions. The first one aimed to characterize the respondents in terms

of gender, age, course, occupational status, availability to attend classroom lessons, and the time spent in traveling to the university. The second one aimed to characterize the use of Educast in terms of the number of assisted videos and the type of device and format used to access them. The third group of questions aimed to collect data on the acceptance of the use of Educast in the teaching/learning context and comprises 9 items corresponding to the TAM (Table VI.1), measured on a scale of 1 (Strongly disagree) to 5 (Strongly agree).

Table VI.1 - Items used in the questionnaire.

Construct	Item
PEOU	PEOU1-Overall, I find the Educast is easy to use for viewing the academic contents recordings.
PU	PU1-Using academic contents recordings allows me to have flexibility in the organization of my study/work.
	PU2-Using academic contents recordings allows me to review the materials presented in class.
	PU3-Using academic contents recordings allows me to retrieve classes which I had no opportunity to attend in person.
	PU4-Using academic contents recordings allows me not to be worried about taking notes in class and thus concentrate more on the presentation by the lecturer.
	PU5-Overall, I find the academic contents recordings useful for my learning.
ATU	ATU1-I like the idea of being able to attend courses using academic contents recordings.
	ATU2-If there is the possibility of using academic contents recordings in my learning, I intend to do so.
	ATU3-Overall, I have a positive attitude towards using academic contents recordings in the Teaching/Learning process.

The items included in PEOU aim to collect data on the degree to which students believe that using Educast is intuitive and does not require great effort, while the items belonging to PU aim to evaluate the degree to which students believe that using Educast enhances their performance. The items included in ATU aim to assess the students' feelings towards using Educast in the learning context.

The collected data were analyzed using the IBM SPSS Statistics 22 software. First, a descriptive analysis was performed in order to characterize the participants and the use of Educast. Afterwards, Mann-Whitney tests were carried out to verify whether there were statistically significant differences between the students that viewed at least one video and those that did not view any video.

VI.5 Results and discussion

There were obtained 54 answers to the questionnaire applied to the students attending the 'Innovation and Entrepreneurship' CU. The results are presented in the following sub-sections: (i) characterization of the participants, (ii) characterization of the use of the Educast, (iii) acceptance of the use of Educast, and (iv) comparison of the acceptance of Educast between users and non-users.

VI.5.1 Characterisation of the participants

Regarding the characterisation of respondents, it can be noticed that they were 63% female and 37% male and that their average age was 28.4 years old (s=5.25), being the minimum 22 years old and the maximum 49 years old.

Table VI.2 shows the number of respondents attending the CU, by PhD area. It can be observed that most of them were from Biology (39%).

Table VI.2 – Number of respondents attending the curricular unit, by PhD area.

Area of the PhD	N
Biology	21
Physical	12
Chemistry	10
Engineering *	9
Others **	2
Total	**54**

Legend: * Civil Engineering, Mechanical Engineering, and Management and Industrial Engineering;
** Energy Systems and Climate Change, and Tourism.

Regarding the occupational status, it can be seen, in Table VI.3, that most of the participants were researchers (83%), being about 9% employed with activities outside the academic field (Employed–others).

Table VI.3 – Number of students per occupational status.

Occupational status	N
Research	45
Employed – others	5
Professor	3
Unemployed	1
Total	**54**

Table VI.4 presents the distribution of the number of respondents taking into account their availability to attend classroom lessons per week. It can be observed that most of the students (72%) have only half a day per week to attend classes (there was 1 missing value).

Table VI.4 – Weekly availability of students to attend classroom lessons.

Availability (per week)	N
1 half day	38
1 day or 2 half days	9
3 half days	1
2 days or 4 half days	5
Total	**53**

When analyzing the time that students spend in traveling from the place where they usually are to the UA in order to attend to classes, it can be observed that it is, on average, 31 minutes (*s*=39.0), being the minimum 1 minute and the maximum 180 minutes.

VI.5.2 Characterisation of the use of Educast platform

The data collected in the questionnaire's section about the use of the Educast regarding the number of students attending the lessons and viewing the videos' recordings, type of

device used and videos' format accessed are synthetized in Tables VI.5, VI.6 and VI.7, respectively.

Table VI.5 – Number of students attending the lessons and viewing videos.

	Attended lessons:		Number of respondents that viewed the videos	
			1st part of the lesson	2nd part of the lesson
1st Lesson	Yes	42	18	19
	No	12	11	10
	Total	**54**	**29**	**29**
2nd Lesson	Yes	40	13	12
	No	14	10	8
	Total	**54**	**23**	**20**
3rd Lesson	Yes	30	9	9
	No	24	15	14
	Total	**54**	**24**	**23**
4th Lesson	Yes	39	12	14
	No	15	14	14
	Total	**54**	**26**	**28**
5th Lesson	Yes	28	8	7
	No	26	19	17
	Total	**54**	**27**	**24**
6th Lesson	Yes	32	11	10
	No	22	17	16
	Total	**54**	**28**	**26**
7th Lesson	Yes	29	7	6
	No	25	13	11
	Total	**54**	**20**	**17**

Note that, as already referred, the studied CU was structured in 7 lessons, each one composed of two parts, being videos recorded separately for each part.

The number of students attending lessons varied from 28 (52%, 5th lesson) to 42 (78%, 1st lesson). In what concerns the videos' visualizations, it can be seen that the number of respondents that viewed the videos varied from 17 (31%, 7th lesson, 2nd part) to 29 (54%, 1st lesson, 1st part and 2nd part).

Regarding the students that attended lessons in person and viewed the respective videos, the number of respondents varied from 6 (7th lesson, 2nd part) to 19 (1st lesson, 2nd part), while the number of students that did not attended lessons in person and viewed the respective videos varied from 8 (2nd lesson, 2nd part) to 19 (5th lesson, 1st part).

Considering the devices used to access and view the videos, it can be observed in Table VI.6 that most respondents used the computer (94%).

Table VI.6 – Devices used to access and view the videos.

Devices	N
Computer	51
Tablet	2
Computer and Tablet	1
Total	**54**

Taking into account the videos' format used, Table VI.7 illustrates that most respondents used the Flash format (54%), followed by QuickTime (40%).

Table VI.7 – Format used to access and view the videos.

Format	N
Flash	26
QuickTime	19
iPod	2
Flash and QuickTime	1
Total	**48**

Finally, regarding the place where students accessed the videos, it was found that 60% of them viewed at home, 15% at the UA, 9% at the UA and home, 6% at the workplace, 6% at the workplace and home, 2% at UA and workplace and 2% at other HEI.

VI.5.3 Acceptance of the use of Educast platform

The acceptance of the use of Educast in teaching/learning context was evaluated through the variables: PEOU, PU, and ATU of the TAM.

The items of the questionnaire that assess acceptance of view of academic content videos published in Educast (see Table VI.1) were analyzed based on descriptive analysis – frequencies, mean, and standard deviation (SD) – as can be seen in Table VI.8, and on a graphical representation of statistics – box plot, shown in Figure VI.5.

Table VI.8 – Frequencies and descriptive statistics for the items from the questionnaire.

Variable	Item	Level of agreement					Total	Mean	SD
		1	2	3	4	5			
PEOU	PEOU1	0	0	8	21	23	52	4.3	0.72
PU	PU1	0	2	7	13	31	53	4.4	0.86
	PU2	0	3	1	13	36	53	4.6	0.80
	PU3	0	0	2	5	45	52	4.8	0.47
	PU4	3	6	14	13	16	52	3.6	1.21
	PU5	0	1	8	12	32	53	4.4	0.82
ATU	ATU1	0	2	6	10	35	53	4.5	0.85
	ATU2	0	1	8	15	29	53	4.4	0.81
	ATU3	0	0	4	16	33	53	4.6	0.64

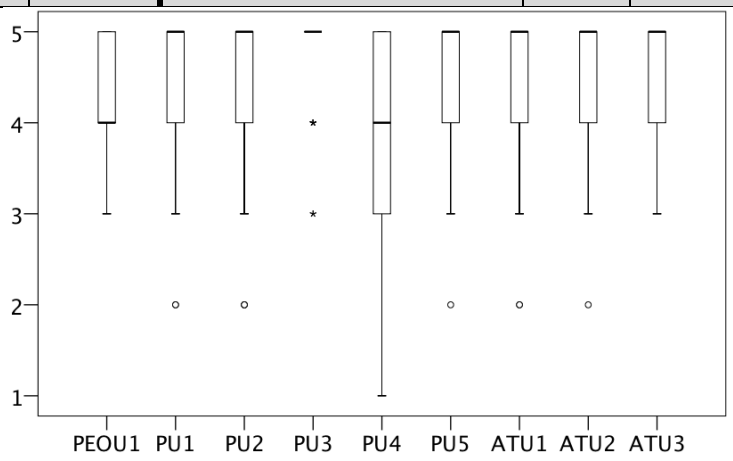

Figure VI.5 – Box plots of the level of agreement of each item relating to assessment of the use of Educast platform.

In general, students expressed a very positive attitude towards the items related to the PEOU, PU and ATU. It is emphasized however that the ATU variable is the one that has a higher mean value, being this result in line with the study of Sanchez-Fernandez *et al*. (2013) that mentions that the attitude toward using video podcasts positively affects the effective use of the tool.

Considering the particular items, PEOU1 – "Overall, I find the Educast is easy to use for viewing the academic contents recordings" (as well as PU4, analyzed next), presents a lower median than the other items, revealing that it may be necessary to introduce some training before students having the first contact with the platform.

On average, the highest rated item is PU3 – "Using academic contents recordings allows me to retrieve classes which I had no opportunity to attend in person", which may mean that e-learning classes can be seen as an alternative for classroom lessons. It is emphasized, however that the item PU4 – "Using academic contents recordings allows me not to be worried about taking notes in class and thus concentrate more on the presentation by the lecturer" has lower classifications than the others, showing that some respondents (44%) do not consider that the video can replace the notes taken from classes, having assigned a score of 3 or less to that item.

Regarding the attitude towards using, it is stressed that ATU3 – "Overall, I have a positive attitude towards using academic contents recordings in the Teaching/Learning process", has a lower dispersion than the majority of the items, with 92% of the respondents classifying it with levels 4 or 5, showing a very positive attitude towers this platform.

The favorable rating assigned to items PU2 – "Using academic contents recordings allows me to review the materials presented in class", and PU5 – "Overall, I find the academic contents recordings useful for my learning", corroborate the results of the study by Canessa *et al.* (2009), that mention that the recordings are mainly useful for revising missing points and concepts.

VI.5.4 Comparison of the acceptance of Educast between users and non-users

Based on the items previously described and analyzed, the comparison of the acceptance of Educast between the respondents that used it at least once and those who did not use, was performed applying unilateral Mann-Whitney tests of hypothesis with a significance level of 5%.

Table VI.9 presents some descriptive statistics of the two groups for each of the items (see Table VI.1): number of respondents (N), minimum (Min), maximum (Max) and median, together with the *p*-values of the Mann Whitney tests that were performed.

Table VI.9 – Descriptive statistics and *p*-value of Mann-Whitney tests.

	Used Educast	N	Min	Max	Median	*p*-value
PEOU1	Yes	31	3	5	5	0.029
	No	20	3	5	4	
	Total	**51**	**3**	**5**	**4**	
PU1	Yes	31	2	5	5	0.138
	No	21	3	5	5	
	Total	**52**	**2**	**5**	**5**	
PU2	Yes	31	2	5	5	0.192
	No	21	2	5	5	
	Total	**52**	**2**	**5**	**5**	
PU3	Yes	30	3	5	5	0.185
	No	21	3	5	5	
	Total	**51**	**3**	**5**	**5**	
PU4	Yes	30	1	5	4	0.074
	No	21	1	5	3	
	Total	**51**	**1**	**5**	**4**	
PU5	Yes	31	3	5	5	0.047
	No	21	2	5	5	
	Total	52	2	5	5	
ATU1	Yes	31	2	5	5	0.121
	No	21	2	5	5	
	Total	**52**	**2**	**5**	**5**	
ATU2	Yes	31	3	5	5	0.051
	No	21	2	5	4	
	Total	**52**	**2**	**5**	**5**	
ATU3	Yes	31	3	5	5	0.034
	No	21	3	5	4	
	Total	**52**	**3**	**5**	**5**	

Taking into account the results presented in Table VI.9, it can be observed that the central tendencies of the two groups distributions show significant differences (5%) for the items PEOU1, PU5 and ATU3. It was also found that the group of students who viewed the recordings exhibited higher levels of agreement with those items of the questionnaire than the group of students that did not view. Note that such differences may reflect the fact that students who viewed the recordings have a higher perception, overall, towards the Perceived Ease Of Use, Perceived Usefulness, and Attitude Toward Using, although they do not show that tendency on the more specific items (PU1, PU2, PU3, PU4, ATU1 and ATU2). It can be then concluded that there was a greater acceptance of the use of Educast by the respondents that experienced that platform at least once than by the ones that never experienced it. This fact is in line with the results obtained with item PU4 that revealed the need for some training before students having the first contact with the platform, as mentioned previously, helping to break the resistance to change, which happens frequently with new technologies.

VI.6 Limitations

Some limitations of this work are related with the small sample size (N=54) and composed by students from only one institution, that although attending the same subject, were from different postgraduate degrees. In order to overcome the effects of those limitations, it is important, as future work, to extend this study to other Curricular Units at the UA and to

other HEI, being thus possible to generalize the conclusions and to detect some eventual differences in the results. It is also suggested that the Educast be used in the context of Massive Open Online Courses (MOOCs) as these courses are based in educational video recordings and have a large potential audience.

VI.7 Conclusion

This paper analyzed the acceptance of an educational videos platform used by HEI in Portugal–Educast, applying the TAM. The study was carried out in the scope of the CU of 'Innovation and Entrepreneurship' which is part of the structure of several doctoral programs at the UA.

A questionnaire adapted from the TAM was applied to 54 students and the results revealed that respondents expressed a positive attitude for the various items related to the PEOU, PU, and ATU.

In general, the variable ATU was the highest rated variable, being thus the variable that impacts more the acceptance of the Educast. Considering the particular items, it can be seen that on average PU3 – "Using academic contents recordings allows me to retrieve classes which I had no opportunity to attend in person" is the highest rated one. This result can be interpreted as students considering e-learning classes as an alternative for classroom lessons. It also stressed that, regarding the lower score values assigned to the item PEOU1 – "Overall, I find the Educast is easy to use for viewing the academic contents recordings", it is considered that introducing some training before students have the first contact with the platform may be a good practice.

Concerning the comparison of the acceptance of Educast between users and non-users, it was found that ratings correspondent to the items that evaluate the overall perception of each variable (PEOU1, PU5 and ATU3) presented higher values for the group of students that used the recordings than for the group of those who did not use, revealing a greater acceptance of Educast by the respondents that experienced that platform at least once than by the ones that never experienced it.

In general, students answered the open question, considering that the recordings were "useful to review concepts" and that "videos were long and should be divided to facilitate finding a particular content".

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VII Exploring the usage of MOOCs in Higher Education Institutions: Characterization of the most used platforms

Reference

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Exploring the usage of MOOCs in Higher Education Institutions: Characterization of the most used platforms

Abstract

This paper analyses the current usage of Massive Open Online Courses (MOOCs) in HEIs. Firstly, a literature review is performed to identify and classify the recent developments in the area and to characterize the most used platforms and courses. Following this, an analysis of MOOCs offered by some HEIs is carried out to characterize and compare the courses available in the platforms. Concerning the main findings, the literature reveals that usage of MOOCs has been growing in recent years and that Coursera and EdX are the two main platforms used. The analysis of MOOCs available in those platforms shows that the number of universities using them and the number of courses offered have been increasing. The comparison between the courses available through the above-mentioned platforms shows that EdX is more interdisciplinary. The outcomes of this work are valuable for researchers on ICT use in HEI and may help professors implementing MOOCs in their own environment.

Keywords

Coursera; EdX; Higher Education; MOOCs;

VII.1 Introduction

Higher Education Institutions (HEIs) are becoming more receptive to integrating new technologies into their teaching and learning processes, with Massive Open Online Courses (MOOCs) platforms being one of the most recent.

The MOOC is a concept associated with e-learning (Fini, 2009) and offers world class education to an unlimited number of participants (massive) around the globe with Internet access (online) for low or no fees (Aboshady et al., 2015; Glance, Forsey & Riley, 2013). MOOCs make use of some traditional course materials such as videos or short videos combined with formative quizzes, texts and problem sets, using tools for interaction, in order to build a community of students and lecturers (Ahlberg, 2014). In these courses, it is also possible to implement formative quizzes, automated assessment, peer and self-assessment and online forums for support and discussion (Glance et al., 2013). Therefore, they can offer educational benefits to HEIs, professors and students (Aboshady et al., 2015), providing opportunities for thousands of learners to participate in free online courses (Ahlberg, 2014; Yousef, Chatti, Wosnitza & Schroeder, 2015).

Hew and Cheung (2014, p. 51) refer to three main differences between MOOCs and traditional classroom courses: "the large and diverse student enrolment in MOOCs, the high dropout rate of MOOCs compared to that of traditional courses, and the relative lack

of instructor presence or support in MOOCs compared to traditional courses". Concerning the comparison between MOOCs and traditional e-learning courses, it is recognized that MOOCs involve more self-directed learning than other e-learning courses, and that the central role of the mediator is more recognised in traditional e-learning courses than in MOOCs (Nyoni, 2013).

The underlying technology of MOOCs is recent. The first MOOC was launched in 2008 (Ahlberg, 2014; Fini, 2009) and in 2011 there was a 'wave of offers' of MOOCs (Tschofen & Mackness, 2012). At present, HEIs are offering a growing variety of MOOCs (Yousef et al., 2015), using different platforms.

This paper aims to analyse the current usage of MOOC platforms by HEIs. This analysis was performed in two phases: the first one consisted of a literature review performed in order to (i) identify and classify the published works and the recent developments in this area, (ii) identify the most popular MOOC platforms, and (iii) characterize the most used platforms and courses based on the practical cases reported in the literature. The second phase involved the analysis of MOOCs offered by some of the most recognized HEIs around the world, in order to characterize and compare the courses available in the two most popular MOOC platforms.

The paper is organized in four sections. The MOOC concept was outlined in this introductory section. The characterization of the most popular MOOC platforms through data from a systematic search is described in the second section and, in the third section the most used MOOC platforms in HEIs are characterized through the data collected. Finally, in the fourth section, some conclusions and directions for future work are presented.

VII.2 Characterization of the most popular MOOC platforms through a systematic search

In this section, the research method of the literature revision and a brief characterization of the articles considered relevant are presented (section VII.2.1). In section VII.2.2, the most mentioned MOOC platforms in the selected articles are identified and the two most often referred to are characterized.

VII.2.1 Selection and characterization of the selected articles

The methodology followed in the first part of the study was a systematic literature review covering the years from 2008 to 2015, since the first MOOC appeared in 2008 (Ahlberg, 2014; Fini, 2009).

In order to gather data about published MOOC literature, the most specialized scientific databases in the areas of Information and Communication Technologies (ICT) and

Education were selected, which were (i) ISI Web of Knowledge; (ii) Scopus and (iii) IEEE Xplorer.

The selected search terms were: (i) MOOC; (ii) massive open online course; (iii) higher education; (iv) university and (v) universities. The search was performed in the title, in the abstract and in the keywords and the search expression used was (MOOC OR "massive open online course") AND ("higher education" OR university OR universities).

An overview of the documents identified is presented in Table VII.1. The first column identifies the database used in each search; the 2nd column presents the resulting number of documents (article, review, conference paper, book, book chapter, editorial) and, in the 3rd column, the resulting number of the document types considered in this work – article or review, from now on named 'article'.

Table VII.1 - Search documents in academic databases.

Database	Total number of documents	Number of documents considered - articles
ISI Web of Knowledge	316	155
Scopus	479	229
IEEE Xplorer	148	10

It should be emphasized that some of the articles are common to more than one database. The data collection resulted thus in 279 articles, 54 only from ISI Web of Knowledge, 132 only from Scopus, 1 only from IEEE Xplorer, 83 from ISI Web of Knowledge and Scopus, 3 from ISI Web of Knowledge and IEEE Xplorer, 2 from Scopus and IEEE Xplorer, and 4 from all the three databases (Figure VII.1).

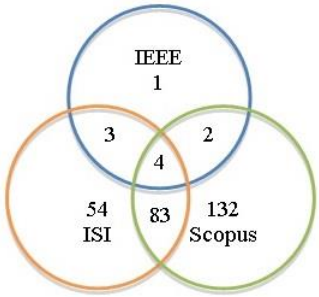

Figure VII.1 - Number of articles found in the three academic databases.

The articles identified were then analysed according to the year of publication, the journals where they were published and the respective authors.

Figure VII.2 presents the number of articles published on MOOCs in the databases analysed, per year, from January 2012 until December 2015 (although the search was performed using 2008 as starting year, the first articles were published in the year 2012), and it can be seen that this number has been increasing consistently through this period of time.

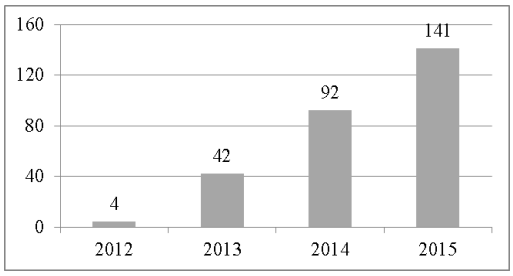

Figure VII.2 - Number of articles by publication year.

Concerning the number of journals, by the end of 2015 there were 166 scientific journals of the 3 selected databases that published articles about MOOCs. Of these, 162 had published less than 7 articles. Among the other 4 journals, the 'International Review of Research in Open and Distance Learning' published 32 articles, 'Profesorado' and 'RUSC Universities and Knowledge Society Journal' published 9 and 'Distance Education' published 8 articles.

An analysis of the number of articles by author has also been made. The authors that presented the highest number of publications (three) are Ramirez-Fernandez, Meneses, Rhoads, Toven-Lindsey and Vazquez Cano. According to Lopez-Meneses, Vazquez-Cano, & Roman (2015), Forsey and Glance are the most cited authors. In this analysis, these two authors have two articles each.

The 279 relevant articles characterized above were then analysed in order to identify the most mentioned MOOC platforms.

VII.2.2 Identification and characterization of the most mentioned MOOC platforms in the selected articles

The criterion used to identify the most mentioned MOOC platforms in the scientific literature was to select those referred to in more than four articles. This analysis resulted in 11 different platforms from a total of 52. Then, the articles that referred to at least one of those 11 platforms were considered, with 182 articles emerging. Table VII.2 presents the number of articles that mention each of the 11 platforms.

Table VII.2 - Number of articles mentioning each MOOC platforms[1].

	Total	Cousera	EdX	Udacity	FutureLearn	MiriadaX	Udemy	Iversity	OpenupEd	Open2Study	Canvas	Khan Academy
Number of articles	182	162	145	107	37	14	13	11	11	11	7	6

[1] See Appendix II.1

It can be noticed that the most referenced platforms are Coursera and EdX. This result is in line with the study by Kim (2015), which states that these two platforms are the most widely used ones.

In order to characterize the most popular MOOC platforms in terms of (i) universities that use them, (ii) courses offered, and (iii) participants in those courses, the 182 articles were subjected to a further selection procedure that took into account various criteria (see Figure VII.3).

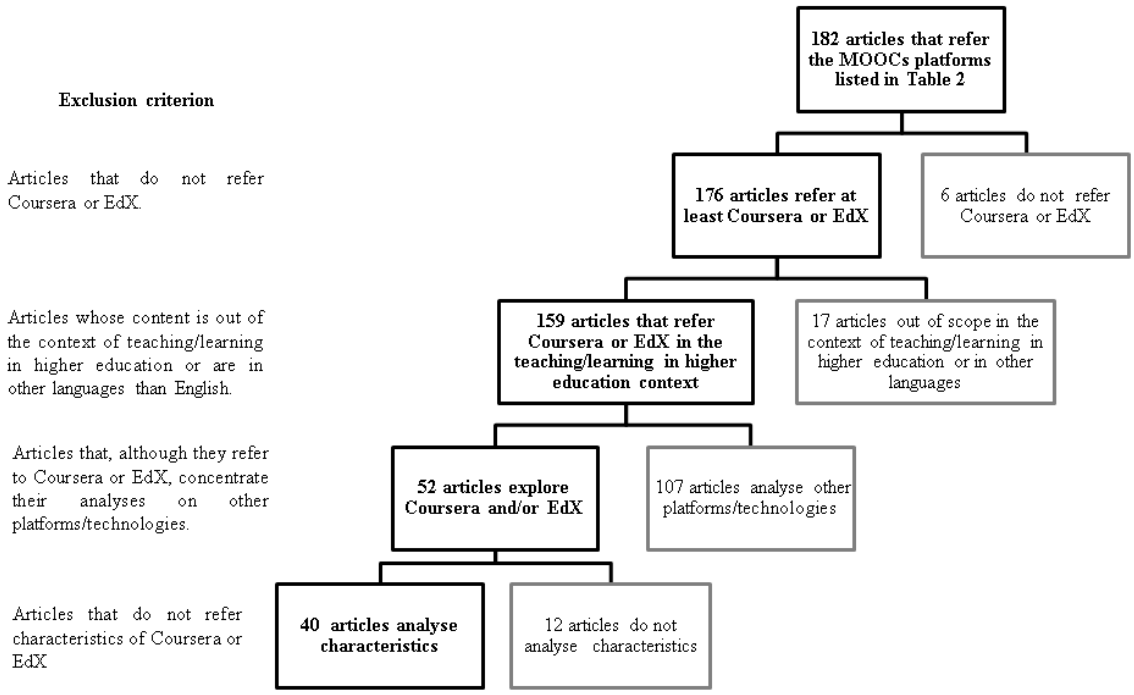

Figure VII.3 - Method used to select the articles that characterize Coursera or EdX.

According to Figure VII.3, 40 articles were found that characterize the Coursera or EdX platforms that were used in the following stage of this study. From these articles, 33 report empirical studies and the remaining 7 focus on a theoretical approach (review studies). Content analysis was performed on these articles in order to identify the features of the Coursera and EdX platforms concerning four categories: universities, courses, participants, and recourses/activities of MOOCs. Table VII.3 presents the features related to universities: number, name and localization of universities that offer MOOCs.

Table VII.3 - Main features related to universities that offer MOOCs in Coursera and/or EdX.

Number of universities that offer MOOCs in Coursera	Number of universities that offer MOOCs in EdX	Reference
36 universities in 2012	3 universities in 2012	(Audsley et al., 2013)
61 universities in 2013		(Clarke, 2013)
70 universities in 2013		(Baggaley, 2013)
80 universities in 2013	29 universities in 2013	(Atenas, 2015)
90 universities	30 universities	(Perez & Guzman-Duque, 2015)
Identification of universities that offer MOOCs in Coursera	**Identification of universities that offer MOOCs in EdX**	**Reference**
Leiden University: 3 MOOCs in 2013-2014		(Admiraal et al., 2015)
University of Pennsylvania: 16 MOOCs		(Ruby et al., 2015)
Duke University: 13 MOOCs in 2014		(Schmid et al., 2015)
University of Edinburgh: 1 MOOC		(Bayne, 2015)
Duke University: 1 MOOC		(Engle et al., 2015)
Identification of universities that offer MOOCs in Coursera and EdX		**Reference**
Johns Hopkins University, University of Pennsylvania, Duke University, University of California – San Francisco, Harvard University, Stanford University, Berkeley, and University of Toronto: 73 MOOCs		(Subhi et al., 2014)
John Hopkins University, University of California, University of Pennsylvania, Open Universities Australia, Harvard University, and University of Sheffield: 40 MOOCs on "Health and Medicine"		(Liyanagunawardena & Williams, 2014)
Localization of universities that offer MOOCs in Coursera	**Localization of universities that offer MOOCs in EdX**	**Reference**
USA, France, Switzerland, Israel, Germany, Taiwan, Singapore, Italy, Denmark, Mexico, Hong Kong, Scotland, Japan, Spain, and Australia		(Clarke, 2013)
USA, UK and Germany: 12 MOOCs in 2013		(Nkuyubwatsi, 2014)
Netherlands: 3 MOOCs in 2013-2014		(Admiraal et al., 2015)
Localization of universities that offer MOOCs in Coursera and EdX		**Reference**
North America, Europe, and Australia: 59 MOOCs		(Subhi et al., 2014)

It can be noticed that the number of universities that offer MOOCs increased from 2012, where there were 36 universities offering MOOCs in Coursera and 3 in EdX (Audsley et al., 2013) and 2013 where there were 80 identified in Coursera and 29 in EdX (Atenas, 2015). Liyanagunawardena & Williams (2014) and Subhi et al. (2014) highlight that the universities offering MOOCs are heavily concentrated in the USA.

Table VII.4 presents the number of courses offered in the Coursera and EdX platforms.

It can be inferred from Table 4 that the number of MOOCs has been increasing. It can be observed that in 2012 there were 198 Coursera courses and 9 EdX courses (Audsley et al., 2013), in 2013 there were 556 courses in Coursera and 112 in EdX (Subhi et al., 2014), in 2014 Coursera offered 664 courses and EdX 182 (Brahimi & Sarirete, 2015), and in June 2015 there were 1041 Coursera courses and 611 in EdX (Lin et al., 2015).

The courses covered many areas of knowledge, from health sciences to arts, music or technology (Audsley et al., 2013; Brahimi & Sarirete, 2015; Dillahunt et al., 2014; Macleod et al., 2015; Perna et al., 2014; Toven-Lindsey et al., 2015; Vazquez-Cano, 2013), their duration varied between 3 to 20 weeks (Admiraal et al., 2015; Engle et al., 2015;

Kustritz, 2014; Liyanagunawardena & Williams, 2014; Najafi et al., 2014; O'Malley et al., 2015; Redfield, 2015; Subhi et al., 2014) and they required 2 to 15 hours of work per week (Admiraal et al., 2015; Audsley et al., 2013; Dillahunt et al., 2014; Haggard, 2013 in Atenas, 2015; Subhi et al., 2014). The number of instructors involved in the courses varies between 1 and 13 (Perna et al., 2014).

Table VII.4 - Summary of the main features of courses in Coursera and/or EdX[2].

Number of courses in Coursera	Number of courses in EdX	Reference
57 courses on health and medicine	5 courses on health and medicine	(Liyanagunawardena & Williams, 2014)
60 courses on bioinformatics and computational biology	12 courses on bioinformatics and computational biology	(Searls, 2014)
198 courses in 2012	9 courses in 2012	(Audsley et al., 2013)
542 courses in 2013	91 courses in 2013	(Atenas, 2015)
556 courses in 2013	112 courses in 2013	(Subhi et al., 2014)
600 courses	170 courses	(Perez & Guzman-Duque, 2015)
664 courses in 2014	182 courses in 2014	(Brahimi & Sarirete, 2015)
839 courses	415 courses	(Nisha & Senthil, 2015)
1041 courses in 2015	611 courses in 2015	(Lin et al., 2015)

The number of people using the platforms were, in November 2014, more than 10 million students using Coursera and more than 1.7 million students using EdX (Kim, 2015). The localization of the courses' participants was highly varied (Bayne, 2015; Hood et al., 2015; Severance, 2015; Soffer & Cohen, 2015)[3].

However, the United States had many more students than the other countries (Fricton et al., 2015; Kustritz, 2014; Macleod et al., 2015). The age of participants was mostly between 24 and 34 (Dillahunt et al., 2014; Gillani & Eynon, 2014), the gender prevalence was largely related to the subject matter (Macleod et al., 2015) with more females than males in general (Fricton et al., 2015; Jiang et al., 2014; Kustritz, 2014; Murray, 2014) and the majority of the participants were undergraduate students (Dillahunt et al., 2014; Engle et al., 2015; Fricton et al., 2015; Gillani & Eynon, 2014; Schmid et al., 2015)[3].

Some resources/activities used in Coursera were videos, quizzes (Egerstedt, 2013; Woodgate et al., 2015) and discussion forums (Burch & Harris, 2014; DeBoer et al., 2014; Egerstedt, 2013; Gillani & Eynon, 2014; Woodgate et al., 2015) and some of the courses also used Facebook and Google + groups (Knox, 2014)[4].

Only a small percentage of the students involved completed the course (Engle et al., 2015; Fricton et al., 2015; Gillani & Eynon, 2014; Jordan, 2014; Murray, 2014; Soffer & Cohen, 2015) and got the respective certificate (Aboshady et al., 2015; Admiraal et al., 2015;

[2] See Appendix II.2
[3] See Appendix II.3
[4] See Appendix II.4

Dillahunt et al., 2014; Egerstedt, 2013; Jiang et al., 2014).This can be explained by the fact that most of the students want just to explore the specific topic of the course rather than complete it (Koller et al., 2013 in Murray, 2014)[4].

An analysis of the MOOC platforms and a comparison between them are performed in the next section.

VII.3 Characterisation of the most used MOOC platforms through collected data

This section involves the analysis of MOOCs offered by some of the most recognized HEIs around the world, in order to characterize and compare the courses available in the two most popular MOOC platforms. The method used in order to collect the data is presented (section VII.3.1), followed by a brief characterization and comparison of the Coursera and EdX MOOC platforms (section VII.3.2).

VII.3.1 Method used in collecting data

According to the literature review, Coursera and EdX are the most referenced platforms. These platforms were then selected for a more detailed practical study that consisted of the analysis of the information available on their sites, which also allowed the characterization and comparison of courses offered through those platforms.

On 22/05/2015 information was collected about 107 courses in Coursera, and on 26/05/2015 information was collected about 115 courses in EdX.

For each platform and for each course, the data collected were: (i) name of course; (ii) HEI offering the course; (iii) area of knowledge; (iv) whether the course presents an introductory video or not; (v) number of instructors involved in the course; (vi) duration; and (vii) expected workload for a student to successfully complete the course.

The collected data were analysed using the IBM SPSS Statistics 22 software. First, a descriptive analysis was performed in order to characterise the courses in the Coursera and EdX platforms. Afterwards, independent samples t-tests were carried out in order to understand whether there were statistically significant differences between the number of the weeks of duration, the minimum and maximum number of hours of work per week, and number of instructors of courses in Coursera and EdX.

VII.3.2 Characterisation and comparison of MOOCs in Coursera and EdX

The Coursera and EdX platforms were analysed considering the following criteria: (i) number of HEIs that offer courses using these platforms; (ii) number of MOOCs made

available by the HEIs that offer more than three courses; (iii) number and areas of knowledge of the courses available through each platform; (iv) percentage of courses that present an introductory video summarizing the objectives and main contents of the course; and (v) descriptive statistics of the duration of the courses, the expected workload for a student to successfully complete the MOOCs, and the number of instructors involved.

Regarding the universities using Coursera, it was found that on 19/05/2015 there were 102 universities offering 1036 courses (Coursera, 2015), while in November 2013 there were 80 universities presenting 542 courses (Atenas, 2015), and on 02/11/2012 there were 36 universities presenting 198 courses (Audsley et al., 2013). Concerning EdX, on 19/05/2015, there were 39 universities offering 516 courses (EdX, 2015), while in November 2013 there were 29 universities and 91 courses (Atenas, 2015), and on 02/11/2012 there were only three universities presenting 9 courses (Audsley et al., 2013). Taking into account the current figures, it can be seen that the relationship between the number of courses and number of universities offering the courses ($N_{Courses}/N_{Universities}$) is higher in the case of EdX (about 13) than in the case of Coursera (about 10).

On the date of this study, it was found that more than 13 million students have signed up for courses using Coursera (Coursera, 2015). The same information from EdX was not available, but it was possible to notice that 0.4 million students obtained certificates from EdX courses (EdX, 2015). Actually, the number of students that use MOOCs in these platforms has increased substantially, since on March 2013, 2.8 million people learned through Coursera, and about 1.3 million people used EdX, and by November 2014, more than 10 million students had signed up for Coursera's courses, and more than 1.7 million students had signed up for EdX's courses (Kim, 2015).

On 22/05/2015, Coursera had 107 courses available from 54 HEIs, while EdX had, on 26/05/2015, 115 courses available from 39 HEIs. In Figure VII.4 it can be seen that 4 of those HEIs (Berklee College of Music, École Polytechnique Fédérale de Lausanne, Peking University and Rice University) offered courses in both platforms simultaneously.

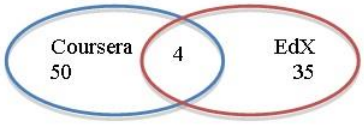

Figure VII.4 - Number of universities offering courses in Cousera and EdX MOOC platforms.

Taking into account the number of HEIs that had courses available in May 2015, and as was already pointed out, there were 54 HEIs using Coursera and 39 HEIs using EdX. Table VII.5 presents the universities offering 4 or more courses.

Harvard University, Peking University and MIT are the universities with more MOOCs available in the platforms studied. Note that Harvard University and MIT only have

courses in the EdX platform, which confirms a higher concentration of courses per HEI in EdX than in Coursera.

Concerning the knowledge areas of the MOOCs, in the Coursera platform they are classified in 21 different categories, while in EdX the correspondent number is 23. Table VII.6 presents the knowledge areas considered in each of the platforms being studied, and the number and percentage of courses classified in each one.

Table VII.5 - Number of MOOCs offered by universities with 4 or more courses available.

	Number of courses		
University	**Coursera**	**EdX**	**Total**
Harvard University	0	26	26
Peking University	9	6	15
MIT	0	12	12
Tsinghua University	0	10	10
Universitat Politècnica de València	0	9	9
University of Pennsylvania	7	0	7
Berklee College of Music	4	2	6
University of Copenhagen	5	0	5
Cornell	0	4	4
Johns Hopkins University	4	0	4
Rice University	3	1	4
Stanford University	4	0	4
Universitat Autònoma de Barcelona	4	0	4
The University of Queensland, Australia	0	4	4

Many of the areas are common to both platforms. In Coursera, the areas where there are more courses are: Computer Science (17; 16.0%), Medicine (17; 16.0%), Humanities (13; 12.3%) and Economics & Finance (13; 12.3%). In EdX the corresponding areas are: Computer Science (17; 14.9%), Biology & Life Sciences (15; 13.2%), Business & Management (14; 12.3%) and History (13; 11.4%).

Toven-Lindsey *et al*. (2015) used Biglan's (1973) model for categorizing academic disciplines in MOOCs. According to the knowledge areas of the courses available in each platform (Table VII.8), a classification based on Biglan's model using the categorization of Laird, Shoup, Kuh and Schwarz (2008) was performed.

Biglan's model is a framework for studying the cognitive style of scholars in different areas. This model clusters subject matter of academic areas in three dimensions. The dimensions are: hard and soft sciences – defined by the "degree to which a paradigm exists", pure and applied – defined by "the degree of concern with application", and life and non-life – defined by "concern with life systems" (Biglan, 1973, p. 203). The categories are eight: Hard-Pure-Life, Hard-Pure-Non-Life, Hard-Applied-Life, Hard-Applied-Non-Life, Soft-Pure-Life, Soft-Pure-Non-Life, Soft-Applied-Life, Soft-Applied-Non-Life.

From this perspective, the categories that aggregate more courses are: Soft (56; 52.8%), Applied (92; 86.8%), and Non-Life (71; 67.0%) in Coursera and Hard (62; 54.4%), Applied (69; 60.5%), and Non-Life (87; 76.3%) in EdX.

Table VII.6 - Areas of knowledge of courses and number of courses on Coursera and EdX platforms.

Areas of Knowledge		**Coursera**		**EdX**	
		N	**%**	**N**	**%**
Architecture		---	---	1	0.9
Art & Culture		---	---	4	3.5
Biology & Life Sciences		6	5.7	15	13.2
Business & Management		6	5.7	14	12.3
Chemistry		---	---	2	1.8
Communication		---	---	4	3.5
Computer Science:	Artificial Intelligence	1	0.9	17	14.9
	Software Engineering	4	3.8		
	Systems & Security	5	4.7		
	Theory	7	6.6		
Economics & Finance		13	12.3	2	1.8
Education		5	4.7	2	1.8
Electronics		---	---	5	4.4
Energy & Earth Sciences		---	---	2	1.8
Engineering		2	1.9	8	7.0
Health & Society		2	1.9	---	---
Environmental Studies		---	---	2	1.8
History		---	---	13	11.4
Humanities		13	12.3	4	3.5
Information, Tech & Design		8	7.5	---	---
Law		1	0.9	3	2.6
Literature		---	---	1	0.9
Mathematics		3	2.8	4	3.5
Medicine		17	16.0	2	1.8
Music, Film, & Audio		4	3.8	---	---
Philosophy & Ethics		---	---	1	0.9
Physical & Earth Sciences		2	1.9	---	---
Physics		2	1.9	4	3.5
Social Sciences		1	0.9	3	2.6
Statistics & Data Analysis		1	0.9	1	0.9
Teacher Professional Development		3	2.8	---	---
Total		106		114	

Figure VII.5 presents the percentage of courses classified in each Biglan category for both platforms.

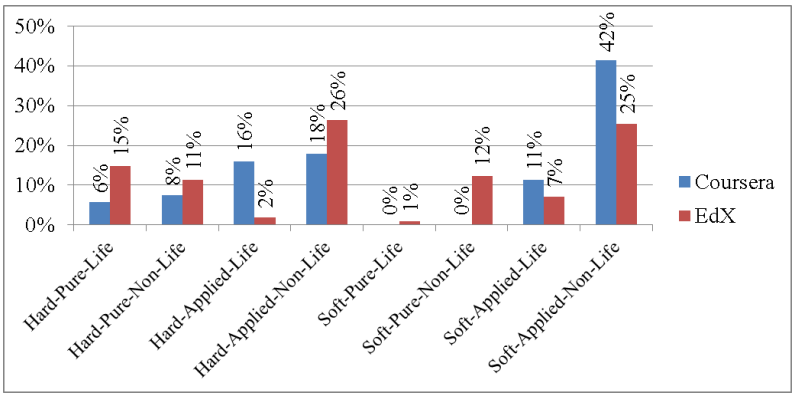

Figure VII.5 - Percentage of MOOCs by Biglan categories in Coursera and EdX platforms.

It can be seen in Figure VII.5 that the categories that encompass more courses in Coursera are Soft-Applied-Non-Life (44; 41.5%), while in EdX they are Hard-Applied-Non-Life (30; 26.3%) and Soft-Applied-Non-Life (29; 25.4%). Comparing the two platforms, it can be observed that there is a larger difference in the categories Hard-Pure-Life (more courses in EdX) and Hard-Applied-Life and Soft-Applied-Non-Life (more courses in Coursera).

With regard to the introductory video, which presents the course in an easy and fast way to provide a first contact with the content and the professor (Audsley et al., 2013), it can be observed that it is included in 93.5% of the courses found in Coursera (Coursera, 2015) and in 88.7% of the courses found in EdX (EdX, 2015).

Finally, some information regarding the duration of the courses and the expected workload for a student to successfully complete the MOOCs (with the exception of the time of attending the "lessons"), are presented.

Table VII.7 shows the descriptive statistics (mean, median, mode, standard deviation and data range) of the duration of the courses (in number of weeks), the courses' workload per week (in hours) and number of instructors for both platforms.

Table VII.7 - Descriptive statistics of the duration and workload of courses, and number of instructors in both platforms.

	Duration (weeks)		**Minimum (hours)**		**Maximum (hours)**		**Number of instructors**	
	Coursera (N=107)	**EdX** (N=111)	**Coursera** (N=107)	**EdX** (N=107)	**Coursera** (N=107)	**EdX** (N=107)	**Coursera** (N=107)	**EdX** (N=115)
Mean	9.38	8.37	3.93	4.14	6.10	5.07	1.76	2.70
Median	6.00	8.00	4.00	4.00	6.00	5.00	1.00	2.00
Mode	6	6	4	4	5	6	1	1
Std. Deviation	13.488	3.885	1.912	2.059	2.595	2.267	1.180	2.421
Data range	[4; 105]	[2; 17]	[1; 10]	[1; 12]	[2; 15]	[1; 12]	[1; 6]	[1; 16]

On average, the durations of the courses are 9.38 (s=13.488) weeks in Coursera and 8.37 (s=3.885) weeks in EdX. The Coursera courses are between 4 and 105 weeks long. It should be stressed that in this case there are two outliers (a course of 104 and another with 105 weeks), that have an impact on the statistics that were calculated and on the comparison with other studies (these outliers were later removed, when the means are compared). Nevertheless, it is important to note that according to other studies, the

duration of courses is 6 to 12 weeks (Perna et al., 2014) and 5 to 15 weeks (Dillahunt et al., 2014), respectively.

Regarding EdX, the courses analysed took between 2 and 17 weeks, while according to Haggard (2013 in Atenas, 2015), the MOOCs courses are usually between 4 and 10 weeks long.

On average, the minimum workload of the Coursera platform was found to be 3.93 (s=1.912) hours per week, and the maximum was 6.10 (s=2.595) hours per week. In EdX, on average, the minimum workload was found to be 4.14 (s=2.059) hours per week, and the maximum 5.07 (s=2.267) hours per week. According to Audsley et al. (2013), the average Coursera course requires 4.6 to 6.8 hours of work per week, and in EdX 10 to 15 hours per week. The discrepancy in the results of this study and the one by Audsley et al. (2013) relating the EdX platform can be explained by the fact that the latter only considered the data from 9 courses, while the former considered the data from 111. Concerning Coursera, there is no such discrepancy, since the number of courses in this platform considered by Audsley et al. (2013) was 198 versus 107 courses in this study.

In Coursera, the students dedicated between 1 and 15 hours a week to work, and in EdX between 1 and 12 hours a week. According Subhi et al. (2014), students must typically dedicate between 3 and 6 hours a week to study.

Comparing the values presented in Table VII.7 for courses available on both platforms, it can be observed that there are no considerable differences in the workload required to successfully complete the courses, since the intervals defined by the minimum and maximum values of workload overlap.

On average, the number of instructors is 1.76 (s=1.180) in Coursera, and 2.70 (s=2.421) in EdX. Most of the courses have only one (Coursera – 59.0%; EdX – 36.5%) or two instructors (Coursera – 21.5%; EdX – 29.6%). While in this study the number of instructors in Coursera was found to be between 1 and 6, according Perna et al. (2014), the corresponding number is between 1 and 13.

The comparison of means between the numbers of the weeks of duration, minimum and maximum number of hours of work per week and number of instructors in Coursera and EdX platforms were carried out using independent samples t-tests.

Table VII.8 presents some descriptive statistics (N, Mean, and Standard Deviation) of the variables considered for each platform. For each variable, the severe outliers were removed (severe outliers were considered to be values exceeding $Q3+3*IQR$, where $IQR=Q3–Q1$ (Inter-Quartile Range) (Bradley, 2007).

The results of the independent samples t-tests for the variables in Coursera and EdX platforms are also presented in Table VII.8.

Table VII.8 - Independent Samples t-tests for the number of the weeks, hours of work per week, and number of instructors in Coursera and EdX platforms.

	Severe outliers removed					
Variable	Platform	N	Mean	SD	t	p-value
Duration (weeks)	Coursera	105	7.57	2.852	-1.727	0.086
	EdX	111	8.37	3.885		
Minimum (hours)	Coursera	107	3.93	1.912	-0.239	0.811
	EdX	105	3.99	1.763		
Maximum (hours)	Coursera	107	6.10	2.595	3.100	0.002
	EdX	107	5.07	2.267		
Number of instructors	Coursera	103	1.61	0.931	-4.332	<0.001
	EdX	112	2.43	1.744		

It can be observed that there are statistically significant differences between the two platforms concerning the means of the maximum number of hours of work per week and of the number of instructors (p-value < 0.05). The courses that, on average, exhibit a higher maximum number of hours of work per week are from the Coursera platform while the ones that, on average, have more instructors are from EdX. The other variables considered did not show statistically significant differences.

VII.4 Conclusion

A systematic literature review about MOOCs in higher education was carried out in order to identify, classify and better understand the works published in this area. The ISI Web of Knowledge, Scopus and IEEE Xplorer databases were used in the search, considering publications since 2008. The analysis resulted in 279 articles, and it was noticed that the number of studies published in this are increased considerably in the last two years.

As Coursera and EdX platforms were the most mentioned in the referred review, a comparison of these platforms was made, using content analysis of the information available on the platforms' sites.

The number of universities using these platforms, as well as the number of courses offered has been increasing over the years. On May 2015 there were 102 universities that offered 1036 courses in the Coursera platform, while regarding EdX, on May 2015 there were 39 universities that offered 516 courses. Thus, it can be concluded that the relationship between the number of courses and number of universities offering the courses is higher in the case of EdX than in the case of Coursera.

With respect to the introductory video, it is included in 93.5% of the courses found in Coursera and in 88.7% of the courses found in EdX. Most of the courses have only one or two instructors.

The average duration of the courses in Coursera is 9.38 weeks, and in EdX is 8.37 weeks. The average course in Coursera requires 3.93 to 6.10 hours of work per week, and in EdX requires 4.14 to 5.07 hours per week.

It may be noted that EdX is more interdisciplinary than Coursera because it covers a higher number of knowledge areas. Architecture, Art & Culture, Communication, History, Literature, and Philosophy & Ethics are examples of areas present in EdX and not included in Coursera. According to Biglan's model, Coursera does not have courses in the Soft-Pure-Life and Soft-Pure-Non-Life categories. Coursera has many more MOOCs in the Soft-Applied-Non-Life category than EdX (41.5% vs 25.4%) and in Hard-Applied-Life (16.0% vs 1.8%), while EdX has more courses in Hard-Pure-Life than Coursera (14.9% vs 5.7%).

Findings show there are statistically significant differences (significance level of 5%) between Coursera and EdX platforms concerning the mean of the maximum number of hours of work per week and of the number of instructors.

It is considered that the outcomes of this work are valuable for researchers on the use of Information and Communication Technologies in Higher Education and the study can help institutions and professors to implement MOOCs in their own environment.

For future work, it is intended to complement the characterization of the two studied platforms. Additionally, it is planned to continue to study the evolution of the concept of MOOCs and their supporting platforms, and analyse other technologies that can emerge in this context.

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VIII Investigating the use and acceptance of technologies by professors in a Higher Education Institution

Reference

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Investigating the use and acceptance of technologies by professors in a Higher Education Institution

Abstract

This paper analyses the use and acceptance of technologies by professors in the Teaching and Learning context in a Higher Education Institution. In the empirical study, a questionnaire based on the Technology Acceptance Model was applied and 97 answers were obtained. The results indicated that the most used technologies are Moodle, Facebook and YouTube and it was concluded that in general those technologies, are well accepted. Few statistical significant differences between respondents' gender, scientific areas or ages were found, probably revealing that the use of those technologies is already widespread in the studied Institution. Results also showed that perceived usefulness and perceived ease of use are two important determinants of Moodle acceptance, and that the majority of respondents did not know the MOOC concept. This work is considered valuable for researchers in the area and for professors that want to implement the use technologies in the teaching and learning context.

Keywords

Technologies Acceptance Model; Learning Management Systems; Web 2.0; MOOCs; Higher education;

VIII.1 Introduction

Many Higher Education Institutions (HEI) have been developing courses using a variety of technologies to deliver distance education programmes, with e-learning being the most popular form (Arkorful, & Abaidoo, 2015; Zimnas, Kleftouris, & Valkanos, 2009). E-learning refers to the use of technologies in order to provide learning solutions where the learning context can be accessed from the web (Zimnas et al., 2009). The technologies that usually support the Teaching and Learning (TL) process in Higher Education Institutions (HEI) can be classified in Learning Management Systems (LMS), Web 2.0 technologies, or Massive Open Online Courses (MOOCs) platforms.

The main objective of this work is to present the results of an empirical study about the use and acceptance of the TL technologies by professors in a Portuguese Higher Education Institution - University of Aveiro (UA).

This paper is organized in five sections. The second section presenting the theoretical background performs an overview of the main technologies used in HE: LMS, Web 2.0 technologies and MOOCs platforms, and reviews the main models of technologies' acceptance. The third section describes the material and methods used in this study. The

fourth section presents the results and discussion. Finally, the last section presents the main conclusions of the study and recommendations for further research.

VIII.2 Theoretical background

VIII.2.1 Technologies used in Higher Education

Information and Communication Technologies (ICTs) support TL process and are frequently involved in data collection, information processing and knowledge creation activities (Costa, Alvelos, & Teixeira, 2015). Nowadays, Universities adapt TL methods using the ICTs for knowledge transmission.

Students own and use a diversity of technologies, but institutions and instructors have yet to seize opportunities to create more varied learning experiences outside the classroom (Dahlstrom, Boor, Grunwald, & Vockley, 2011; Epelboin, 2013).

ICTs in education context have been changing according to the evolution of technology. The society has embraced new forms of communication over time. A typical example is the evolution from the basic correspondence through postal service to the variety of tools in Web (Moore, Dickson-Deane, & Galyen, 2011), where e-mail plays an important role.

Next subsections address the concepts of LMS, Web 2.0, and MOOCs platforms as important representatives of technologies used in education, particularly, in HEIs.

VIII.2.1.1 Learning Management Systems

Learning Management Systems (LMS) are technological systems used to create online courses (Paulsen, 2003) and grew from a range of multimedia and internet developments in the 1990s (Coates, James, & Baldwin, 2005). They allow users to register, monitor and evaluate activities and to manage contents, as well as to exchange information among geographically dispersed users. In the educational context, LMS allow the use of various methods to impart information, and develop skills and competences (Ekúndayò & Tuluri, 2011).

LMS support distance education and complement the traditional way of teaching (Costa et al., 2015), through e-learning activities such as communication, collaboration and information/knowledge transfer (Al-Busaidi & Al-Shihi, 2012). By using these systems, students can access courses' contents in different formats (text, image, sound), as well as interact with teachers and/or colleagues, via, for example, message boards, forums, chats, video-conferences (Sanchez & Hueros, 2010). These platforms are closed to authorized users, are teacher-centred and do not rely a lot on students' contribution (Manca & Ranieri, 2016). The LMS can be commercial solutions as Blackboard, or open-source ones, such as Moodle.

The current LMS incorporate Web 2.0 technologies. These platforms strengthen traditional academic values of sharing and collaborative creation of knowledge by providing teachers and learners with platforms for collaboration, thus enabling teachers and learners to jointly develop educational content, supporting the exchange of material, and facilitating community building (Ornellas & Carril, 2014). The LMS platforms allow maintaining a repository of information, but also designing an active, participative and collaborative virtual teaching, since they allow communication between all the members of the platform (Garcia et al., 2015).

VIII.2.1.2 Web 2.0 technologies

Web 2.0 is a second generation of Web applications, based on online services, collaboration, communication, and sharing, and reflects different ways of promoting interaction between people (Bennett, Bishop, Dalgarno, Waycott, & Kennedy, 2012). It emerged in October 2004, developed by O'Reilly and MediaLive International (O'Reilly, 2005) and supports social interaction, feedback, conversation and networking, being endowed with a flexibility that enables collaboration. This paradigm redefines the interaction between Internet and users, allowing the creation of virtual applications using data and functionality from a number of different sources (Costa, Teixeira, & Alvelos, 2014). The use of Web 2.0 technologies has significant potential to support and enhance in-class TL in HEI (Ajjan & Hartshorne, 2008; Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013). The Web 2.0 technologies are open to everyone and anybody can use them (Ornellas & Carril, 2014).

Some of the Web 2.0 technologies are Wikis, Blogs, Microblogs, Social Networks, Social Bookmarks, and Media Sharing (Video Sharing, Podcasting, Photo Sharing, and Slides Sharing). Wikis allow one person or more to build up a corpus of knowledge in a set of interlinked Webpages, using a process of creating, writing and editing pages (Grosseck, 2009; Kear, Woodthorpe, Robertson, & Hutchison, 2010). Blogs represent a Webpage with brief paragraphs of opinions, information in the form of text, images, video, audio, or links, called posts, arranged chronologically being the most recent the first (Grosseck, 2009; Halic, Lee, Paulus, & Spence, 2010). Microblogs are similar to Blogs, that allow to publish brief online texts limited to 140-200 characters (Ebner, Lienhardt, Rohs, & Meyer, 2010; Holotescu & Grosseck, 2009; Hsu & Ching, 2012). Social Networks support collaboration, knowledge sharing, interaction, and communication of users from different places with a common goal (Grosseck, 2009; Usluel & Mazman, 2009). Media Sharing allow to store, search, display and share media' files (Anderson, 2007), being the most common Video Sharing, Podcasting, Photo Sharing, and Slide Sharing.

VIII.2.1.3 Massive Open Online Courses

The Massive Open Online Courses (MOOCs) concept emerged in 2008 (Fini, 2009) and has been adopted by many universities across the world (Coates et al., 2005; Hew, & Cheung, 2014). MOOCs can be defined as online courses that bring together people who are interested in learning about a specific subject. Their main goal is to change "the fixed dynamics of rigid university training models and the traditional organizational structures of universities" (Aguaded-Gomez, 2013, p. 7). These courses are based on learning networks (Kop et al., 2011), are guided by subjects' experts as learning facilitators (Educause, 2012; Kop, Fournier, & Mak, 2011; Liyanagunawardena, Adams, & Williams, 2013), are free of charge, and provide the students with flexibility, on a variety of themes (Daniel, Cano, & Gisbert, 2015). MOOCs provide an opportunity for people to access free courses offered by top universities in the world and therefore attracted great attention and engagement from college teachers and students (Xu & Yang, 2015).

In 2011, there was a 'wave of offers' of MOOCs (Tschofen & Mackness, 2012). Some universities have been offering online educational programs and creating their own MOOCs' platforms. This technology is being used as a new online educational model (Sharma, Joshi, & Sharma, 2016) where participants are encouraged to freely share information between them by means of technologies as Social Networks (Baker, Bujak, & DeMillo, 2012).

The LMS platforms can also be used for a form of courses which are small MOOCs with less than 10,000 students enrolled (Epelboin, 2013), like Small Private Online Courses (SPOCs) (Bartolomé & Steffens, 2015).

VIII.2.2 Acceptance of technologies in Higher Education

The acceptance of technologies is usually evaluated through theoretical models such as the TAM - Technology Acceptance Model or UTAUT - Unified Theory of Acceptance and Use of Technology. The TAM is based on the Theory of Reasoned Action (TRA), in which the Theory of Planned Behaviour (TPB) is also based. UTAUT was developed based on TRA and TAM (Venkatesh et al., 2003).

The TAM, developed by Davis (1986), is the most widely used model of technology acceptance (Venkatesh et al., 2003). According to it (Figure VIII.1), the Actual System Use (ASU) of the technology in evaluation, is determined by the Attitude Toward Using it (ATU), being this variable influenced by other two variables: Perceived Ease Of Use (PEOU) and Perceived Usefulness (PU). Those two variables can be influenced by External Variables (EV) (Davis, 1986).

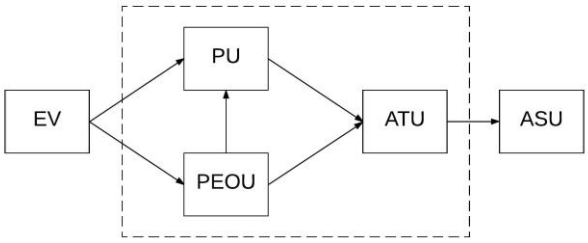

Figure VIII.1 – TAM (Davis, 1986).

Perceived Ease of Use (PEOU) is defined as the degree to which an individual believes that the use of a particular system is intuitive and does not require great effort (Davis, 1986; 1989). Perceived Usefulness (PU) is defined as the degree to which an individual believes that use of the system contributes to increase the performance of their work (Davis, 1986; 1989; Davis et al., 1989). Besides being influenced by external variables (EV), it is also influenced by PEOU, since technologies perceived as easier to use tend to be perceived as more useful. Attitude Toward Using (ATU) is defined as a positive or negative feeling of an individual towards the use of the system (Davis, 1986; 1989; Davis et al., 1989) and is influenced by PU and PEOU.

The application of TAM is an extension of the original model where EV are added according to the specific characteristics of the analysed technology (Oum & Han, 2011), such as features of technology, user characteristics, environments, user involvement, and structure of organization (Chen et al., 2012).

Concerning the Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), and represented in Figure VIII.2, it was based on other conceptual models of technologies' acceptance. This model consists of four constructs – Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions – and also by four moderating variables – Gender, Age, Experience, and Voluntariness of Use (Venkatesh et al., 2003).

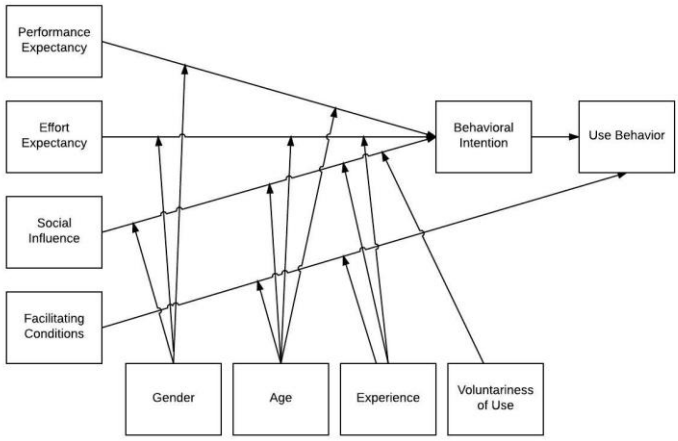

Figure VIII.2 - UTAUT model (Venkatesh et al., 2003).

The Performance Expectancy is defined as "the degree to which an individual believes that using the system will help him or her to improve job performance" (Venkatesh et al., 2003, p.447). This construct evolved from other models' constructs, like, for example, the PU of TAM (Venkatesh et al., 2003). The Effort Expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p.450). This construct includes PEOU of the TAM (Venkatesh et al., 2003). The Social Influence is defined as "the degree to which an individual perceives how important it is for other people to use the system" (Venkatesh et al., 2003, p.451). The Facilitating Conditions are defined as "the degree to which an individual believes that an organizational and technical infrastructure exist to support the system" (Venkatesh et al., 2003, p.453). The first three constructs (Performance Expectancy, Effort Expectancy, and Social Influence) influence the Behavioural Intention and the last (Facilitating Conditions) influences the Use Behaviour.

In this study, the variables ATU, PEOU and PU of TAM were used, as well as Social Influence (SI) of UTAUT with External Variables.

VIII.3 Material and methods

This study, carried out at the University of Aveiro (UA), aimed to analyse the use and acceptance of technologies used by professors in the TL context, being its main objectives: (i) to characterize the usage and the acceptance of the technologies used; (ii) to compare the acceptance of the technologies between some groups of professors; (iii) to use the TAM to better characterize the acceptance, by professors, of the most used technologies; and (iv) to explore the usage of MOOCs.

The UA has an integrated structure that allows the articulation and harmonization of teaching and research environments and offers a wide range of degree programs in several areas of knowledge. Consequently, it has a multidisciplinary and innovative nature, offering 184 undergraduate and graduate courses, 14,280 students, and 903 professors. The UA has 16 departments and four polytechnics schools, comprising the areas of Life Sciences and Health, Natural and Environmental Sciences, Exact Sciences and Engineering, and Social Sciences and Humanities (UA, 2016). In this institution, the quality issue has been placed as a priority that is reflected in the three areas of its mission: Education, Research and Cooperation. Considering the Education area, the UA offers a broad range of ICT that support its processes.

The data collection of this study was performed using a questionnaire designed based on the literature review and applied to all the professors of the UA (903) between March and May, 2016. There were obtained 97 answers from diverse scientific areas. The final questionnaire resulted from the application of a prior version to a pilot sample of 5 professors and is divided into the following three sections:

- Characterization of the participants;
- Characterization of the use and acceptance of some LMS and Web 2.0 technologies;
- Characterization of the use of MOOCs.

The technologies' acceptance was assessed using the TAM variables and a five-point Likert scale that measured the level of agreement of the respondent with each item (1- do not agree at all; 5- completely agree). There were 19 items for characterizing the acceptance of the technologies not provided by the UA: Facebook, Linkedln, YouTube, Flickr, Instagram, iTunes, MediaWiki, Blogger, Twitter, and one more (20 items) for characterizing the acceptance of technologies provided by the UA: Moodle, Educast, and a Web 2.0 platform named Sapo campus that provides Video Sharing, Photo Sharing, Wikis and Blogs.

Table VIII.1 - Items considered in the evaluation of the acceptance of the usage of the technologies.

Variable	**Item**
Perceived Ease Of Use (PEOU)	PEOU1 - Learning how to use TECHNOLOGY X is easy.
	PEOU2 - It is often necessary to consult the support/help tutorials to use TECHNOLOGY X.
	PEOU3 - The TECHNOLOGY X menus and features are easy to understand.
	PEOU4 - I get confused when I use the resources/activities of TECHNOLOGY X.
	PEOU5 - I often make mistakes when I use TECHNOLOGY X.
	PEOU6 - It's easy to remember how to perform the tasks related to the creation/editing of resources/activities in TECHNOLOGY X.
	PEOU7 - Overall, I find TECHNOLOGY X is easy to use.
Perceived Usefulness (PU)	PU1 - Using TECHNOLOGY X allows me to better organize and track tasks related to the Teaching-Learning process.
	PU2 - TECHNOLOGY X allows me to perform tasks without being dependent on schedules.
	PU3 - Using TECHNOLOGY X allows me to save time.
	PU4 - Using TECHNOLOGY X improves the outcome of the Teaching-Learning process.
	PU5 - Overall, I find TECHNOLOGY X useful for the Teaching-Learning process.
Attitude Toward Using (ATU)	ATU1 - I like using TECHNOLOGY X in Teaching-Learning context.
	ATU2 - I recommend the use of TECHNOLOGY X to support the Teaching-Learning process.
	ATU3 - Overall, I have a favourable attitude towards using TECHNOLOGY X in Teaching-Learning context.
Social Influence (SI)	SI1 - I use TECHNOLOGY X because it is provided by the University of Aveiro.*
	SI2 - I use TECHNOLOGY X because I was influenced by colleagues.
	SI3 - I use TECHNOLOGY X because I was directly or indirectly influenced by students.
	SI4 - The editing features/activities in TECHNOLOGY X allow me to communicate/collaborate with students.
	SI5 - I consider that there is a tendency to develop more activities using TECHNOLOGY X in the future.

Legend: TECHNOLOGY X - Technology under evaluation (Facebook, Linkedln, YouTube, Flickr, Instagram, iTunes, MediaWiki, Blogger, Twiter, Moodle, Educast, Video Sharing – *Sapo campus*, Photo Sharing – *Sapo campus*, Wiki– *Sapo campus*, Blog – *Sapo campus*); * - item used in the technologies provided by the UA.

Table VIII.1 presents the variables and the TAM items considered in the evaluation of the referred technologies' acceptance. The expression "TECHNOLOGY X" should be replaced by each of the technologies under evaluation.

The collected data were analysed using the IBM SPSS Statistics 23 software. First, a descriptive analysis was performed, in order to characterize the participants and the behaviour of each variable measured. Following, Mann-Whitney and Kruskal-Wallis tests were carried out in order to verify whether there were statistically significant differences between levels of agreement regarding each variable among groups of professors characterized by gender, research areas, and age group. Finally, multiple regressions were used to calculate the influences and the relationships among TAM variables.

VIII.4 Results and discussion

The results from the questionnaire are presented in the following five sub-sections: (i) characterisation of the participants; (ii) characterisation of the use and acceptance of technologies; (iii) comparison of the acceptance between some groups of professors; (iv) use of TAM for evaluating the acceptance of the more used technologies; and (v) characterisation of the use of MOOCs.

VIII.4.1 Characterization of the participants

Participants were 62 females and 35 males and the average age of respondents was 44.5 years (s=8.42). The majority of the professors were from the university subsystem (76; 79.2%), from which 50 (52.1%) were Assistant Professors, as illustrated in Table VIII.2.

Table VIII.2 – Professional category of Academics.

Education subsystem	**Professional category**	**N**	**%**
University	Full Professor	6	6.3
	Associate Professor	14	14.6
	Assistant Professor	50	52.1
	Assistant	6	6.3
Polytechnic school	Coordinator Professor	3	3.1
	Adjunct Professor	14	14.6
	Other	3	3.1
	Total	**96**	**100.0**

Table VIII.3 presents the distribution of the respondents by the research areas. It can be observed that the majority of them were from Social Sciences and Humanities (54; 55.7%) and Exact Sciences and Engineering (36; 37.1%).

Table VIII.3 – Research areas of the academics.

Research areas	N	%
Life and Health Sciences	4	4.1
Natural and Environmental Sciences	3	3.1
Exact Sciences and Engineering	36	37.1
Social Sciences and Humanities	54	55.7
Total	**97**	**100.0**

VIII.4.2 Characterization of the use and acceptance of technologies

The most used platforms by the respondents were: Moodle (96), Facebook (40), and YouTube (32). This result is in line with the results reported in the literature (Campanella et al., 2008; Escobar-Rodriguez, Carvajal-Trujillo, & Monge-Lozano, 2014; Danyaro, Jaafar, De Lara, & Downe, 2010; Galan, Lawley, & Clements, 2015; Manca & Ranieri, 2016). Professors, when faced with the use of two or more platforms of the same technology, indicated which one they use more, in order to proceed with the questionnaire regarding only that one.

Table VIII.4 presents, for each platform, the number of answers given in the section related to the acceptance of the technologies used.

Table VIII.4 – Number of answers to technologies' acceptance.

Technology	Platform	Number of answers
LMS	Moodle	96
	Educast	4
Social Networks	Facebook	36
	Linked In	8
Video Sharing	YouTube	29
Photo Sharing	Instagram	5
Podcasting	ITunes	6
Wikis	Wiki-*sapo campus*	3
	Mediawiki	5
Blogs	Blog-*sapo campus*	4
	Blogger	4
Microblogs	Twiter	7

Regarding technology acceptance, the technologies with more answers were Moodle (96), Facebook (36) and YouTube (29) and their acceptance was evaluated by the variables described in Table VIII.1. Table VIII.5 presents a descriptive analysis of the answers to the items related to the referred variables.

Table VIII.5 – Descriptive statistics of the items on the of technologies' acceptance.

	Moodle					Facebook					YouTube				
Item	**N**	**Mean**	**Med**	**Mod**	**SD**	**N**	**Mean**	**Med**	**Mod**	**SD**	**N**	**Mean**	**Med**	**Mod**	**SD**
PEOU1	96	4.00	4.00	4	0.781	35	4.43	5.00	5	0.739	29	4.07	4.00	4	0.704
PEOU2*	95	1.96	2.00	2	0.933	32	1.66	1.00	1	1.035	27	2.07	2.00	2	0.874
PEOU3	92	3.80	4.00	4	0.867	34	4.15	4.00	4	0.784	26	3.77	4.00	4	0.992
PEOU4*	95	2.00	2.00	2	0.911	34	1.79	1.50	1	1.008	26	1.73	2.00	2	0.667
PEOU5*	95	1.87	2.00	2	0.775	34	1.82	2.00	2	0.834	25	1.76	2.00	2	0.663
PEOU6	95	3.85	4.00	4	1.000	33	3.97	4.00	4 or 5	1.045	25	3.80	4.00	3 or 4	0.866
PEOU7	96	4.04	4.00	4	0.832	34	4.24	4.00	4	0.781	28	4.04	4.00	4	0.838
PEOU	**89**	**3.98**	**4.00**	**4.00**	**0.634**	**32**	**4.23**	**4.14**	**5.00**	**0.663**	**25**	**3.99**	**4.00**	**4.00**	**0.630**
PU1	95	3.77	4.00	4	0.994	33	2.61	2.00	2	1.298	25	3.28	3.00	4	1.137
PU2	93	4.19	4.00	4	0.900	33	3.27	3.00	4	1.281	24	3.33	3.50	4	1.129
PU3	93	3.69	4.00	4	1.073	33	2.85	3.00	2	1.228	25	3.24	3.00	4	1.268
PU4	96	3.74	4.00	4	1.018	34	3.29	3.00	3	0.938	27	3.70	4.00	4	1.103
PU5	96	4.11	4.00	4	0.844	35	3.20	3.00	4	0.964	27	3.78	4.00	4	0.934
PU	**92**	**3.89**	**4.00**	**4.00**	**0.756**	**33**	**3.04**	**3.00**	**3.20**	**0.944**	**23**	**3.39**	**3.40**	**3.00**	**0.949**
ATU1	96	4.00	4.00	4	0.846	36	2.92	3.00	3	1.079	26	3.81	4.00	4	1.021
ATU2	96	3.94	4.00	4	0.938	36	2.83	3.00	3	1.056	28	3.96	4.00	4	0.922
ATU3	96	4.08	4.00	4	0.854	36	3.06	3.00	3	0.955	27	4.00	4.00	4	0.877
ATU	**96**	**4.01**	**4.00**	**4.00**	**0.843**	**36**	**2.94**	**3.00**	**3.00**	**0.988**	**26**	**3.94**	**4.00**	**4.00**	**0.885**
SI1	96	4.64	5.00	5	0.651	---	---	---	---	---	---	---	---	---	---
SI2	86	2.05	2.00	1	1.283	35	2.71	3.00	4	1.363	24	2.58	3.00	3	1.248
SI3	87	1.74	1.00	1	1.051	36	2.64	3.00	1	1.397	26	2.65	2.50	2	1.263
SI4	96	4.04	4.00	4	0.905	36	3.56	3.00	3	0.843	25	3.04	3.00	3	1.136
SI5	95	3.76	4.00	4	0.964	33	3.70	4.00	4	1.045	26	3.85	4.00	4	1.008
SI	**86**	**2.88**	**2.88**	**2.75**	**0.659**	**32**	**3.16**	**3.25**	**3.25**	**0.570**	**21**	**2.98**	**3.00**	**3.00**	**0.782**

Legend: * - scale with an inverted order; N - number of respondents; Med - median; Mod - mode; SD - standard deviation.

In general, academics expressed a positive attitude concerning the various items. Regarding the items PEOU2– "It is often necessary to consult the support/help tutorials to use TECHNOLOGY X", PEOU4– "I get confused when I use the resources/activities of TECHNOLOGY X", and PEOU 5– "I often make mistakes when I use the TECHNOLOGY X", it should be noticed that the questions were asked using the scale with an inverted order, when compared with the other items. As a consequence, these items present low levels of agreement.

The values computed for the variables PEOU, PU, ATU and SI corresponded to the average values of the respective items, calculated for each respondent. This procedure led to different sample sizes, as the missing values had a higher impact in the variables considered (PEOU, PU, ATU and SI) than in the respective items. The values of the scale of the items PEOU2, PEOU4 and PEOU5 were changed, converting the level 1of the scale to 5, the level 2 to 4, the level 4 to 2, and the level 5 to 1.

Regarding Moodle, the mean value of PEOU was 3.98 (s=0.634), with the items PEOU1– "Learning how to use Moodle is easy", and PEOU7– "Overall, I find the Moodle is easy to use" having a higher level of agreement. This result is consistent with the study of North-Samardzic and Jiang (2015), where the ease of use of the technology is the most important factor that influences intention to use Moodle. The PU variable has a mean value of 3.89 (s=0.756), with the item PU3- "Using Moodle allows me to save time" having, on average,

lower value than the other items. This result was partially aligned with the study from Islam and Azad (2015) which indicated professors considered that Moodle "add an extra load to their teaching tasks and reduce their autonomy and control in the classroom". The mean value of ATU was 4.01 (s=0.843), with items ranging from 3.94 to 4.08. The mean value of SI was 2.88 (s=0.659), having the items SI2– "I use Moodle because I was influenced by colleagues" and SI3– "I use Moodle because I was influenced directly or indirectly by the students", on average, lower values than the other items. It should be noticed that the item SI1– "I use Moodle because it is the LMS provided by the University of Aveiro" presented the highest average value (4.64) of all the items, probably reflecting that professors felt the importance of having a LMS available to support the TL process and used the one provided by the institution where they teach.

Concerning Facebook, the mean value of PEOU was 4.23 (s=0.663), and the items PEOU1 and PEOU7 have had a higher level of agreement than the others. This result reveals that Facebook is relatively easy to use, as the study of Pinho and Soares (2011) point out. The mean value of the PU variable was 3.04 (s=0.944), and the items of PU present average values from 2.61 to 3.29. The mean of ATU is 2.94 (s=0.988) and its items present average values ranging from 2.86 to 3.06. According these findings, the perceived usefulness and ease of use can have impact on the intention to adopt Facebook (Thongmak, 2014). The mean value of SI was 3.16 (s=0.570) having the item SI5 a higher value than the other items.

Considering YouTube, the mean value of PEOU was 3.99 (s=0.630) with the items PEOU1- "Learning how to use YouTube is easy" and PEOU7- "Overall, I find the YouTube is easy to use" showing a higher level of agreement. The items that belong to PU present average values from 3.24 to 3.78. The items on the variable ATU present average values of agreement ranging from 3.81 to 4.00. Regarding SI variable it can be stressed that the item SI5 presents an average value (3.85) higher than the other items.

It is interesting to note that, in what concerns the variable PEOU, the three technologies analysed had PEOU1 and PEOU7 as the items showing higher values, probably meaning that the ease of use is an important issue for the respondents that is present in all these technologies. Regarding SI items, it should be remarked that, while with Moodle the higher level of agreement refers to its use because it is the LMS provided by the UA, with Facebook and YouTube the tendency of using them in the future is the highest valued item. Comparing the main variables among the three technologies, the PEOU has a higher mean value in Facebook than in other technologies, suggesting that it is an easy-to-use technology. The PU has a higher mean value in Moodle than YouTube and Facebook, probably meaning that Moodle is more useful in the TL context. The ATU had a higher mean value in Moodle than in the other technologies, showing that professors have a

favourable attitude in using this tool in the TL context. The SI showed a higher mean value for Facebook, confirming its greater social nature.

VIII.4.3 Comparison of the acceptance of the more used technologies between groups of professors

In this section some comparisons of the acceptance of Moodle, Facebook and YouTube between groups of professors based on gender, age group and scientific area were performed. The age groups considered were [28, 39], [40, 49] and [50, 67] and the scientific areas considered were area A that grouped Life and Health Sciences, Natural and Environmental Sciences, and Exact Sciences and Engineering, and area B that was Social Sciences and Humanities. The statistical tests performed were Mann-Whitney for gender and scientific area and Kruskal-Wallis for age groups, and Table VIII.6 presents the items for which the null hypothesis was rejected and, therefore, the differences among groups were statistically significant.

Table VIII.6 - Results of Mann-Whitney and Kruskal-Wallis tests.

	Group		**Moodle**		
			n	**Mean Rank**	***p*-value**
PEOU1	Gender	F	62	53.64	0.007
		M	34	39.13	
PEOU7	Gender	F	62	52.48	0.043
		M	34	41,25	
PU4	Gender	F	62	52.69	0.038
		M	34	40.87	
PU5	Gender	F	62	52.74	0.029
		M	34	40.76	
ATU1	Gender	F	62	53.10	0.019
		M	34	40.12	
	Area	A	43	42.56	0.043
		B	53	53.32	
ATU2	Area	A	43	41.19	0.014
		B	53	54.43	
ATU3	Gender	F	62	52.60	0.035
		M	34	41.01	
	Area	A	43	41.49	0.016
		B	53	54.19	
SI2	Area	A	39	37.78	0.038
		B	47	48.24	
SI5	Age group	[28, 39]	23	58.33	0.020
		[40, 49]	39	49.53	
		[50, 67]	33	39.00	

Legend: F-Female; M-Male; A-Life and Health Sciences, Natural and Environmental Sciences, and Exact Sciences and Engineering; B-Social Sciences and Humanities.

The comparison of the Moodle acceptance between gender, show statistically significant differences in items PEOU1, PEOU7, PU4, PU5, ATU1 and ATU3, where the females present, on average rank, higher values than males. These results are similar to those presented in the study of Padilla-Meléndez, Aguila-Obra, & Garrido-Moreno (2015), where females showed higher scores in the item "I like using Moodle".

Concerning the scientific area, there were statistically significant differences in the items ATU1, ATU2, ATU3 and SI2, where the professors belonging to area B presented, on average rank, higher values. This result is partially consistent with the study of Manca and Ranieri (2016) where the professors in "Humanities and Arts plus Social Sciences are more prone to use Social Media for their pedagogical affordances" (p. 229).

Regarding age groups, the only item for which there were statistically significant differences was SI5, where the group having 28 to 39 years old presents a higher average rank than the others, meaning that younger UA professors showed a tendency of developing more activities using Moodle in the future.

Relating to Facebook acceptance and the two gender groups, there were found statistically significant differences only in the variable ATU1 (p-value=0.010), where the males presented, on average rank, higher values (18.90) than females (17.59), showing that men tended to use this technology in the TL context more than women.

Concerning YouTube, no statistical significant differences among the studied groups and for all the items were found.

VIII.4.4 The application of TAM for assessing the most used technologies' acceptance

As the results presented in the previous section showed that there were some items for which there were statistical significant differences in the Moodle's acceptance concerning gender and scientific areas (6 in the case of gender and 4 in the case of scientific area), it was decided, in the case of this technology, to study the relationships presented in the TAM separately for the referred groups. Regarding Facebook and YouTube, the TAM was applied without considering groups of individuals, due to the inexistence of statistical significant differences among them. Therefore, there were analysed the relationships among the constructs for six TAM models, namely, Moodle' TAM for female, Moodle' TAM for male, Moodle' TAM for area A, Moodle' TAM for area B, Facebook' TAM and YouTube' TAM.

The relationships were measured through Pearson correlations coefficients and regression models. The regression model was based in the original TAM, represented in Figure VIII.1 (ASU was not object of this study), and thus consisting in the one simple regression and two multiple ones. The method used was the stepwise regression.

The expressions of the regressions performed can be represented as:

ATU=f(PEOU, PU), PU=g(PEOU, SI), and PEOU=h(SI)

where f, g and h represent linear functions of the variables between parenthesis.

The values of ATU, PU, PEOU, and SI were calculated by computing the mean values of the items that correspond to each of the variables.

VIII.4.4.1 Moodle acceptance by Gender

Table VIII.7 presents the Pearson correlations coefficients among the four TAM variables that resulted for Moodle by gender.

Table VIII.7 – Pearson correlations coefficients among the four constructs of Moodle acceptance for females and for males.

	Females				Males			
	PEOU	**PU**	**ATU**	**SI**	**PEOU**	**PU**	**ATU**	**SI**
PEOU	---	---	---	---	---	---	---	---
PU	0.451** (N=53)	---	---	---	0.213 (N=32)	---	---	---
ATU	0.474** (N=57)	0.821** (N=58)	---	---	0.506** (N=32)	0.736** (N=34)	---	---
SI	0.108 (N=52)	0.342* (N=53)	0.318* (N=57)	---	0.166 (N=28)	0.558** (N=29)	0.589** (N=29)	---

Legend: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

The results from Table VIII.7 reveal that PU and ATU are strongly correlated (Pearson correlation coefficient between 0.7 and 0.9) for both genders. The correlation between PU and PEOU is only statistically significant in the case of the female group, while between ATU and PEOU the correlations are statistically significant for both groups, with intermediate values. Correlations between SI and PU and SI and ATU, although statistically significant for both genders, are stronger in the case of males (intermediate, versus weak correlations in the case of females).

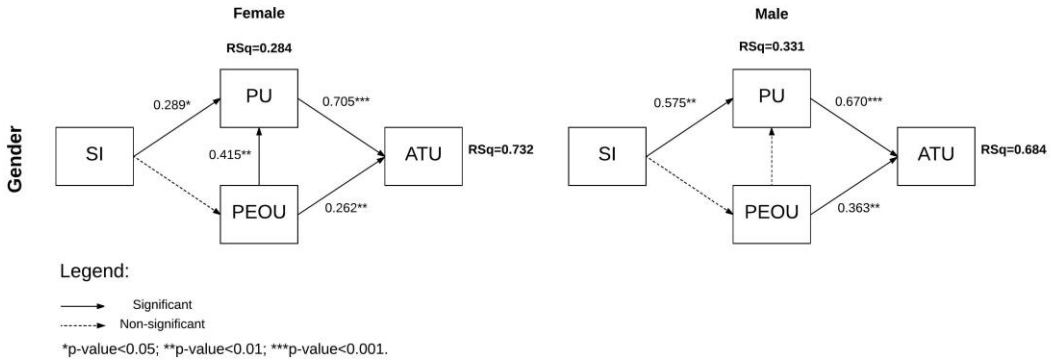

Figure VIII.3 - Models obtained for Moodle in the UA, by gender.

The model that resulted from the correlations shown in Table VIII.7 and from the regressions characterized next, are shown in Figure VIII.3. Note that above each arrow is

the value of the standardized coefficient (ß) of the correspondent regression, and next to each dependent variable the R-Square (RSq) value is presented.

In the Female regression model for Moodle (n=53), the PU (β=0.705) and PEOU (β=0.262) were found to be significant predictors of the ATU, explaining 73.2% of the total variance. The PEOU (β=0.415) and the SI (β=0.289) were also found to be significant predictors of the PU, explaining 28.4% of the total variance (n=48).

In the Male regression model for Moodle (n=32), the PU (β=0.670) and PEOU (β=0.363) were found to be significant predictors of ATU, as in the female case, but explaining less of the total variance 68.4%. In what respects to PU, it was found, that unlike what happens with women, SI (β=0.575) was the only variable that was considered in the regression (n=28), which explained 33.1% of the total variance.

In the models for both genders, the coefficients of the regressions PEOU=h(SI) are not statistically significant, thus indicating a lack of a linear relationship between those variables.

VIII.4.4.2 Moodle acceptance by Scientific area

Table VIII.8 presents the Pearson correlations coefficients among the four TAM variables of Moodle by scientific area, using the same notation as above: Area A- Life and Health Science, Natural and Environmental Science, and Exact Sciences and Engineering and Area B- Social Sciences and Humanities.

Table VIII.8 – Pearson correlations coefficients among the four constructs of Moodle acceptance for the two groups of scientific areas.

	Area A				**Area B**			
	PEOU	**PU**	**ATU**	**SI**	**PEOU**	**PU**	**ATU**	**SI**
PEOU	---	---	---	---	---	---	---	---
PU	0.373* (N=37)	---	---	---	0.331* (N=48)	---	---	---
ATU	0.559** (N=40)	0.717** (N=40)	---	---	0.397** (N=49)	0.858** (N=52)	---	---
SI	0.162 (N=37)	0.459** (N=36)	0.463** (N=39)	---	0.074 (N=43)	0.437** (N=52)	0.356* (N=46)	---

Legend: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

The results of correlations for Area A and for Area B are not very different. In fact, as happened with the previous analysis, the larger and most significant correlations are between the variables PU and ATU. The correlations between PU and PEOU are weak for both areas and between SI and PU are intermediate also for both areas. For the pairs 'ATU and PEOU' and 'SI and ATU', Area A shows higher correlations than Area B.

Regarding SI and PEOU, as happened with both genders, the correlations were not statistically significantly different. The model that results from the correlations shown in Table 8 and from the regressions characterized next, are shown in Figure VIII.4.

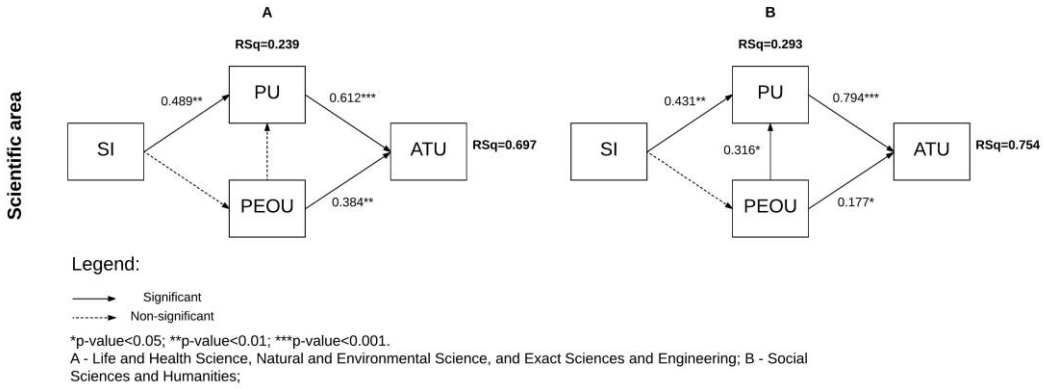

Figure VIII.4 - Models obtained for Moodle in the UA, by scientific area.

In the Scientific Area A regression model for Moodle (n=37), the PU (β=0.612) and PEOU (β=0.384) were found to be significant predictors of ATU, explaining 69.7% of the total variance. In the considered model (n=34), PU is only explained by SI (β=0.489), with a total variance explained of 23.9%.

Considering the Scientific Area B regression model for Moodle (n=48), the PU (β=0.794) and PEOU (β=0.177) were significant predictors of ATU, explaining 75.4% of the total variance. The PEOU (β=0.316) and SI (β=0.431) were significant predictors of PU explaining 29.3% of the total variance (n=42).

As with the models for both genders, the coefficients of the regressions PEOU=h(SI) are not statistically significant, thus indicating a lack of a linear relationship between those variables.

In the case of the Moodle, in all the four models studied (Female, Male, Area A, and Area B), the correlations between PU and ATU are strong, positive and significant. This result is in line with the study from Escobar-Rodriguez and Monge-Lazano (2012), which indicates that having the perception that Moodle increases the work performance, has a positive influence on the intention to use it. Concerning the PEOU, it has a positive correlation with ATU, again agreeing with the results of the study Escobar-Rodriguez and Monge-Lazano (2012). The correlation between PU and PEOU is positive and statistically significant (except in the case of males). This result is only partially in line with the same study, where this relationship is not statistically significant.

VIII.4.4.3 Facebook and YouTube acceptance

The results obtained for Facebook and YouTube are presented in this subsection, in the same way as were presented for Moodle but, as was already mentioned, without subdividing the original sample. Table VIII.9 presents the Pearson correlations coefficients among the four TAM variables that resulted for Facebook and YouTube.

Table VIII.9 – Pearson correlations coefficients among the four constructs of Facebook and YouTube acceptance.

	Facebook				YouTube			
	PEOU	**PU**	**ATU**	**SI**	**PEOU**	**PU**	**ATU**	**SI**
PEOU	---	---	---	---	---	---	---	---
PU	0.172 (N=30)	---	---	---	0.461* (N=23)	---	---	---
ATU	0.153 (N=32)	0.673** (N=33)	---	---	0.316 (N=23)	0.668** (N=22)	---	---
SI	-0.211 (N=28)	0.005 (N=29)	-0.100 (N=32)	---	-0.069 (N=19)	0.415 (N=19)	0.118 (N=20)	---

Legend: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

The results from Table VIII.9 reveal that PU and ATU have strong statistically significant correlation values, both for Facebook and YouTube, which are very similar. Concerning YouTube, there is another statistically significant correlation value (moderate) and is between PU and PEOU. The low number of variables correlated for these technologies can be explained by the lower number of respondents to the questions related to them. The models that resulted from the correlations shown in Table VIII.9 and from the regressions characterized next, are shown in Figure VIII.5.

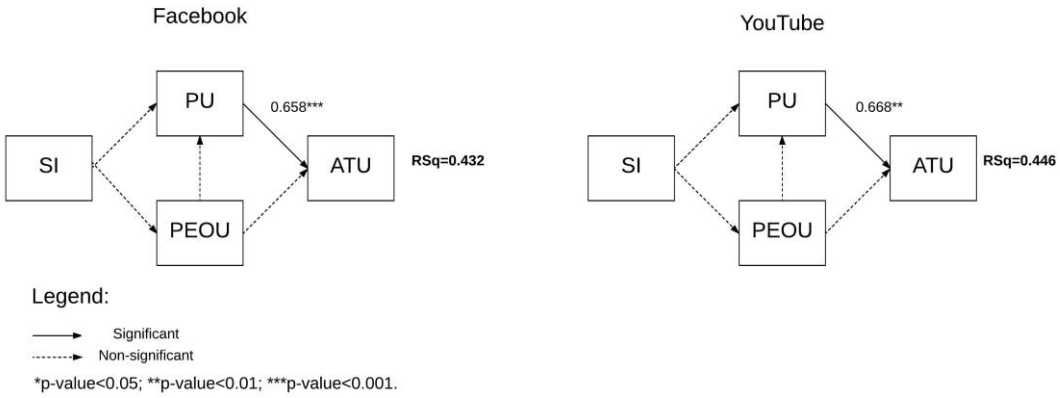

Figure VIII.5 - Models obtained for Facebook and YouTube in the UA.

According to the models obtained for Facebook and YouTube, the PU was the only independent variable included in the regressions that explained ATU, that turned out to be simple linear ones. The regression for Facebook (n=30) presents a $\beta_{PU\text{-}Facebook}$ of 0.658 and a total variance explained of 43.2% ($R^2_{Facebook}$) while the one for YouTube (n=22) presents a $\beta_{PU\text{-}YouTube}$ of 0.668 and a total variance explained of 44.6% ($R^2_{YouTube}$).

According to the multiple regressions just presented, it was verified that, in the TL context, the PEOU and PU constructs are important determinants of the acceptance of Moodle. This result is in accordance with Escobar-Rodriguez and Monge-Lazano (2012, p. 1086), that referring to the acceptance of Moodle, mention: "two important determinants to analyse what cause people to accept or reject information technology are perceived usefulness and perceived ease of use". Concerning Facebook and YouTube, the regression results only

pointed out PU as a determinant of the technologies' acceptance. This could be explained by the fact that there are less respondents answering to those technologies, meaning that they are not so used and making more difficult to draw conclusions about their acceptance. On the other hand, the small sample dimension can be affecting the significance of the PEOU variable in the models.

VIII.4.5 Characterization of the use of MOOCs and MOOCs platforms

The majority of the respondents (55; 56.7%) did not know the MOOC concept. From those who reported knowing the concept (42), 42.9% have already accessed MOOC platforms, 23.8% (10) attended to at least one MOOC, and 4.8% (2) collaborated on the development of at least one MOOC.

Table VIII.10 relates to MOOC platforms and presents the number of respondents that reported they knew, consulted, attended, and used the referred platforms.

Table VIII.10 – Use of MOOC platforms

MOOC platform	Know	Consulted	Attended	Collaborated
Coursera	16	15	5	1
EdX	6	3	2	0
Others*	4	3	2	1

* Eco Project, Udacity, Moodle

Coursera was the most known platform, being, also the one more consulted and attended.

It should be noticed that from those respondents that knew the concept 57.1% (24) would like to develop a MOOC, 31.0% (13) did not have an opinion about it. This fact should be considered because it can reveal that professors do not know the context and the concept sufficiently, in order to attend to and collaborate in the conception of MOOCs.

VIII.5 Conclusion

In this study, the use and acceptance of technologies by professors in Higher Education Institution (HEI) were analysed. The technologies identified as most used in the Teaching and Learning (TL) process in HE were Moodle, Facebook and YouTube. The study on the technologies acceptance by the professors in the University of Aveiro was implemented through the application of a questionnaire based on the TAM.

The results of the questionnaire pointed out that in general Moodle, Facebook and YouTube were well accepted by the respondents.

When the acceptance' items applied to Facebook and YouTube were analysed, they do not show any statistical significant differences among groups of respondents based on gender, scientific area and age, probably revealing that the use of these technologies is already

widespread in the TL context. Regarding Moodle, there were found statistical significant differences in some items, with females presenting, on average rank, higher values than males, and the Social Sciences and Humanities area presenting, on average rank, higher values than the other area.

Perceived usefulness presented a strong correlation with attitude toward using Moodle, while concerning Facebook and YouTube, the referred correlation was moderate.

According to the results of multiple regressions, perceived usefulness and perceived ease of use are two important determinants of the Moodle's acceptance, while regarding Facebook and YouTube, the only determinant of their acceptance is the perceived usefulness.

Results also showed that the majority of the professors did not know the concept of MOOCs, but the ones that know it, are aware of Coursera and EdX platforms, and would like to develop a MOOC in the future.

This study is limited to only one HEI. Future work should be done in order to expand the study to others HEIs, comparing the results and concluding about larger populations. The comparison of the acceptance between Moodle, Facebook and YouTube, which could not be performed due to the small number of respondents using the three technologies, can help to understand how they are being used and to explore the differences in order to contribute for a better use of each of them in the TL process.

As the results of this work provide insights on factors that contribute to the intention to adopt technologies in the TL context in Higher Education, the study is considered valuable not only for researchers in the area, as for professors that want to develop the implementation of technologies in their academic environment.

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IX General conclusions and further studies

General conclusions

A model to develop and implement courses with the use of technologies

Further studies

IX.1 General conclusions

Information and Communication Technologies (ICT) used to support the Teaching-Learning (TL) process in Higher Education (HE) can be classified as Learning Management Systems (LSM), Web 2.0 technologies (Wikis, Blogs, Microblogs, Social Networks, and Media Sharing), or Massive Open Online Courses (MOOC).

Regarding LMS, Moodle platform is the most used open-source one, and is also used at the University of Aveiro (UA), the Higher Education Institutions (HEI) where this study was carried out. In addition to the tools incorporated in the standard platform (Assignments, Chats, Forums, News and Quiz/Survey), Moodle@UA also integrates external tools, as Blogs UA, Wikis UA, Questionnaires and Video-conference tools.

The results from the practical studies carried out in this thesis, already reported in each of the chapters, show that although students are digital natives and use technologies in an intensive way in their everyday life, in the academic context, they do not show the same level of technologies usage. Concerning teachers' perspective, it can be concluded that in the TL context they use the technologies available at the institution. In fact, Moodle was the most used platform referred by teachers and students in the TL process, being used mainly as a repository of material and information, and for asynchronous communication. It can then be concluded that at the UA, Moodle is not used to its full potential.

In what relates to Web 2.0 tools, the results pointed out that students used more these tools in leisure environments than in the learning one, being Video Sharing, Social Networks and Wikis the most used within the TL context. In particular, the results of the practical experience conducted concerning the use of Wikis within a specific curricular unit, revealed that students showed a positive attitude towards the use of Wikis in the TL process, considering them useful in the learning environment and easy to use. Wikis are valuable tools for working collaboratively, being, therefore, excellent complements to traditional LMS. A small group of teachers refer they use social networks for communicating with their students. According to the practical experience performed with an educational videos' platform – Educast – it was verified that this technology is well accepted by students.

Finally, concerning the MOOC concept, which use is widespread in the top world universities, it has been found that teachers at the UA didn't have any experience of developing MOOCs. This issue can be related to the fact that the UA doesn't provide access to any MOOC platform. However, in Portugal, there are already some HEIs offering this type of courses.

The skills that students must achieve in their learning can be improved or facilitated through pedagogical methods that use ICTs. However, when it is intended to use any

technology in the TL process, the professors must consider its integration into a pedagogical perspective so that its use is as adequate as possible.

The technologies analysed can be used as an integrated way to help professors in the TL process. Each tool can be used for different activities independently or combined with others. Professors should be careful in selecting the type of activities to be developed using technologies and establish the objectives of the activities and the rules of engagement with their students.

Based on (i) the evidences from the literature on the various topics related to this study, (ii) the results of the empirical studies presented in this work, and (iii) the content analyses performed on the Web-sites of the world top universities, a model to assist the teacher in the TL process is proposed. This model is presented as a conclusion of this thesis, and is intended to help professors on planning and developing courses of various types (curricular units, training courses or TL activities) and different modalities (face-to-face, e-learning or b-learning modalities).

IX.2 A model to develop and implement courses with the use of technologies

The skills that students must achieve in their learning can be improved or facilitated through pedagogical methods that use ICTs. However, when it is intended to use some technologies in the TL process, professors must consider their integration into a pedagogical perspective.

Professors today should be prepared to use ICTs as part of their skills. The increasing number of students and their diversity, which were accompanied by the development of ICTs, have created new forms of Distance Education (DE) for which academics have to be prepared. The fact that Higher education has been accessible to more people has stimulated the interest in DE (Altbach, 1999). Computer-mediated and direct contact with the instructor (based on Web via videoconference or e-mail) are part of a combination of instructional techniques that can help the TL process becoming more effective (Altbach, 1999).

In this context, professors should be careful when selecting the type of activities to be developed using technologies and establish the objectives of the activities and the rules of engagement with their students.

Once faculty members start dealing with very diverse realities, they must: (i) know how to prepare students to provide them general and social skills, (ii) reformulate their functions to a lifelong learning society, (iii) prepare students for internationalization, and (iv)

provide practical learning experiences in addition to teaching in the classroom (Enders, 2006).

IX.2.1 Some barriers to the adoption of technologies in teaching and learning context

There has been a concern to equip educational institutions with technologies and there has been an overall investment in ICT to improve the TL, but despite the investments made in many countries regarding infrastructures and equipment to improve education, the adoption and integration of technologies in this context have been limited (Khan, Hasan, & Clement, 2012). The integration of technologies is then directly influenced by some barriers (Hew & Brush, 2007). In order to understand the reasons for the low usage of technologies in the TL process, an analysis of some barriers was carried out, taking into account the literature. Table IX.1 summarizes the barriers to the adoption of technologies, considering them at institutional and individual levels.

Table IX.1 - Barriers to adoption of technologies in the TL process.

Barrier	Authors								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Institutional level									
Lack of equipment (Hardware / Software)		*		*	*	*	*	*	*
Lack of training		*					*	*	
Lack of support / technical support		*			*	*	*		
Lack of institutional support		*	*		*	*			
Technical failures of equipment and technical problems				*					
Lack of financial support	*	*				*			*
Individual level									
Lack of confidence in the technology			*	*		*	*	*	
Lack of time to prepare and research materials for classes	*	*		*		*			
Lack of skills					*	*	*	*	*
Attitude of teachers		*				*	*		*
Lack of time to learn how to use new technologies	*	*	*		*	*			
Resistance to change				*			*		
Afraid to use		*				*			
Uncertainty about the use and value			*						*
Lack of knowledge of how to use			*						*
Difficulty to realize the advantages of using technologies in teaching				*	*				
Lack of interest in using						*			
Low levels of usage of ICT by teachers				*					

Legend: (1) - (Jacobsen, 1998); (2) - (Rogers, 2000); (3) - (Butler & Sellbom, 2002); (4) - (Andrew, 2004); (5) - (Hew & Brush, 2007); (6) - (Al-Senaidi, Lin, & Poirot, 2009); (7) - (Bingimlas, 2009); (8) - (Buabeng-Andoh, 2012); (9) - (Khan et al., 2012);

There are many barriers to adoption technologies in the TL context, and the most common at the individual level is the lack of time to prepare and search resources to be used according to the appropriate technology.

When the barriers that affect teachers and HEIs are identified, they can be overcome and therefore the technologies are adopted and used in the TL process. Parallel to the analysis of the barriers in the adoption of technologies, some authors point out recommendations to be considered in the planning of the adoption and implementation of technologies in the

TL process. According to Hew and Brush (2007), the strategies to overcome the barriers are: (i) to have a shared vision and a technologies integration plan; (ii) to overcome the scarcity of resources; (iii) to change attitudes and beliefs; (iv) to carry out professional development; and (v) to have alternative forms of evaluation.

In addition to these recommendations Al-Senaidi *et al.* (2009) indicate other actions to be considered when planning the adoption of technologies: (i) to establish collaboration between technologies experts and teachers; (ii) to provide training in technologies; and (iii) to allocate more time for teachers to learn and improve knowledge and skills in technologies.

In order to support TL process, instruction models can help defining strategies to design learning activities that allow the building of skills and knowledge.

IX.2.2 An overview about instructional models

An instructional model is the use of learning strategies tested to design learning activities that allow the building of skills and knowledge. Instruction models involve the planning, development and use of methods, techniques, activities, materials, events and educational products in specific teaching situations in order to facilitate learning (Gagné & Briggs, 1974; Dick, Carey, & Carey, 2014).

There is a variety of terms used to refer to instruction models, like systems approach, Instructional Systems Design (ISD), instructional development, or Instructional Design (ID) (Reiser, 2001). ISD differs from ID in the number of phases considered. While the first one has five phases (analysis, design, production, implementation and evaluation), the second one focuses only on the first two stages: analysis and design (Merriënboer, 1997).

The main differences between instructional models are the number and name of the steps to follow (Gagné & Merrill, 1990; Reiser, 2001), as well as the recommended actions (Kruse, 2006 in Almeida, 2009). In 1980 there were at least 40 instruction models (Andrews & Goodson, 1980; Reiser, 2001).

IX.2.2.1 ADDIE model

The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model is the most used (Hsu, Lee-Hsieh, Turton, & Cheng, 2014; Khodabandelou & Samah, 2012; Zimnas, Kleftouris, & Valkanos, 2009) and popular (Hoogveld, Paas, Jochems, & van Merriënboer, 2001; Myers, Watson, & Watson, 2008) instruction model and integrates the referred five phases. The instructional design field is common with an over-abundance of design models. However, most are built upon the premise of the ADDIE model (Myers et al., 2008; Visscher-Voerman & Gustafson, 2004).

There are several versions of the ADDIE model (Myers et al., 2008) that reflect the changes it took over time. Its first version appeared in 1975 and was created by the Centre for Educational Technology at the Florida State University for the US Army. Later it was adopted by all US armed forces (Branson et al., 1975; Clark, 1995a). This version is a linear model represented in Figure IX.1.

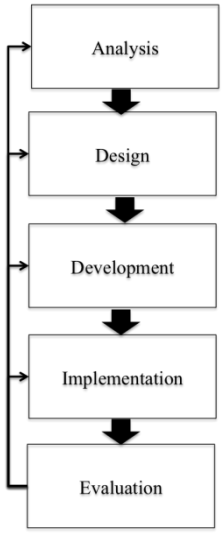

Figure IX.1 - Version of the ADDIE model of Branson *et al.* (1975).

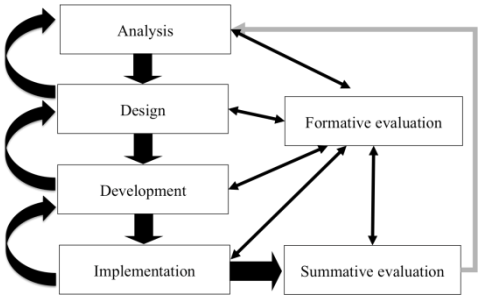

Figure IX.2 - Version of the ADDIE model of McGriff (2000) and Jiang (2012).

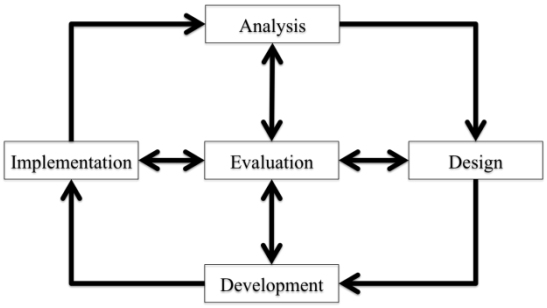

Figure IX.3 - Version of the ADDIE model of Myers *et al.* (2008).

The version presented in Figure IX.2, is a dynamic and interactive model, in which the evaluation phase is divided into formative and summative evaluation (McGriff, 2000).

Another version, which can be seen in Figure IX.3 is a valuable tool for training specialists in creating and delivering effective programs, providing an organized approach to all the process of training programs (Myers et al., 2008).

The five phases of ADDIE model systematically lead the designer through the creation of instruction from the initial request to evaluation and revision (Reinbolda, 2013), and are detailed in Table IX.2.

The phases of ADDIE allow (i) the identification of training needs, (ii) the definition of learning tasks, (iii) the establishment of performance measures, (iv) the selection of the appropriate method of course delivery, and (v) the assessment of students' performance (Clark, 1995b). ADDIE can provide a structured guide for the entire training project (Myers et al., 2008).

Table IX.2 – Phases of ADDIE model.

Phase	Description
Analysis	-process of defining what is to be learned (Hsu et al., 2014; McGriff, 2000); -identify all the variables that need to be considered when designing the course (Bates, 2015); -foundation for all other phase (McGriff, 2000); -consists of questions such as: ‘‘Who?’’, ‘‘What?’’, ‘‘Where?’’, ‘‘Why?’’ and ‘‘By whom?’’ (Myers et al., 2008); -should define the problem, identify the source of the problem, determine possible solutions (McGriff, 2000), and define the learner characteristics, environment, and infrastructure (Myers et al., 2008); -involves the investigation of learner, content, and task (Ozdilek & Robeck, 2009); -the outputs of this phase often include the learner profile, and a list of tasks to be instructed (McGriff, 2000).
Design	-process of specifying how it is to be learned (Hsu et al., 2014; McGriff, 2000); -using the outputs from the analysis phase to plan a strategy for the instruction development (McGriff, 2000); -the elements of this phase include an analysis of learning, define the learning objectives (Bates, 2015; Clark, 1995b; McGriff, 2000; Ozdilek & Robeck, 2009), specific objectives, instructional strategies (Myers et al., 2008; Ozdilek & Robeck, 2009), selecting a delivery system, sequencing the instruction (McGriff, 2000), and deciding on the selection and use of technology, such as an LMS, video or social media (Bates, 2015); -the outputs of this phase will be the inputs for the development phase (McGriff, 2000).
Development	-process of authoring and producing the instructional materials (Clark, 1995b; Hsu et al., 2014; McGriff, 2000; Myers et al., 2008; Ozdilek & Robeck, 2009). Instructional materials are all forms of instruction such as learner's manual, overhead transparencies, videos, and tests (Dick et al., 2014), loading of content into a web site or LMS (Bates, 2015). And develop assessments based on the objectives (Dick et al., 2014); -the purpose of this phase is to generate the lesson plan and lesson materials. During this phase, one should develop the instruction, all media that will be used in the instruction, and any supporting documentation, include hardware and software (McGriff, 2000); -this phase based on the Analysis and Design phases (McGriff, 2000).
Implementation	-process of installing the project in the real world context (Hsu et al., 2014; McGriff, 2000); -addresses the execution of the instructional materials (Ozdilek & Robeck, 2009) or the training program (Clark, 1995b; McGriff, 2000; Myers et al., 2008; Ozdilek & Robeck, 2009), whether it’s classroom or computer-based (Dick et al., 2014; McGriff, 2000); -should promote understanding of material, support the students’ mastery of objectives (McGriff, 2000), and student assessment (Bates, 2015).
Evaluation	-process of determining the adequacy of the instruction (McGriff, 2000); -Verify that the learning objectives, performance of process have all been met (Clark, 1995b; Hsu et al., 2014; Myers et al., 2008); -measured effectiveness and efficiency of the instruction (McGriff, 2000); -cheek the feedback and data is collected in order to identify areas that require improvement and this feeds into the design, development and implementation of the next iteration of the course (Bates, 2015); -should actually occur throughout the instructional design process, within phases, between phases and after implementation (McGriff, 2000); -addresses both formative and summative assessment (Ozdilek & Robeck, 2009). Formative evaluations are performed throughout the first four phases and a summative evaluation is performed at the end of the process (Clark, 1995b; McGriff, 2000; Myers et al., 2008). The objective of the formative evaluation is to improve the instruction before the final version is implemented (McGriff, 2000). The summative assessment data are used to make a decision about the instruction (McGriff, 2000); -this phase is divided into internal and external evaluation, and revise system (Branson et al., 1975).

This model allows the integration of technologies in the TL process, such as Web 2.0 technologies (Myers et al., 2008) and LMS (Jin-Hua, Chun, Hui, & Shumei, 2009; Myers et al., 2008).

IX.2.3 Proposed model

The model proposed on this work is adapted from the ADDIE Model and is based on technological platforms that are intended to assist the teacher in the TL process. It is a model for planning and developing courses that can be of various types (curricular units, training courses or TL activities). This model, as referred in the Methodology section, took into account the best practices reported in the literature and observed in the sites of some

top world universities. The courses planed with this model can be carried out in face-to-face, e-learning or b-learning modalities.

A high level representation of the proposed model is presented in Figure IX.4.

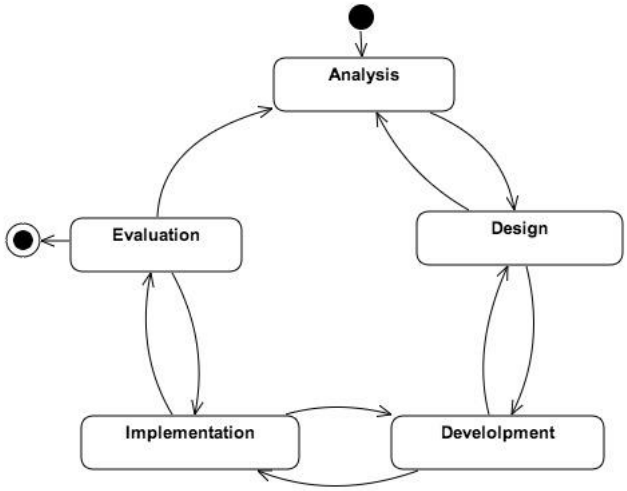

Figure IX.4 - Adapted ADDIE Model for courses' planning and development.

The proposed adapted ADDIE model is cyclical and dynamic, beginning with the Analysis phase and ending with the Evaluation one. Nevertheless, whenever a new course edition is planned, the results of the Evaluation phase of the last edition should be incorporated in the Analysis phase of the next cycle.

At the end of each phase there is the needed to evaluate the activities and it may be required to adapt and / or review the activities of the previous phase. Following, a brief description of each of the model's phases is presented

Analysis phase – in this phase, the training needs are identified, and the designation, the learner profile (McGriff, 2000; Myers et al., 2008), the duration, the start date, and the modality (face to face or not face to face) of the course are established (Myers et al., 2008). This information should be available to students when promoting / disseminating the course.

Design phase – in this phase the general objectives (Clark, 1995b; McGriff, 2000), specific objectives, and course content are stated (Myers et al., 2008). If there are prerequisites for the course, the teacher needs to define them and to evaluate the need to apply a diagnostic test to determine the knowledge level of the students. The professor should then associate the objectives and contents to each of the sessions and estimate the self-study hours that students need. Following the evaluation (type, form and evaluation moments) should be defined (Dick et al., 2014). In accordance with its modality, the type of technologies to support the course (Web 2.0, LMS, or MOOC platforms) has to be decided (McGriff, 2000). During the execution of this phase, it can be necessary to review

or redefine activities of the previous one. The activities of the Design phase are detailed in the activity diagram presented in Figure IX.5.

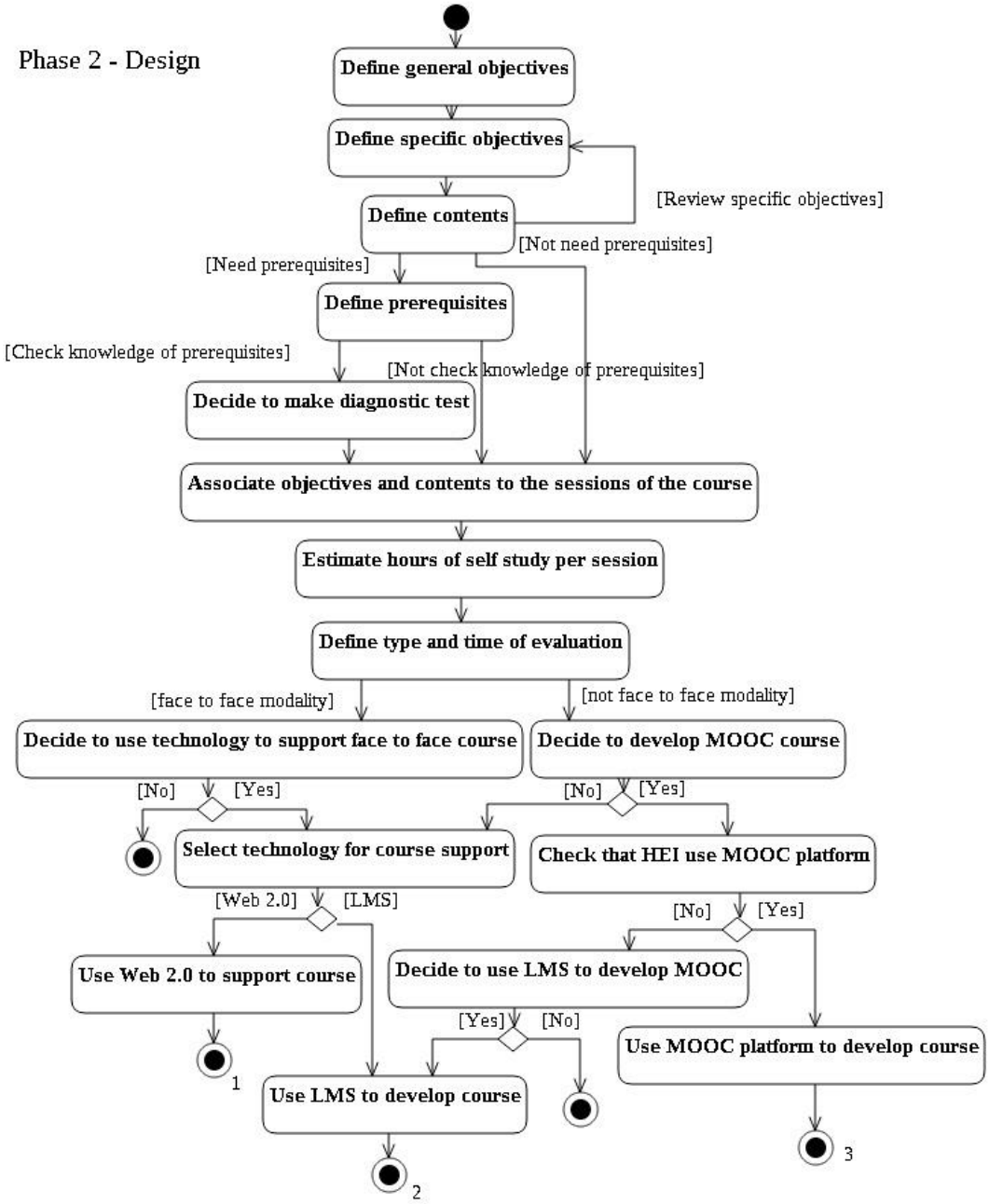

Figure IX.5 - Design phase of the adapted ADDIE Model.

Development phase – in this phase all the resources and materials needed to implement the course, (documents, videos, assessment test) are developed and created (Clark, 1995b; Dick et al., 2014; Hsu et al., 2014; McGriff, 2000; Myers et al., 2008). The most appropriate technologies should be chosen according to their availability in the HEI (Web 2.0, LMS or MOOC platform). The use of Web 2.0 tools (Wikis, Blogs, Video Sharing, Photo Sharing, and Social Networking) can also be performed using LMS or MOOC platform. The activities of this phase are represented in the diagram of Figure IX.6.

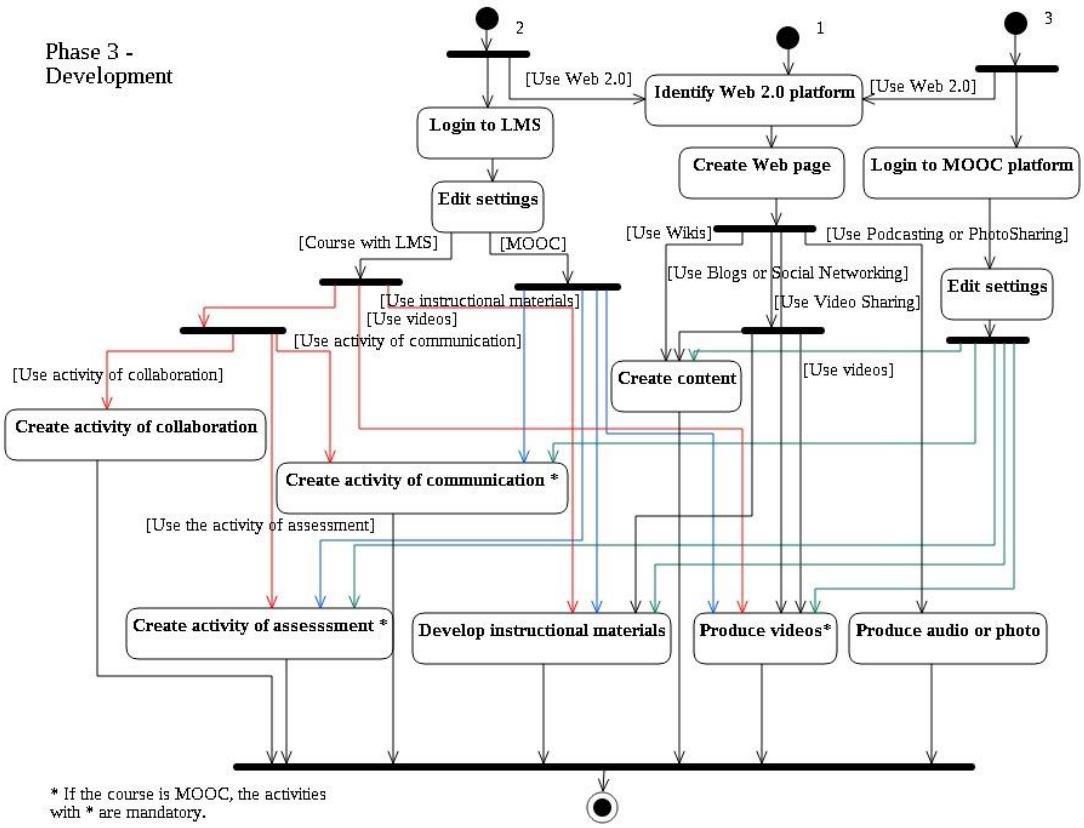

Figure IX.6 - Development phase of the adapted ADDIE Model.

Implementation phase – in this phase, the course is delivered and managed according to the plan defined in the previous phases (Clark, 1995b; Hsu et al., 2014; McGriff, 2000; Myers et al., 2008), which include the modality of the course (Dick et al., 2014; McGriff, 2000).

Throughout the course, the teacher will make available to students the contents created (videos, documents, other material) and lead the activities (the spaces of communication and collaboration and assessment tools). The management of contents and activities can be done over the course sessions, allowing the adaptation to content and/or materials if necessary, reducing drop-out rates. Thus, this phase will have iteration with the previous phase, especially if the teacher prepares or adapts the materials during the sessions.

Evaluation phase – in this phase, the course is assessed based on students' performance, participation and satisfaction (Clark, 1995b; Hsu et al., 2014; Myers et al., 2008). The teacher should also make a self-assessment of the course. Based on this information, the teacher should determine if there is need for revision of the course (Branson et al., 1975; McGriff, 2000), what type of revision to perform, and eventually prepare a revised plan for a future edition of the course (Branson et al., 1975). The activities of this phase are represented in the diagram of Figure IX.7.

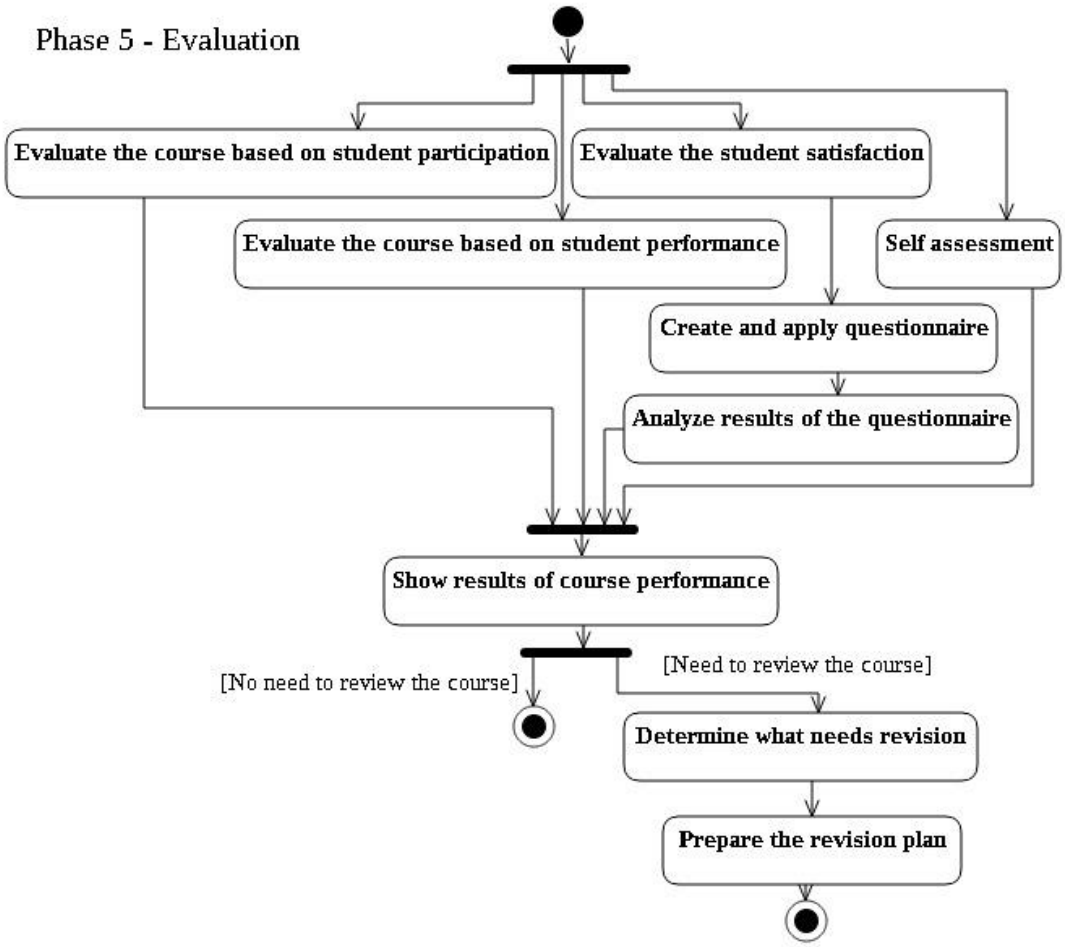

Figure IX.7 - Evaluation phase of the adapted ADDIE Model.

This model also aims to be flexible and versatile to support the teacher in the planning and development of any educational program. Note the technologies' selection shall always depend on their availability in the HEI that promotes the course.

IX.3 Further studies

Specifically concerning MOOCs, as the more recent technological generation in the TL context, it is important to note that they can be used to promote institutions internationally, namely in the Portuguese speaking countries, depending on the strategic objectives of the Higher Education Institutions.

Further research should extend the practical studies to students from other institutions in order to validate the results in the context of Portuguese Higher Education Institutions. It is considered important to perform a careful analysis of the underlying reasons for the use, or not, of technologies by the academic community, as well as to investigate on how these tools can help on promoting the success of the TL process, focusing on the emerging technologies.

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Appendix I - Data collection instruments

Appendix I.1 - Questionnaire: The use of Moodle and Web 2.0 by students (in Portuguese)

Appendix I.2 – Unstructured interview: Validation of the questionnaire about the use of Moodle by students (in Portuguese)

Appendix I.3 – Questionnaire: The use of Wiki by students (in Portuguese)

Appendix I.4 – Questionnaire: The acceptance of Wiki by students (in Portuguese)

Appendix I.5 – Questionnaire: The use and acceptance of Educast by students (in Portuguese)

Appendix I.6 – Questionnaire: The use and acceptance of technologies by professors (in Portuguese)

Appendix I.1 - Questionnaire: The use of Moodle and Web 2.0 by students

Questionário

Este trabalho enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro sob a orientação da Professora Doutora Helena Alvelos e da Professora Doutora Leonor Teixeira. O questionário visa um estudo preliminar no sentido de perceber o impacto das plataformas tecnológicas no processo de ensino/aprendizagem.
Os dados do questionário são confidenciais, garantindo também o anonimato total.

I. Caracterização

1. **Qual a sua idade?** __ anos.
2. **Qual o seu género?**

   ☐ Feminino ☐ Masculino

3. **Qual o grau e respectivo ano a que está inscrito? (*assinale apenas uma opção*)**

   Licenciatura:
   ☐ 1º ano
   ☐ 2º ano
   ☐ 3º ano

   Mestrado:
   ☐ 1º ano
   ☐ 2º ano

4. **Qual o curso que frequenta?**

   ☐ Gestão
   ☐ Engenharia e Gestão Industrial
   ☐ Turismo
   ☐ Gestão e Planeamento em Turismo
   ☐ Economia
   ☐ Sistemas Energéticos Sustentáveis
   ☐ Outro. Qual? _____

5. **Qual ou quais o(s) dispositivo(s) que usa para aceder à internet? (*pode escolher mais do que uma opção*)**

   ☐ Computador/Portátil
   ☐ Telemóvel/ *SmartPhone*
   ☐ PDA
   ☐ Outro. Qual? _____

6. **Que rede(s) utiliza para aceder à internet? (*pode escolher mais do que uma opção)***

   ☐ Rede da UA
   ☐ Rede Particular (Casa)
   ☐ Rede de espaços públicos
   ☐ Outra. Qual? _____

7. **Indique que tipo de utilização faz da Internet para <u>estudo/ trabalho</u> e para fins de <u>lazer.</u> (*pode escolher mais do que uma opção*)**

   Estudo/trabalho:
   ☐ e-mail
   ☐ Redes sociais
   ☐ Ler notícias
   ☐ Pesquisar
   ☐ Outra. Qual? _____

   Lazer
   ☐ e-mail
   ☐ Redes sociais
   ☐ Ler notícias
   ☐ Pesquisar
   ☐ Jogar
   ☐ Outra. Qual? _____

8. **Quanto tempo, em média, por dia utiliza a Internet? _____** horas. **E desse tempo, quanto é atribuído à prática de estudo/aprendizagem? _____** horas.

II. Uso de Ferramentas/serviços da Web 2.0

1. **Das ferramentas que a seguir se apresentam, quais as que utiliza, e com que frequência as utiliza? (*preencha com um algarismo uma das opções para cada coluna*).** Exemplo: se usar **5** vezes por dia os *Blogs*, das quais **3** vezes são para fins de estudo/aprendizagem, o preenchimento é do seguinte modo:

Exemplo:

	No total	**Para fins de estudo/aprendizagem**
Blogs	__ *nunca* ***5*** *vezes por dia ou* __ *vezes por semana ou* __ *vezes por mês*	__ *nunca* ***3*** *vezes por dia ou* __ *vezes por semana ou* __ *vezes por mês*

Questões:

	No total	**Para fins de estudo/aprendizagem**
Blogs	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Wikis	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Redes Sociais (Ex:. Facebook, Myspace, Linkedln)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Social bookmarking ou Social tagging (Ex:. del.icio.us, Bibsonomy) - Favoritos ou marcadores on-line	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Podcasts (Ex:. iTunes)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Vídeos (Ex:. YouTube)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Fotos (Ex:. Flickr)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Apresentações (Ex:. Slideshare)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
RSS feeds	__ nunca	__ nunca

	__ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ vezes por dia ou __ vezes por semana ou __ vezes por mês
Data mash-up (Ex:. Google Maps)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Start pages (Ex:. iGoogle)	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês
Outra. Qual? _____	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês	__ nunca __ vezes por dia ou __ vezes por semana ou __ vezes por mês

2. No caso das ferramentas que utiliza, de entre as que se apresentam abaixo, indique a(s) finalidade (s) de utilização no processo ensino/aprendizagem. (*para cada ferramenta pode escolher mais que uma opção*)

	Para pesquisa	Para trabalho em grupo	Para comunicar com / colocar questões aos colegas	Para comunicar com / colocar questões aos professores	Para entregar trabalhos aos professores
Blogs	☐	☐	☐	☐	☐
Wikis	☐	☐	☐	☐	☐
Redes Sociais (Ex:. Facebook, Myspace, Linkedln)	☐	☐	☐	☐	☐
Social bookmarking ou Social tagging (Ex:. del.icio.us, Bibsonomy) Favoritos ou marcadores on-line	☐	☐	☐	☐	☐
Áudio - Podcasts (Ex:. iTunes)	☐	☐	☐	☐	☐
Vídeos (Ex:. YouTube)	☐	☐	☐	☐	☐
Fotos (Ex:. Flickr)	☐	☐	☐	☐	☐
Apresentações (Ex:. Slideshare)	☐	☐	☐	☐	☐
RSS feeds	☐	☐	☐	☐	☐
Data mash-up (Ex:. Google Maps)	☐	☐	☐	☐	☐
Start pages (Ex:. iGoogle)	☐	☐	☐	☐	☐
Outra. Qual? _____	☐	☐	☐	☐	☐

III. Moodle

1. Com que regularidade acede ao Moodle? (*preencha com um algarismo uma das opções, indicando o número de vezes que acede por dia ou por semana ou por mês, ou assinale com uma cruz a opção 'nunca' no caso de não utilizar).*

__ nunca

__ vezes por dia ou
__ vezes por semana ou
__ vezes por mês

2. Com que finalidade utiliza o Moodle? (*pode escolher mais do que uma opção*)

☐ Fazer *download* dos materiais
☐ Ver anúncios relativamente às disciplinas
☐ Comunicar com os Professores
☐ Colocar dúvidas
☐ Entregar trabalhos
☐ Outra. Qual? _____

***3.* Qual é o formato dos materiais a que teve, ou tem, acesso no Moodle para fins de estudo/ aprendizagem, durante o actual semestre? (*pode escolher mais do que uma opção*)**

☐ Textos (Word ou Pdf)
☐ Apresentações/Slides
☐ Folhas de cálculo/Base de dados
☐ Vídeos
☐ Imagens
☐ Outro. Qual? _____

4. Da lista que se apresenta a seguir, assinale as ferramentas do <u>Moodle</u> que utiliza no contexto <u>ensino/aprendizagem</u>. Na mesma questão, utilize a escala apresentada à direita para atribuir o grau de importância à sua eventual utilização no contexto ensino/aprendizagem, independentemente de a utilizar ou não.

	Utiliza?	**Grau de importância**				
		1-Pouco importante	**2**	**3**	**4**	**5-Muito importante**
Blogs UA	☐	☐	☐	☐	☐	☐
Wikis UA	☐	☐	☐	☐	☐	☐
Fóruns	☐	☐	☐	☐	☐	☐
Questionários	☐	☐	☐	☐	☐	☐
Notícias/Anúncios	☐	☐	☐	☐	☐	☐
Chat	☐	☐	☐	☐	☐	☐
Vídeo Conferencia	☐	☐	☐	☐	☐	☐
Teste on-line	☐	☐	☐	☐	☐	☐
Entrega de Trabalhos	☐	☐	☐	☐	☐	☐
Outra. Qual? _____	☐	☐	☐	☐	☐	☐

Inclua os comentários que julgue relevantes:

Comentários:

Muito obrigada pela colaboração

Carolina Costa - Aluna do PDEGI

Appendix I.2 – Unstructured interview: Validation of the questionnaire about the use of Moodle by students

Guião da Entrevista

Nome:		
Data:	Hora:	Local:

Enquadramento:

A presente entrevista enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro. Pretende-se uma visão das pessoas que colaboram na parte administrativa do Moodle e confirmar as funcionalidades existentes na plataforma da UA.

Objectivos:

- Validar as funcionalidades identificadas através da análise bibliográfica efectuada;
- Conhecer quais as funcionalidades mais utilizadas pelos professores;

Questões:

1. Em que ano a UA adoptou o Moodle?
2. Qual foi a motivação que levou a UA a passar para a plataforma Moodle?
3. Quais são as vantagens do Moodle relativamente às outras? Quais eram as alternativas?
4. Quais são as ferramentas que o Moodle da UA disponibilizada?
5. Quais são as funcionalidades que são mais utilizadas pelos professores?
6. Que tipo de dados/informação têm (acesso, tempo de cada acesso, tipo de material)?
7. Fazem algum tipo de tratamento desses dados?
8. Divulgam ou facultam os dados ou o tratamento?
9. Como devo proceder para pedir os dados (se tiverem dados)?

	Moodle da UA tem?	**O Moodle permite?**
Blogs		
Wikis		
Redes Sociais (Ex:. Facebook, Myspace, Linkedln)		
Social bookmarking ou Social tagging (Ex:. del.icio.us, Bibsonomy) - Favoritos ou marcadores on-line		
Podcasts (Ex:. iTunes)		
Vídeos (Ex:. YouTube)		
Fotos (Ex:. Flickr)		
Apresentações (Ex:. Slideshare)		
RSS feeds		
Data mash-up (Ex:. Google Maps)		
Start pages (Ex:. iGoogle)		
Outra. Qual? _____		

	Moodle UA Tem?	*Moodle?*	*Tem dados?*	*Tratamento de dados*
Blogs UA				
Wikis UA				
Forúns				
Questionários				
Notícias/Anúncios				
Chat				
Vídeo Conferencia				
Teste on-line				

Appendix I.3 – Questionnaire: The use of Wiki by students

Questionário nº1/2

Este estudo enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro sob a orientação da Professora Doutora Helena Alvelos e da Professora Doutora Leonor Teixeira. O questionário visa perceber qual o nível de utilização de Wikis e qual a finalidade de utilização antes de proporcionar uma sessão de sensibilização ao uso desta ferramenta no processo de ensino/aprendizagem. As respostas aos questionários não influenciam em nada a classificação obtida na disciplina. Não há respostas certas ou erradas relativamente a qualquer das questões, pretendendo-se apenas a sua opinião pessoal e sincera. Os dados do questionário são confidenciais.

1. **Nº mecanográfico:** _____

2. **Utilizador universal** (Login da UA): _____

3. **Qual a sua idade?** ____ anos.

4. **Tem computador pessoal?**

   ☐ Sim ☐ Não

Se respondeu sim, indique o(s) tipo(s) de computador(es) que tem: Portátil ☐ Fixo ☐

5. **Tem acesso à Internet na sua residência em tempo de aulas?**

   ☐ Sim ☐ Não

6. **Qual (quais) o(s) *browser(s)* que utiliza para aceder à Internet?**

   Mozilla Firefox ☐
   Internet Explorer ☐
   Google Chrome ☐
   Apple Safari ☐
   Opera ☐
   Outro. Qual? _____

7. **Conhece o conceito de Web 2.0?**

   ☐ Sim ☐ Não

   Se sim, indique duas ferramentas Web 2.0:_____

8. **Conhece o conceito de Wiki?**

   ☐ Sim ☐ Não

9. Utiliza Wikis em contexto de lazer?

Não utilizo ☐

Utilizo apenas para ver informação ☐

Utilizo para ver informação e para editar conteúdos ☐ Indique qual (quais) a(s) Wiki(s) que já editou.

_____

10. Utiliza Wikis para estudar/fazer trabalhos?

Não utilizo ☐

Utilizo apenas para ver informação ☐

Utilizo para ver informação e para editar conteúdos ☐ Indique qual (quais) a(s) Wiki(s) que já editou.

_____

Inclua os comentários que julgue relevantes:

Muito obrigada pela colaboração

Carolina Costa - Aluna do PDEGI

Appendix I.4 – Questionnaire: The acceptance of Wiki by students

Questionário nº2/2

Este estudo enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro sob a orientação da Professora Doutora Helena Alvelos e da Professora Doutora Leonor Teixeira. O questionário visa avaliar a aceitação, por parte dos alunos, da tecnologia Wiki como meio de promoção da melhoria do processo ensino/aprendizagem. As respostas ao questionário não influenciam em nada a classificação obtida na disciplina. Não há respostas certas ou erradas relativamente a qualquer das questões, pretendendo-se apenas a sua opinião pessoal e sincera. Os dados do questionário são confidenciais.

1. **Nº mecanográfico: _____**

2. **Utilizador universal** (Login da UA): _____

3. **Qual a sua idade? ____** anos.

4. **Escolha o principal motivo pelo qual antes desta experiência não editava Wikis.**

Não sabia o que era uma Wiki ☐
Sabia o que era uma Wiki mas não sabia que as Wikis se podiam editar ☐
Sabia que as Wikis se podiam editar mas não conhecia os benefícios da sua edição ☐
Sabia que as Wikis se podiam editar mas não tinha conhecimentos acerca do código para poder editar ☐

5. **Gostou da experiência relativa à edição da Wiki?** (Utilize a escala **1-Não gostei nada**, **5-Gostei muito**)

1	2	3	4	5
☐	☐	☐	☐	☐

6. **Na sequência da experiência realizada, e no sentido de avaliar a possível utilização futura da ferramenta Wiki, por favor, indique o seu grau de concordância com as seguintes afirmações:** (assinale o número que melhor corresponde à sua opinião com base na escala **1-Não concordo nada**, **5-Concordo totalmente**; **NS/NR** – não sei ou não respondo)

	Grau de concordância					NS/ NR
	1	2	3	4	5	
Facilidade de uso percebida						
É necessário consultar frequentemente o guião de apoio / ícone de ajuda para utilizar as Wikis.	☐	☐	☐	☐	☐	☐
Os ícones e o texto associados às Wikis são de fácil compreensão.	☐	☐	☐	☐	☐	☐
É fácil lembrar-me de como executar as tarefas relacionadas com a edição das Wikis.	☐	☐	☐	☐	☐	☐
Fico confuso quando utilizo uma Wiki.	☐	☐	☐	☐	☐	☐
Cometo erros frequentemente quando utilizo uma Wiki.	☐	☐	☐	☐	☐	☐
Aprender a utilizar as Wikis é fácil.	☐	☐	☐	☐	☐	☐
No geral, acho que as Wikis são fáceis de utilizar.	☐	☐	☐	☐	☐	☐

Utilidade percebida						
A utilização de Wikis melhora o resultado da minha aprendizagem.	☐	☐	☐	☐	☐	☐
A utilização de Wikis permite-me organizar melhor o meu trabalho.	☐	☐	☐	☐	☐	☐
A utilização de Wikis faz-me poupar tempo.	☐	☐	☐	☐	☐	☐
A utilização de Wikis permite-me ter um maior controlo sobre o meu trabalho.	☐	☐	☐	☐	☐	☐
A comunicação proporcionada pelas Wikis permite-me aprender através dos conteúdos colocados pelos outros.	☐	☐	☐	☐	☐	☐
As Wikis permitem fazer trabalhos de grupo sem depender da presença física dos outros elementos do grupo.	☐	☐	☐	☐	☐	☐
As Wikis permitem fazer trabalhos de grupo sem estar dependente dos horários dos outros elementos do grupo.	☐	☐	☐	☐	☐	☐
No geral, acho as Wikis úteis para a minha aprendizagem.	☐	☐	☐	☐	☐	☐
Intenção/Atitude para usar						
Gosto da ideia de poder participar em actividades que utilizam Wikis.	☐	☐	☐	☐	☐	☐
Se houver a possibilidade de utilizar Wikis na minha aprendizagem, tenho a intenção de o fazer.	☐	☐	☐	☐	☐	☐
Eu recomendo aos outros a utilização de Wikis no processo Ensino/Aprendizagem.	☐	☐	☐	☐	☐	☐
Para fazer o meu trabalho, eu usaria Wikis em vez de outros meios disponíveis.	☐	☐	☐	☐	☐	☐
Globalmente, a minha atitude é favorável à utilização de Wikis no processo Ensino/Aprendizagem.	☐	☐	☐	☐	☐	☐
Influência social						
Se os meus colegas utilizarem Wikis, eu também conto utilizar.	☐	☐	☐	☐	☐	☐
Se os meus professores utilizarem Wikis, eu também conto utilizar.	☐	☐	☐	☐	☐	☐
A edição de Wikis ajuda-me a comunicar/colaborar com os outros.	☐	☐	☐	☐	☐	☐
A contribuição para a edição de Wikis permite-me ser reconhecido(a) na comunidade em que me insiro.	☐	☐	☐	☐	☐	☐
No geral, contribuir para a edição de Wikis faz-me sentir socialmente mais activo(a).	☐	☐	☐	☐	☐	☐
Considero que existe uma tendência para, no futuro, se utilizarem mais Wikis.	☐	☐	☐	☐	☐	☐

7. **Se lhe for dada a possibilidade de utilizar esta ferramenta na elaboração do relatório final de TAGI, conta fazê-lo?**

☐ Sim ☐ Não

Inclua os comentários que julgue relevantes:

Comentários:

Muito obrigada pela colaboração

Carolina Costa - Aluna do PDEGI

Appendix I.5 – Questionnaire: The use and acceptance of Educast by students

Questionário

Este estudo enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro sob a orientação da Professora Doutora Helena Alvelos e da Professora Doutora Leonor Teixeira. O questionário visa avaliar a aceitação, por parte dos alunos, de gravações de conteúdos lectivos (aulas) publicadas na Plataforma Educast como meio de promoção da melhoria do processo ensino/aprendizagem. Não há respostas certas ou erradas relativamente a qualquer das questões, pretendendo-se apenas a sua opinião pessoal e sincera. Os dados do questionário são confidenciais.

1. **Qual a sua idade?** ____ anos.
2. **Qual o seu género?**
   ☐ Feminino ☐ Masculino
3. **Qual o Programa Doutoral que frequenta?**
   ☐ Biologia
   ☐ Engenharia Civil
   ☐ Engenharia e Gestão Industrial
   ☐ Engenharia Mecânica
   ☐ Engenharia Química
   ☐ Geociências
   ☐ Geotecnologias
   ☐ Marketing e Estratégia
   ☐ Nanociências e Nanotecnologia
   ☐ Química
   ☐ Sistema Energéticos e Alterações Climáticas
   ☐ Turismo
   Outro. Qual? _____
4. **Qual a sua situação profissional?**
   ☐ Bolseiro(a) de investigação
   ☐ Docente do Ensino Superior
   ☐ Trabalhador(a) independente
   ☐ Trabalhador(a) por conta de outrem, excluindo docente do Ensino Superior
   ☐ Desempregado(a)
   Outro. Qual? _____
5. **Qual a sua disponibilidade semanal para assistir às aulas presenciais?**
   ☐ 1 meio dia (manhã / tarde)
   ☐ 1 dia inteiro
   ☐ 2 meios dias (manhãs / tardes)
   ☐ 3 meios dias (manhãs / tardes)
   ☐ 2 dias inteiros
   ☐ 4 meios dias (manhãs / tardes) ou mais
6. **Quanto tempo demora na deslocação desde o local onde habitualmente se encontra até à Universidade de Aveiro, para assistir às aulas?** _____
7. **Indique as sessões que assistiu presencialmente e o número de visualizações das gravações.**

Sessão	Assistiu presencialmente		Nº de visualização das gravações
1ª Sessão - Professor Joaquim José Borges Gouveia 12-04-2012	☐ Sim	☐ Não	1ª Sessão 1/2: ____ 1ª Sessão 2/2: ____
2ª Sessão - Professora Irina Saur-Amaral 19-04-2012	☐ Sim	☐ Não	2ª Sessão 1/2: ____ 2ª Sessão 2/2: ____
3ª Sessão - Professora Irina Saur-Amaral 26-04-2012	☐ Sim	☐ Não	3ª Sessão 1/2: ____ 3ª Sessão 2/2: ____
4ª Sessão - Professor José Paulo Rainho 03-05-2012	☐ Sim	☐ Não	4ª Sessão 1/2: ____ 4ª Sessão 2/2: ____
5ª Sessão - Professor José Paulo Rainho 10-05-2012	☐ Sim	☐ Não	5ª Sessão 1/2: ____ 5ª Sessão 2/2: ____

6ª Sessão - Professor José Paulo Rainho 17-05-2012	☐ Sim	☐ Não	6ª Sessão 1/2: ____ 6ª Sessão 2/2: ____
7ª Sessão - Professor Joaquim José Borges Gouveia 24-05-2012	☐ Sim	☐ Não	7ª Sessão 1/2: ____ 7ª Sessão 2/2: ____

8. Que dispositivo utiliza para visualizar as gravações?

☐ Computador
☐ Telemóvel / Smartphone
☐ Tablet (iPad, Galaxy Tab, PlayBook, Tablet S, …)
Outro. Qual? _____

9. Que formato escolhe para visualizar as gravações?

☐ Flash
☐ Quicktime
☐ iPod

10. Onde costuma visualizar as gravações?

☐ Universidade de Aveiro
☐ Local de Trabalho
☐ Casa
☐ Locais públicos
Outro. Qual? _____

11. No sentido de avaliar a possível utilização futura de gravações de conteúdos lectivos publicadas na plataforma Educast, por favor, indique o seu grau de concordância com as seguintes afirmações: (assinale o número que melhor corresponde à sua opinião com base na escala **1-Não concordo nada**, **5-Concordo totalmente**; **NS/NR** – não sei ou não respondo)

	Grau de concordância					**NS/ NR**
	1	**2**	**3**	**4**	**5**	
No geral, acho que a Plataforma Educast é fácil de utilizar para visualizar gravações de conteúdos lectivos.	☐	☐	☐	☐	☐	☐
A utilização de gravações de conteúdos lectivos permite-me ter flexibilidade na organização do meu estudo/trabalho.	☐	☐	☐	☐	☐	☐
A utilização de gravações de conteúdos lectivos permite-me rever as matérias expostas nas aulas.	☐	☐	☐	☐	☐	☐
A utilização de gravações de conteúdos lectivos permite-me recuperar aulas às quais não tive oportunidade de assistir presencialmente.	☐	☐	☐	☐	☐	☐
A utilização de gravações de conteúdos lectivos permite-me não estar preocupado em tirar os apontamentos nas aulas e, assim, concentrar-me mais na exposição feita pelo docente.	☐	☐	☐	☐	☐	☐
No geral, acho as gravações de conteúdos lectivos úteis para a minha aprendizagem.	☐	☐	☐	☐	☐	☐
Gosto da ideia de poder frequentar unidades curriculares que utilizam gravações de conteúdos lectivos.	☐	☐	☐	☐	☐	☐
Se houver a possibilidade de visualizar gravações de conteúdos lectivos na minha aprendizagem, tenho a intenção de o fazer.	☐	☐	☐	☐	☐	☐
Globalmente, a minha atitude é favorável à utilização de gravações de conteúdos lectivos no processo Ensino/Aprendizagem.	☐	☐	☐	☐	☐	☐
A visualização de gravações de conteúdos contribui para um isolamento das pessoas.	☐	☐	☐	☐	☐	☐
Considero que existe uma tendência para, no futuro, se utilizarem mais gravações de conteúdos lectivos.	☐	☐	☐	☐	☐	☐

Inclua os comentários que julgue relevantes:

Comentários:

Muito obrigada pela colaboração
Carolina Costa - Aluna do PDEGI

Appendix I.6 – Questionnaire: The use and acceptance of technologies by professors

Tecnologias de suporte ao processo Ensino/Aprendizagem

Este estudo enquadra-se no âmbito de uma tese do Programa Doutoral em Engenharia e Gestão Industrial da Universidade de Aveiro (UA) sob a orientação da Professora Doutora Helena Alvelos e da Professora Doutora Leonor Teixeira. O questionário tem como objetivo perceber a utilização e a aceitação de tecnologias de suporte ao processo Ensino/Aprendizagem por parte dos Docentes da Universidade de Aveiro (UA). Não há respostas certas ou erradas relativamente a qualquer das questões e os resultados obtidos serão tratados de forma anónima.

Questionário

1. Género:

○ Feminino ○ Masculino

2. Idade:

Neste campo só é possível introduzir números.

3. Indique a categoria profissional em que se enquadra:

Escolha uma das seguintes respostas

- ○ Professor Catedrático
- ○ Professor Catedrático Convidado
- ○ Professor Associado com Agregação
- ○ Professor Associado
- ○ Professor Associado Convidado
- ○ Professor Auxiliar com Agregação
- ○ Professor Auxiliar
- ○ Professor Auxiliar Convidado
- ○ Assistente
- ○ Assistente Convidado
- ○ Outro. Qual?

4. Indique o departamento / escola politécnica no qual exerce funções:

Escolha uma das seguintes respostas

- ○ Departamento de Ambiente e Ordenamento
- ○ Departamento de Biologia
- ○ Departamento de Ciências Médicas
- ○ Departamento de Ciências Sociais, Políticas e do Território
- ○ Departamento de Comunicação e Arte
- ○ Departamento de Economia, Gestão, Engenharia Industrial e Turismo
- ○ Departamento de Educação e Psicologia
- ○ Departamento de Eletrónica, Telecomunicações e Informática
- ○ Departamento de Engenharia de Materiais e Cerâmica
- ○ Departamento de Engenharia Civil
- ○ Departamento de Engenharia Mecânica
- ○ Departamento de Física
- ○ Departamento de Geociências
- ○ Departamento de Línguas e Culturas
- ○ Departamento de Matemática
- ○ Departamento de Química
- ○ Escola Superior de Design, Gestão e Tecnologias da Produção Aveiro Norte (ESAN)
- ○ Escola Superior de Saúde da Universidade de Aveiro (ESSUA)
- ○ Escola Superior de Tecnologia e Gestão de Águeda (ESTGA)
- ○ Instituto Superior de Contabilidade e Administração da Universidade de Aveiro (ISCA-UA)

5. Indique a área de investigação em que trabalha:

Escolha uma das seguintes respostas

- ○ Ciências da Vida e da Saúde
- ○ Ciências Naturais e do Ambiente
- ○ Ciências Exatas e da Engenharia
- ○ Ciências Sociais e Humanidades

6. Seleccione as tecnologias que utiliza para a criação de conteúdos e para comunicar no contexto Ensino/Aprendizagem:

6.1. Learning Management Systems (LMS)

Selecione todas as que se apliquem

- [x] Moodle@UA
- [x] Outro

* **Outro. Qual?**

6.2. Sistema de gestão de vídeo

Selecione todas as que se apliquem

- [x] Educast
- [x] Outro

* **Outro. Qual?**

XXX

* **Indique o sistema de gestão de vídeo que utiliza mais:**

Escolha uma das seguintes respostas

- ○ Educast
- ○ XXX

6.3. Redes Sociais

Selecione todas as que se apliquem

- [x] Facebook
- [x] LinkedIn
- [x] Outra

* **Outra. Qual?**

YYY

* **Indique a rede social que utiliza mais:**

Escolha uma das seguintes respostas

- ○ Facebook
- ○ Linkedin
- ○ YYY

6.4. Vídeo Sharing

Selecione todas as que se apliquem

- [x] Vídeo Sharing - Sapo campus
- [x] YouTube
- [x] Outro

* **Outro. Qual?**

ZZZ

* **Indique o vídeo sharing que utiliza mais:**

Escolha uma das seguintes respostas

- ○ Vídeo Sharing - Sapo campus
- ○ YouTube
- ○ ZZZ

6.5. Foto Sharing

Selecione todas as que se apliquem

- ☑ Foto Sharing - Sapo campus
- ☑ Flickr
- ☑ Instagram
- ☑ Outro

* **Outro. Qual?**

AAA

* **Indique o foto sharing que utiliza mais:**

Escolha uma das seguintes respostas

- ○ Foto Sharing - Sapo campus
- ○ Flickr
- ○ Instagram
- ○ AAA

6.6. Podcasts

Selecione todas as que se apliquem

- ☑ iTunes
- ☑ Outro

* **Outro. Qual?**

BBB

* **Indique o podcasts que utiliza mais:**

Escolha uma das seguintes respostas

- ○ iTunes
- ○ BBB

6.7. Wikis

Selecione todas as que se apliquem

- ☑ Wiki – Sapo campus
- ☑ MediaWiki
- ☑ Outro

* **Outro. Qual?**

CCC

* **Indique o wikis que utiliza mais:**

Escolha uma das seguintes respostas

- ○ Wikis – Sapo campus
- ○ MediaWiki
- ○ CCC

6.8. Blogs

Selecione todas as que se apliquem

- ☑ Blog - Sapo campus
- ☑ Blogger
- ☑ Outro

* **Outro. Qual?**

DDD

* **Indique o blog que utiliza mais:**

Escolha uma das seguintes respostas

- ◉ Blogs - Sapo campus
- ○ Blogger
- ○ DDD

6.9. MicroBlogs

Selecione todas as que se apliquem

- ☑ Twiter
- ☑ Outro

* **Outro. Qual?**

EEE

* **Indique o microblog que utiliza mais:**

Escolha uma das seguintes respostas

- ◉ Twiter
- ○ EEE

II Parte

Com base na sua experiência de utilização, no contexto Ensino/Aprendizagem, de cada uma das Tecnologias referidas seguidamente, e no sentido de avaliar a sua utilização no desenvolvimento e implementação de cursos (p. ex., unidades curriculares, formações), por favor, responda às questões seguintes indicando o seu grau de concordância com as afirmações apresentadas, utilizando a escala 1-Não concordo nada a 5-Concordo totalmente e N/A-Não se aplica.

7.1. O Moodle no contexto Ensino/Aprendizagem

Facilidade de utilização percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Aprender a utilizar o Moodle é fácil.	○	○	○	○	○	○
É necessário consultar frequentemente o guião de apoio / tutoriais de ajuda para utilizar o Moodle.	○	○	○	○	○	○
Os menus e os recursos do Moodle são de fácil compreensão.	○	○	○	○	○	○
Fico confuso quando utilizo os recursos/actividades do Moodle.	○	○	○	○	○	○
Cometo erros frequentemente quando utilizo o Moodle.	○	○	○	○	○	○
É fácil lembrar-me de como executar as tarefas relacionadas com a criação/edição dos recursos/actividades no Moodle.	○	○	○	○	○	○
No geral, acho que o Moodle é fácil de utilizar.	○	○	○	○	○	○

Utilidade percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
A utilização do Moodle permite-me organizar e controlar melhor as tarefas relacionadas com o processo Ensino/Aprendizagem.	○	○	○	○	○	○
O Moodle permite-me executar as tarefas sem estar dependente de horários.	○	○	○	○	○	○
A utilização do Moodle permite-me poupar tempo.	○	○	○	○	○	○
A utilização do Moodle melhora o resultado do processo Ensino/Aprendizagem.	○	○	○	○	○	○
No geral, acho o Moodle útil para o processo Ensino/Aprendizagem.	○	○	○	○	○	○

Atitude para utilizar

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Agrada-me utilizar o Moodle no contexto Ensino/Aprendizagem.	○	○	○	○	○	○
Recomendo a utilização do Moodle para apoiar o processo Ensino/Aprendizagem.	○	○	○	○	○	○
Globalmente, sou favorável à utilização do Moodle no contexto Ensino/Aprendizagem.	○	○	○	○	○	○

Influência social

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Utilizo o Moodle porque é o LMS disponibilizado pela Universidade de Aveiro.	○	○	○	○	○	○
Utilizo o Moodle porque fui influenciado(a) por colegas.	○	○	○	○	○	○
Utilizo o Moodle porque fui influenciado(a) diretamente ou indiretamente pelos alunos.	○	○	○	○	○	○
A edição de recursos/actividades no Moodle permite-me comunicar/colaborar com os alunos.	○	○	○	○	○	○
No geral, a utilização do Moodle no contexto Ensino/Aprendizagem faz-me sentir socialmente/academicamente mais activo(a).	○	○	○	○	○	○
Considero que existe uma tendência para, no futuro, se desenvolverem mais actividades com recurso ao Moodle.	○	○	○	○	○	○

7.3. O Educast no contexto Ensino/Aprendizagem

Facilidade de utilização percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Aprender a utilizar o Educast é fácil.	○	○	○	○	○	○
É necessário consultar frequentemente o guião de apoio / tutoriais de ajuda para utilizar o Educast.	○	○	○	○	○	○
Os menus e os recursos do Educast são de fácil compreensão.	○	○	○	○	○	○
Fico confuso quando utilizo os recursos/actividades do Educast.	○	○	○	○	○	○
Cometo erros frequentemente quando utilizo o Educast.	○	○	○	○	○	○
É fácil lembrar-me de como executar as tarefas relacionadas com a criação/edição dos recursos/actividades no Educast.	○	○	○	○	○	○
No geral, acho que o Educast é fácil de utilizar.	○	○	○	○	○	○

Utilidade percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
A utilização do Educast permite-me organizar e controlar melhor as tarefas relacionadas com o processo Ensino/Aprendizagem.	○	○	○	○	○	○
O Educast permite-me executar as tarefas sem estar dependente de horários.	○	○	○	○	○	○
A utilização do Educast permite-me poupar tempo.	○	○	○	○	○	○
A utilização do Educast melhora o resultado do processo Ensino/Aprendizagem.	○	○	○	○	○	○
No geral, acho o Educast útil para o processo Ensino/Aprendizagem.	○	○	○	○	○	○

Atitude para utilizar

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Agrada-me utilizar o Educast no contexto Ensino/Aprendizagem.	○	○	○	○	○	○
Recomendo a utilização do Educast para apoiar o processo Ensino/Aprendizagem.	○	○	○	○	○	○
Globalmente, sou favorável à utilização do Educast no contexto Ensino/Aprendizagem.	○	○	○	○	○	○

Influência social

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Utilizo o Educast porque é o Sistema de gestão de vídeo disponibilizado pela Universidade de Aveiro.	○	○	○	○	○	○
Utilizo o Educast porque fui influenciado(a) por colegas.	○	○	○	○	○	○
Utilizo o Educast porque fui influenciado(a) diretamente ou indiretamente pelos alunos.	○	○	○	○	○	○
A edição de recursos/actividades no Educast permite-me a comunicar/colaborar com os alunos.	○	○	○	○	○	○
No geral, a utilização do Educast no contexto Ensino/Aprendizagem faz-me sentir socialmente/academicamente mais activo(a).	○	○	○	○	○	○
Considero que existe uma tendência para, no futuro, se desenvolverem mais actividades com recurso ao Educast.	○	○	○	○	○	○

7.4. O Facebook no contexto Ensino/Aprendizagem

Facilidade de utilização percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Aprender a utilizar o Facebook é fácil.	○	○	○	○	○	○
É necessário consultar frequentemente o guião de apoio / tutoriais de ajuda para utilizar o Facebook .	○	○	○	○	○	○
Os menus e os recursos do Facebook são de fácil compreensão.	○	○	○	○	○	○
Fico confuso quando utilizo os recursos/actividades do Facebook.	○	○	○	○	○	○
Cometo erros frequentemente quando utilizo o Facebook.	○	○	○	○	○	○
É fácil lembrar-me de como executar as tarefas relacionadas com a criação/edição dos recursos/actividades no Facebook.	○	○	○	○	○	○
No geral, acho que o Facebook é fácil de utilizar.	○	○	○	○	○	○

Utilidade percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
A utilização do Facebook permite-me organizar e controlar melhor as tarefas relacionadas com o processo Ensino/Aprendizagem.	○	○	○	○	○	○
O Facebook permite-me executar as tarefas sem estar dependente de horários.	○	○	○	○	○	○
A utilização do Facebook permite-me poupar tempo.	○	○	○	○	○	○
A utilização do Facebook melhora o resultado do processo Ensino/Aprendizagem.	○	○	○	○	○	○
No geral, acho o Facebook útil para o processo Ensino/Aprendizagem.	○	○	○	○	○	○

Atitude para utilizar

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Agrada-me utilizar o Facebook no contexto Ensino/Aprendizagem.	○	○	○	○	○	○
Recomendo a utilização do Facebook para apoiar o processo Ensino/Aprendizagem.	○	○	○	○	○	○
Globalmente, sou favorável à utilização do Facebook no contexto Ensino/Aprendizagem.	○	○	○	○	○	○

Influência social

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Utilizo o Facebook porque fui influenciado(a) por colegas.	○	○	○	○	○	○
Utilizo o Facebook porque fui influenciado(a) diretamente ou indiretamente pelos alunos.	○	○	○	○	○	○
A edição de recursos/actividades no Facebook permite-me comunicar/colaborar com os alunos.	○	○	○	○	○	○
Considero que existe uma tendência para, no futuro, se desenvolverem mais actividades com recurso ao Facebook.	○	○	○	○	○	○

7.5. O YouTube no contexto Ensino/Aprendizagem

Facilidade de utilização percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Aprender a utilizar o YouTube é fácil.	○	○	○	○	○	○
É necessário consultar frequentemente o guião de apoio / tutoriais de ajuda para utilizar o YouTube.	○	○	○	○	○	○
Os menus e os recursos do YouTube são de fácil compreensão.	○	○	○	○	○	○
Fico confuso quando utilizo os recursos/actividades do YouTube.	○	○	○	○	○	○
Cometo erros frequentemente quando utilizo o YouTube.	○	○	○	○	○	○
É fácil lembrar-me de como executar as tarefas relacionadas com a criação/edição dos recursos/actividades no YouTube.	○	○	○	○	○	○
No geral, acho que o YouTube é fácil de utilizar.	○	○	○	○	○	○

Utilidade percebida

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
A utilização do YouTube permite-me organizar e controlar melhor as tarefas relacionadas com o processo Ensino/Aprendizagem.	○	○	○	○	○	○
O YouTube permite-me executar as tarefas sem estar dependente de horários.	○	○	○	○	○	○
A utilização do YouTube permite-me poupar tempo.	○	○	○	○	○	○
A utilização do YouTube melhora o resultado do processo Ensino/Aprendizagem.	○	○	○	○	○	○
No geral, acho o YouTube útil para o processo Ensino/Aprendizagem.	○	○	○	○	○	○

Atitude para utilizar

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Agrada-me utilizar o YouTube no contexto Ensino/Aprendizagem.	○	○	○	○	○	○
Recomendo a utilização do YouTube para apoiar o processo Ensino/Aprendizagem.	○	○	○	○	○	○
Globalmente, sou favorável à utilização do YouTube no contexto Ensino/Aprendizagem.	○	○	○	○	○	○

Influência social

	Não concordo nada 1	2	3	4	Concordo totalmente 5	Não se aplica N/A
Utilizo o YouTube porque fui influenciado(a) por colegas.	○	○	○	○	○	○
Utilizo o YouTube porque fui influenciado(a) diretamente ou indiretamente pelos alunos.	○	○	○	○	○	○
A edição de recursos/actividades no YouTube permite-me comunicar/colaborar com os alunos.	○	○	○	○	○	○
No geral, a utilização do YouTube no contexto Ensino/Aprendizagem faz-me sentir socialmente/academicamente mais activo(a).	○	○	○	○	○	○
Considero que existe uma tendência para, no futuro, se desenvolverem mais actividades com recurso ao YouTube.	○	○	○	○	○	○

III Parte

8. Conhece o conceito Massive Open Online Course (MOOC):

(•) Sim ( ) Não

9. Conhece alguma plataforma MOOC?

(•) Sim ( ) Não

9.1. Qual (is)?
Selecione todas as que se apliquem

☑ Coursera
☑ EdX
☑ Outra

* **Outra. Qual?**

10. Já consultou MOOCs?

(•) Sim ( ) Não

10.1. Em que plataforma consultou MOOCs?
Selecione todas as que se apliquem

☐ Coursera
☐ EdX
☐ XXX

11. Já frequentou MOOCs?

(•) Sim ( ) Não

11.1. Em que plataforma frequentou MOOCs?
Selecione todas as que se apliquem

☐ Coursera
☐ EdX
☐ XXX

12. Já colaborou na elaboração de MOOCs?

◉ Sim ○ Não

12.1. Em que plataforma colaborou na elaboração de MOOCs?
Selecione todas as que se apliquem

☐ Coursera
☐ EdX
☐ XXX

13. Estaria disposto(a) a desenvolver ou a colaborar no desenvolvimento de um MOOC?
Escolha uma das seguintes respostas

◉ Sim ○ Não ○ Não sei / Não respondo

Inclua os comentários que julgue relevantes:

Muito obrigada pela colaboração
Carolina Costa - Aluna do PDEGI
(carolinacosta@ua.pt)

Appendix II – Additional information: Chapter VII – Exploring the usage of MOOCs in Higher Education Institutions: Characterization of the most used platforms

Appendix II.1 - Table: References of the articles and MOOC platforms

Appendix II.2 - Table: Summary of the main features of Courses in Coursera and/or EdX

Appendix II.3 - Table: Summary of the main features of participants in Coursera and / or EdX courses

Appendix II.4 - Table: Summary of the main Activities in Coursera and / or EdX

Appendix II.1 - Table: References of the articles and MOOC platforms

The following table presents the references of those articles as well as the platforms they mention. In the last line of table, the total number of articles and the number of those where each platform is mentioned are presented.

Table - References of the articles and MOOC platforms.

Reference	Total	Cousera	EdX	Udacity	FutureLearn	MiriadaX	Udemy	Iversity	OpenupEd	Open2Study	Canvas	Khan Academy
(Amemado, 2014; Audsley et al., 2013; Ayala et al., 2014; Baggaley, 2013, 2014; Bonvillian & Singer, 2013; Bulfin et al., 2014; Carr, 2012; Chang et al., 2015; Comeau & Cheng, 2013; Cusumano, 2014; Deale, 2015; DeBoer et al., 2014; Egerstedt, 2013; Engle et al., 2015; Erdem-Aydin, 2015; Glance et al., 2013; Guzdial & Adams, 2014; Jordan, 2014; Kellogg, 2013; King et al., 2014; Knoedler, 2015; Knox, 2014; Kurhila & Vihavainen, 2015; Li et al., 2015; Lin et al., 2015; Literat, 2015; Liyanagunawardena et al., 2013; Longstaff, 2014; Lopez-Meneses et al., 2015; Lowenthal & Hodges, 2015; Martin, 2012; Moskal et al., 2015; Mune, 2015; Perez & Guzman-Duque, 2015; Perna et al., 2014; Piao et al., 2015; Sangra et al., 2015; Schmid et al., 2015; Sementelli & Garrett, 2015; Severance, 2015; Sharrock, 2015; Skiba, 2012; Toven-Lindsey et al., 2015; Vallaeys, 2014; Van-Dijck & Poell, 2015; Wellen, 2013; Wright, 2013; Xu & Yang, 2015; Zhu, 2015)	50	•	•	•								
(Cervone, 2015; Dagiene & Gudoniene, 2015; Dalsgaard & Thestrup, 2015; Daniel et al., 2015; Dillahunt et al., 2014; Evans & Myrick, 2015; Friedman & Friedman, 2013; Gillani & Eynon, 2014; Hall, 2015; Hollands, 2014; Hurst, 2015; Israel, 2015; Laplante, 2013; Liñán & Pérez, 2015; Mackness et al., 2013; Marshall, 2014; Najafi et al., 2015; Ožvoldová & Ondrůšek, 2015; Qu & Chen, 2015; Redfield, 2015; Ruby et al., 2015; Sancho-Vinuesa et al., 2015; Searls, 2014; Subhi et al., 2014; Yousef et al.,	25	•	•									

2015)												
(Admiraal et al., 2015; Bayne, 2015; Comer et al., 2014; Fisher, 2014; Fowler & Smith, 2013; Fricton et al., 2015; Griffiths et al., 2015; Hood et al., 2015; Jiang et al., 2014; Jiang et al., 2015; Kustritz, 2014; Murray, 2014; O'Malley et al., 2015; Sadhasivam, 2014; Salmon et al., 2015; Sidorenko, 2014; Spada, 2014; Tucker et al., 2014; Vazquez-Cano, 2013)	19	●										
(Aboshady et al., 2015; Ahlberg, 2014; Alevizou, 2015; Atenas, 2015; Burch & Harris, 2014; Clarke, 2013; Kovanovic et al., 2015; Norberg et al., 2015; Rachel et al., 2015; Rohs & Ganz, 2015; Sa-Don et al., 2015)	11	●	●	●	●							
(Angiuli et al., 2015; Canessa et al., 2013; Coelho et al., 2015; Cordero et al., 2015; Fox, 2013; Jones, 2015; Monedero-Moya, et al., 2015; Moodie, 2014 ; Najafi et al., 2014; Naresh & Reddy, 2015; Reilly et al., 2014)	11		●									
(Ashton & Davies, 2015; Castaño-Garrido et al., 2015; Castillo et al., 2015; Langen & Bosch, 2013; Manouselis et al., 2013; Montgomery et al., 2015)	6	●		●								
(Choi & Roh, 2015; Galán, 2014; Impey et al., 2015; Soffer & Cohen, 2015; Zhuhadar et al., 2015)	5	●	●	●			●					
(Cano-Garcia et al., 2015; Estevez-Ayres et al., 2013; Gallego-Arrufat et al., 2015; Ramirez-Fernandez & Silvera, 2015)	4	●	●	●		●						
(Jobe & Hansson, 2014; Kern, 2014; Mehta et al., 2013; Pantò & Comas-Quinn, 2013)	4	●	●	●								●
(Nkuyubwatsi, 2014; O'Connor, 2014)	2	●	●	●	●			●	●	●		
(Brahimi & Sarirete, 2015; Kim, 2015)	2	●	●	●	●			●		●		
(Nyoni, 2013; Selwyn et al., 2015)	2	●	●	●	●							
(Medina-Salguero & Aguaded, 2014; Vázquez-Cano & Meneses, 2014)	2	●	●	●		●						
(Macleod et al., 2015)	1	●	●		●							
(Freitas et al., 2015; Mihai et al., 2015)	2	●	●		●					●		
(Law, 2015; Woodgate et al., 2015)	2	●			●							
(Barrs, 2015; Koo et al., 2015)	2				●							
(Liyanagunawardena & Williams, 2014)	1	●	●	●	●	●	●	●	●	●	●	
(Jansen et al., 2015)	1	●	●	●	●	●		●				
(Fidalgo-Blanco et al., 2015)	1	●	●	●	●	●						
(Tanaš, 2015)	1	●	●	●	●			●	●			
(배예선 & Jun, 2014)	1	●	●	●	●		●	●		●		
(Parkinson, 2014)	1	●	●	●	●							
(Pujar & Bansode, 2014)	1	●	●	●	●				●			

(Barnes, 2013)	1	●	●	●	●				●	●		
(Martín-Monje el al., 2014)	1	●	●	●		●			●		●	
(Vila et al., 2014)	1	●	●	●		●					●	
(Oyo & Kalema, 2014)	1	●	●	●			●					
(Wu, 2013)	1	●	●	●			●					●
(Hew & Cheung, 2014)	1	●	●	●			●				●	
(Nisha & Senthil, 2015)	1	●	●	●				●				
(Paton, 2014)	1	●	●		●							
(Rhoads et al., 2015)	1	●	●		●			●				
(Vargas, 2014)	1	●	●		●		●			●		
(Leito et al., 2015)	1	●	●				●					
(McGreal et al., 2015)	1	●	●				●				●	
(Luaces et al., 2015)	1	●	●									●
(Hollands & Tirthali, 2014)	1	●	●									
(Daza et al., 2013)	1	●		●		●			●			
(Sanchez-Vera et al., 2015)	1	●			●				●			
(Martin et al., 2015)	1	●				●						
(Costa-Jussà et al., 2015)	1	●									●	
(Drake et al., 2015)	1		●	●								
(Brown et al., 2015)	1		●	●	●			●	●	●		
(Rhoads et al., 2013)	1		●	●								
(Firmin et al., 2014)	1			●								
(Sarabia-Cobo et al., 2015)	1					●						
(Ros et al., 2014)	1								●			
(Costa-Jussà et al., 2014)	1										●	
Number of articles	182	162	145	107	37	14	13	11	11	11	7	6

Appendix II.2 - Table: Summary of the main features of Courses in Coursera and/or EdX

The following table presents the number of offered courses, there are of knowledge, their duration in weeks, and the workload (hours of work per week) in Coursera and EdX.

Table - Summary of the main features of Courses in Coursera and/or EdX.

Number of courses in Coursera	Number of courses in EdX	Reference
57 courses on health and medicine	5 courses on health and medicine	(Liyanagunawardena & Williams, 2014)
60 courses on bioinformatics and computational biology	12 courses on bioinformatics and computational biology	(Searls, 2014)
198 courses in November 2012	9 courses in November 2012	(Audsley et al., 2013)
542 courses in November 2013	91 courses in November 2013	(Atenas, 2015)
556 courses in December 2013	112 courses in December 2013	(Subhi et al., 2014)
600 courses	170 courses	(Perez & Guzman-Duque, 2015)
664 courses in May 2014	182 courses in May 2014	(Brahimi & Sarirete, 2015)
839 courses	415 courses	(Nisha & Senthil, 2015)
1041 courses in June 2015	611 courses in June 2015	(Lin et al., 2015)
Areas of courses in Coursera	**Areas of courses in EdX**	**Reference**
Humanities, Economics and Finance, and Technology		(Dillahunt et al., 2014)
Artificial Intelligence, Machine Learning, Databases		Macleod et al., 2015)
Biology & Life Sciences, Education, and Mathematics		(Audsley et al., 2013)
Computer Science, humanities, Social Sciences, health & society, Biology & life Sciences, Business & Management, Economics & Finance, IT & Design, Medicine, and Engineering		(Brahimi & Sarirete, 2015)
Health, Math and Economics, Business, and Humanities		(Perna et al., 2014)
Education & Social sciences, Humanities, Information, Technology, and Design, Music, Film, and Audio Engineering		(Vazquez-Cano, 2013)
Areas of courses in Coursera and EdX		**Reference**
Hard-Pure-Life, Hard-Pure-Non-Life, Hard-Applied-Life, Hard-Applied-Non-Life, Soft-Pure-Life, Soft-Pure-Non-Life, Soft-Applied-Life, Soft-Applied-Non-Life (Biglan categories for academic disciplines)		(Toven-Lindsey et al., 2015)
Duration (weeks) of courses in Coursera	**Duration (weeks) of courses in EdX**	**Reference**
5 to 8 weeks		(Admiraal et al., 2015)
5 to 15 weeks		(Dillahunt et al., 2014)
6 weeks		(O'Malley et al., 2015; Kustritz, 2014; Najafi et al., 2014)
6 to 12 weeks		(Perna et al., 2014)
10 weeks		(Redfield, 2015)
12 weeks		(Engle et al., 2015)
Duration (weeks) of courses in Coursera and EdX		**Reference**
4 to 10 weeks		(Haggard, 2013 in Atenas, 2015)
6 to 9 weeks (median 7)		(Subhi et al., 2014)

3 to 20 weeks (average 6.7)		(Liyanagunawardena & Williams, 2014)
Workload (hours per week) of courses in Coursera	**Workload (hours per week) of courses in EdX**	**Reference**
4 to 12 hours per week		(Dillahunt et al., 2014)
5 to 8 hours per week		(Admiraal et al., 2015)
median of 5 to 7 hours per week, mode of 5 to 8, mean of 4.7 to 6.8	10, 12 or 15 hours per week	(Audsley et al., 2013)
Workload (hours per week) of courses in Coursera and EdX		**Reference**
3 to 6 hours per week (median of 4.5)		(Subhi et al., 2014)
2 to 6 hours per week		(Haggard, 2013 in Atenas, 2015)
average 4.2 hours per week		(Liyanagunawardena & Williams, 2014)
Other characteristic of courses in Coursera	**Other characteristic of courses in EdX**	**Reference**
1 to 13 teaching assistants per course		(Perna et al., 2014)
158/198 of courses included an introductory video		(Audsley et al., 2013)

Appendix II.3 - Table: Summary of the main features of participants in Coursera and / or EdX courses

The following table presents some features of participating on MOOCs in Coursera and EdX platforms.

Table - Summary of the main features of participants in Coursera and / or EdX courses.

Number of students Coursera	Number of students in EdX	Reference
710,000 students in 16 courses		(Ruby et al., 2015)
33,378 students accessed 1 MOOC		(Engle et al., 2015)
41,636 students		(Dillahunt et al., 2014)
25,918 students		(Schmid et al., 2015)
3,504 students		(Kustritz, 2014)
	155,000 students in 1st EdX course	(Severance, 2015)
2,926,062 students in 2012	500,000 students in 2012	(Clarke, 2013)
10 million students in November 2014	1.7 million of students in November 2014	(Kim, 2015)
10 million of students	3 million of students	(Nisha & Senthil, 2015)
Localization of students in Coursera	**Localization of students in EdX**	**Reference**
United States (23%), United Kingdom (11%), and India (6%)		(Macleod et al., 2015)
North America (41%), Europe (26%), Asia (19%), South America (6%), Oceania (4%), and Africa (3%) from 139 countries		(Burch & Harris, 2014)
United States (36%), Canada (6%), United Kingdom (5%), India (5%), Australia (3%), China (3%), Brazil (2%), Spain (2%), Germany (2%), Greece (2%), Russia (1%), 168 other countries (34%), and Emerging Economies (24%) from 179 countries		(Fricton et al., 2015)
From 200 countries		(Bayne, 2015)
From 126 countries		(Soffer & Cohen, 2015)
From 79 countries		(Hood et al., 2015)
United States (55%)		(Kustritz, 2014)
	From 162 countries	(Severance, 2015)
Age of students in Coursera	**Age of students in EdX**	**Reference**
18-24 (13%), 25-34 (27%), 35-44 (19%), 44-54 (18%), 55-64 (13%), and >65 (9%)		(Fricton et al., 2015)
18-24 (24%), 25-34 (31%), and 35-44 (18%)		(Macleod et al., 2015)
18-24 (23%), and 24-34 (40%)		(Dillahunt et al., 2014)
18-25 (29.5%), 26-34 (30.3%), 35-44 (7.4%), 45-54 (12.6%), 55-64 (7.6%), and > 65 (2.7%)		(Engle et al., 2015)
<18 (3%), 18–64 (94%), and >65 (3%)		(Schmid et al., 2015)
24-34 (40%)		(Gillani & Eynon, 2014)
25-34 (highest proportion)		(Murray, 2014)
36-40 (mean age range)		(Kustritz, 2014)
Gender of students in Coursera	**Gender of students in EdX**	**Reference**
Male (85%) in AI Planning course and Female (90%) in Equine Nutrition (Gender participation rates have been largely a function of the subject matter)		(Macleod et al., 2015)
Male (69%)		(Dillahunt et al., 2014)
Female		(Jiang et al., 2014)
Female (90%)		(Murray, 2014)
Female (81%)		(Kustritz, 2014)

Female (57%)		(Fricton et al., 2015)
Degree of students in Coursera	**Degree of students in EdX**	**Reference**
Doctorate (3.5%), master's degree (36.3%), bachelor's degree (42.1%), some college (12.2%), completed high school (4.2%), some high school (1.5%)		(Gillani & Eynon, 2014):
Master's degree (34%), bachelor's degree (37%)		(Dillahunt et al., 2014)
Doctorate or professional degree (17%), Master's degree (25%), Bachelor's degree (31%), Associate's degree or college (17%), High school diploma or less (10%)		(Fricton et al., 2015)
Postgraduate (28%), undergraduate (35%), secondary (29%)		(O'Malley et al., 2015)
Bachelor's degree (35%), Master's degree (32%)		(Schmid et al., 2015)
Postgraduate degrees (60%)		(Bayne, 2015):
Doctoral degree (5%), Master's degree (24%), Bachelor's degree (36%), High school or the equivalent (10%), College (20%), Professional degree (5%)		(Engle et al., 2015)
Employed as a data professional (38%), higher education qualification (18%), employed as a data professional and studying for a higher education qualification (8%), neither employed as a data professional nor studying for a higher education qualification (36%)		(Hood et al., 2015)

Appendix II.4 - Table: Summary of the main Activities in Coursera and / or EdX.

The following table presents some recourses / atividades used in MOOCs.

Table - Summary of the main Activities in Coursera and / or EdX.

Recourses / Activities in Coursera	Recourses / Activities in EdX	Reference
Videos, quizzes, discussion forums		(Egerstedt, 2013)
Videos, quizzes, and discussion forum course content and activities		(Woodgate et al., 2015)
Assignments, lectures, and discussion forums		(Burch & Harris, 2014)
Lecture segments, Forums		(Gillani & Eynon, 2014)
Joined the Facebook group, and joined in Google+ group		(Knox, 2014)
	Lecture video, homework problem, and Forum	(DeBoer et al., 2014)
Recourses / Activities in Coursera and EdX		**Reference**
Text-based lessons, and video recordings including PowerPoint slides		(Toven-Lindsey et al., 2015)
Percentages of certificate / completed course in Coursera	**Percentages of certificate / completed course in EdX**	**Reference**
Certificates (1%)		(Egerstedt, 2013)
Completed and earned a certificate (4%)		(Dillahunt et al., 2014)
Signed up for the certification track (2%), and completed the voluntary final exam (10%)		(Admiraal et al., 2015)
Completed at least one part of an exam but did not complete all of the exams (11%), completed all of the exams but did not pass the course (2%), passed the course without distinction (2%), and passed the course with distinction (1%)		(Engle et al., 2015)
Completed the full course evaluation (3%)		(Fricton et al., 2015)
Completed the course (7%)		(Soffer & Cohen, 2015)
Submitted at least one quiz or the final project (3%), and finished with scores (2%)		(Gillani & Eynon, 2014)
Grade records (72%), Distinction certificate (1%), and Normal certificate (5%)		(Jiang et al., 2014)
End of the course (23%), and completion rate (30%)		(Murray, 2014)
Percentages of certificate / completed course in Coursera and EdX		**Reference**
Completed courses earning certificates (16%)		(Aboshady et al., 2015)
Completion rates (10%)		(Jordan, 2014)

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Appendix III – Additional information: Chapter VIII – Investigating the use and acceptance of technologies by professors in a Higher Education Institution

Appendix III.1 - Systematic literature review

Appendix III.1 - Systematic literature review

A literature revision was performed, aiming at identifying the most used technologies in the referred context and analysing the framework of the studies on their acceptance.

In this section the research method and the results of the literature revision are presented.

Material and methods

In order to realize which were the most used technologies in the TL process, a literature review was performed. It was found that Moodle is the most used LMS (Campanella et al., 2008; Costa, Alvelos, & Teixeira, 2015; Escobar-Rodriguez, Carvajal-Trujillo, & Monge-Lozano, 2014), and Facebook and YouTube are the most popular Web 2.0 tools among students (Danyaro, Jaafar, De Lara, & Downe, 2010; Galan, Lawley, & Clements, 2015; Manca & Ranieri, 2016).

Aiming at gathering data about published acceptance of the technologies that were identified as most used in TL process (Moodle, Facebook, YouTube) in HE, some searches in specialized scientific databases in the areas of Information and Communication Technologies (ICT) and Education were performed. The referred databases were (i) ISI Web of Knowledge; (ii) Scopus; and (iii) IEEE Xplorer.

Table 1 – Number of articles that resulted from the searches performed (28/07/2016).

	Moodle		**Facebook**		**YouTube**	
Search database	**Number of articles**	**Total number of articles**	**Number of articles**	**Total number of articles**	**Number of articles**	**Total number of articles**
ISI Web of Knowledge	47	61	45	65	9	17
Scopus	30		32		10	
IEEE Xplore	8		13		5	

The searches were performed in the title, in the abstract and in the keywords of the scientific documents (type: article) and the search expressions used were: (i) Moodle AND ("higher education" OR university OR universities) AND acceptance; (ii) Facebook AND ("higher education" OR university OR universities) AND acceptance; and (iii) YouTube AND ("higher education" OR university OR universities) AND acceptance. The number of articles identified in each search are presented in Table 1.

It should be emphasized that some of the articles are common to more than one database, the reason why the total number of articles does not correspond to the sum of their number for each technology.

Some articles were excluded essentially due to the fact that their objects were not directly related with the purpose of this study or their full-text were not accessible. Figure 1presents the process of selecting the articles for the subsequent analysis.

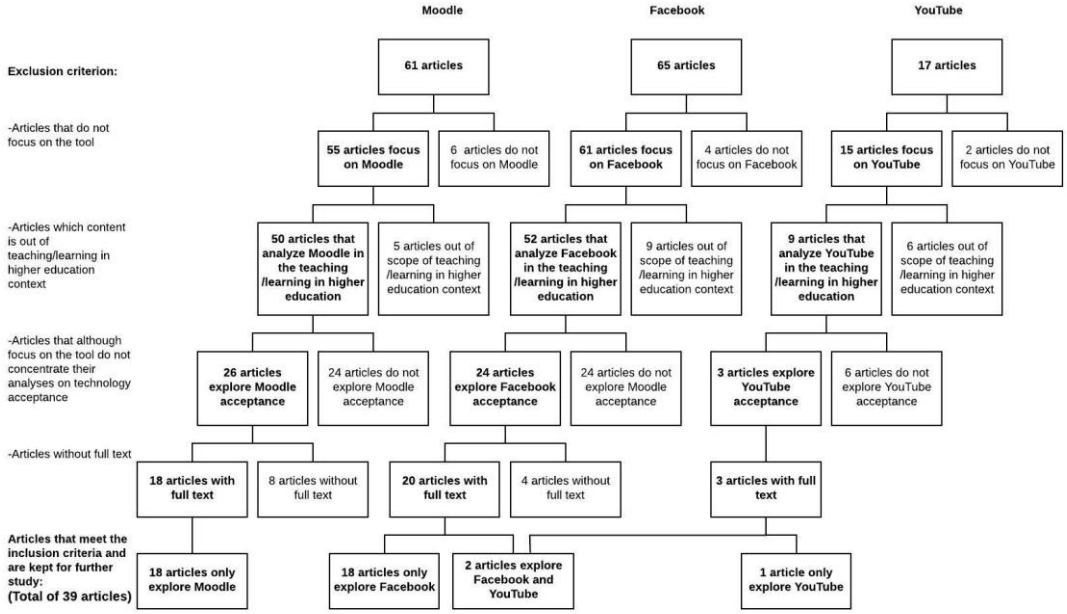

Figure 1 - Methodology used to select the articles.

According to Figure 1, there were found 18 articles that explore only Moodle acceptance, 18 articles that analyse only Facebook acceptance, one that explores only YouTube acceptance, and two articles that analyse Facebook and YouTube.

Results and discussion

Based on the articles that were found in the systematic literature revision, a content analysis of each of the articles was carried out, in order to identify the technology acceptance models used, the techniques or methods employed to analyse and evaluate the acceptance, and the category and the number of the participants in the study. These results are presented in Table 2.

According to Table 2, evaluation of technology acceptance of is mostly performed with TAM (26 out of 39). The majority of the studies were carried out involving students, being six studies with students and professors (four on Moodle, one on Facebook and YouTube, and one on YouTube) and just one (on Moodle) where participants were only professors. Regarding the sample size, the majority of the studies report more than one hundred participants although three studies involved less than one hundred participants. The techniques used to analyze the data in the latter condition were mainly descriptive statistics, correlation, and regression.

Table 2 – Characteristics of the articles on Acceptance models of Moodle, Facebook and YouTube.

	Reference	Model	Analysis	Participants in the study
Moodle	(Escobar-Rodriguez & Monge-Lozano, 2012)	TAM	Regression, PLS	162 business administration students in a Spanish public University
	(Sánchez & Hueros, 2010)	TAM	FA	226 students of the University of Huelva
	(Chen et al., 2012)	TAM	Regression	242 students of the computer science department at Ming Chuan University, Taiwan
	(Basol & Balgalmis, 2016)	TAM	DS, MANOVA, Correlation	340 students undergraduate teacher candidates who attended a mid-sized university in the inland side of Turkey's Black Sea region
	(Abbad, Morris, & Nahlik, 2009)	TAM	SEM	486 undergraduate students, the Arab Open University
	(Cuesta, Abella, & Alegre, 2014)	TAM	DS, Correlation	51 students
	(Kilic, 2013)	TAM	SEM, FA, Regression	501 students
	(Kilic, 2014)	TAM	DS, SEM, regression	501 students
	(Majdalawi, Almarabeh, & Mohammad, 2014)	TAM	FA, ANOVA	240 students
	(Padilla-Meléndez, Águila-Obra, & Garrido-Moreno, 2015)	TAM	SEM	386 students
	(Mijatovic, Cudanov, Jednak, & Kadijevich, 2013)	TAM	Correlation	185 fourth-year undergraduate students of the largest state university in Serbia
	(Islam, 2013)	TAM	PLS	249 university students participating in hybrid courses
	(North-Samardzic & Jiang, 2015)	UTAUT	PLS	227 students and 140 academics
	(Baytiyeh, 2013)	UTAUT	FA, ANOVA	189 professors and 1,867 students at the American University of Beirut
	(Marques, Villate, & Carvalho, 2011)	UTAUT	DS	Professors of *Instituto Superior de Engenharia do Porto*
	(Islam & Azad, 2015)	UTAUT	ANOVA, PLS	249 students and 185 professors in a Finnish university
	(Islam, 2015)	UTAUT	PLS	233 students and 70 professors in a Finnish university
	(Garcia et al., 2015)	---	M-W, KW, FA, Regression	606 students from two universities
Facebook	(Borrero, Yousafzai, Javed, & Page, 2014)	TAM	SEM	214 university students in Spain
	(Park, 2012)	TAM	SEM	584 students
	(Pinho & Soares, 2011)	TAM	SEM	150 university students
	(Mahlangu, 2014)	TAM	SEM	269 students drawn from a South African public higher education institution located in the Gauteng province
	(Teo, 2016)	TAM	SEM	498 students from a public-funded Thailand university
	(Teo & Jarupunphol, 2015)	TAM	SEM	498 students from a university in Southern Thailand
	(Sharma, Joshi, & Sharma, 2016)	TAM	SEM	215 Omani students
	(Tantiponganant & Laksitamas, 2014)	TAM	SEM	350 freshmen university students
	(Thongmak, 2011)	TAM, TPB	DS, FA, Regression	224 students of Thammasat Business School
	(Thongmak, 2014)	TAM	DS, FA	224 students of Thammasat Business School
	(Kanthawongs, Kanthawongs, & Chitcharoena, 2013)	TAM	Regression	57 undergraduate students enrolling in Bachelor of Business Administration

	(Albayrak & Yildirim, 2015)	TAM, TPB	DS, M-W, Correlation	42 students of Introduction to Programming and Discrete Mathematics courses
	(Bonsón, Escobar, & Ratkai, 2014)	TAM, TRA, UTAUT	PLS	732 European university students
	(Escobar-Rodriguez, Carvajal-Trujillo, & Monge-Lozano, 2014)	UTAUT	PLS	956 students enrolled in a Spanish public university
	(Mouakket, 2015)	---	SEM	397 undergraduate students
	(Sanchez, Cortijo, & Javed, 2014)	---	SEM	214 undergraduate students at the University of Huelva (Spain)
	(Wang, Xu, & Chan, 2015)	---	PLS	110 undergraduate students of non-computing faculties in a large Singapore university
	(Yang & Brown, 2015)	---	FA, Path analysis	321 college students attending a major Midwestern university
Facebook, YouTube	(Akbari, Ahmadian, & Mohsenpourkebria, 2013)	TAM	Regression, t-test	232 completed questionnaires from 70 lecturers and 162 students
	(Yoo & Huang, 2011)	UTAUT	DS, t-test	183 students (83 American and 100 Korean)
YouTube	(Jung & Lee, 2015)	UTAUT	DS, ANOVA, Regression	569 students (90 from the USA and 479 from Japan) and 56 professors (27 from the USA and 29 from Japan)

Legend: DS - Descriptive statistics; FA - Factorial analysis; PLS - Partial least squares; SEM - Structural equations model; M-W - Mann-Whitney test; KW - Kruskal Wallis test.

Concerning the acceptance of Moodle by students, the following results should be highlighted: students have a positive attitude toward using Moodle, intend to use Moodle in the future (Chen et al., 2012) and believe that a LMS will be more useful to them if it is easy to use (Abbad, Morris, & de Nahlik, 2009). In general, students consider Moodle the more important the more their professors use it (North-Samardzic & Jiang, 2015). However, if a professor decides to use a LMS in his / her course, its use becomes somewhat mandatory for students (Islam & Azad, 2015). For both professors and students, the ease of use of Moodle is the most important factor that influences the intention to use it (North-Samardzic & Jiang, 2015). Some studies concluded that Moodle is a tool that helps professors: (i) to better organize the time, (ii) to manage the content of the subjects and (iii) to centralize the information and communication with the students (Padilla-Meléndez, Águila-Obra, & Garrido-Moreno, 2015). Islam (2013) stresses that professors should play more active roles in course pages, such as keeping them up-to-date, uploading learning material before face-to-face lectures, moderating, and participating in student discussions when necessary.

Regarding Facebook, the perceived ease of use and perceived usefulness have impact on attitude toward Social Networking (Pinho & Soares, 2011). The perceived usefulness and ease of use by students and professors drive students' intention to adopt Facebook (Thongmak, 2014).

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