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When Grad Students Adopt Technology Applications: An Exploratory Study in a Virtual Learning Environment

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To identify the factors that drive graduate students to adopt technology applications in their learning process and thereby we offer insights into the design and implementation of new learning methodologies and resources.
Study Design: Utilization of audio-visual cases in an e-learning environment.
Place and Duration of Study: Open University of Catalonia (Spain), May 2012.
Methodology: This study has involved a sample of 32 business students and has an exploratory nature. Due to the small sample size we used non-parametric statistical techniques and the Mann-Whitney U test to determine if students' perceptions reflected their assessments on

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material design and its effects on the development of their academics activities. Among non-parametric statistical techniques, the Mann-Whitney U statistic is comparable to an analysis of variance in samples that are less than 30.

Results: Among this sample, 56.5% are women. With regard to age, more than 60% fall in the range of between 25 and 45 years of age, and of these, 53% are older than 35 years. In relation to experience, 52.2% indicate they have more than 15 years' work experience. Yet we found no significant differences across these categorizations in terms of students' perceptions of the audio-visual material. So, students between 25 and 35 years of age consistently present very positive perceptions of the use of these materials, and for the more specific category of 35–45 years, the percentage increases to 76.5%. When students have significant work experience, 58.5% of them express positive perceptions of the use of audio-visual materials.

Conclusion: Students express positive attitudes toward a new technological resource "audio-visual cases", noting that this tool improved their comprehension of the problem and its origin. In addition to revealing which elements influence in students' adoption of new methodologies and resources that rely on intensive technology use.

Keywords: Critical thinking; e-learning; audio-visual case; labor competencies.

1. INTRODUCTION

Universities seek increasingly to find and incorporate different and innovative models of education and research in order to better align with business models and to meet market demand [1,2,3]. Attention is paid to knowledge transfers across universities and industry as well as improved transfer mechanisms [4-7]. In response, relevant research investigates business–university cooperation, transfers of knowledge, and research networks, which might comprise various structures, such as incubators or science parks that foster entrepreneurial activity through the exploitation of research results and spin-offs or start-up firms. To redesign degree programs and teaching activities, educational efforts takes into account the requirements of market demand in order to help students acquire the skills and competencies needed for their professional activity.

Several factors advance these shifts such as limited financial resources and intensive and global competition, the innovation of new teaching methods, the intensive use of information and communication technologies (ICT) as well as the European legislative framework (EHEA). Further, modern universities must acknowledge the modern student profile, including digital natives who regard learning as an ongoing process, since they demand theoretically based and practical training that will grant them skills immediately applicable to their jobs [8,9]. As a result, universities must develop innovative formulas of action which help them meet market demand and, in turn, achieve a sustainable competitive advantage [10,11]. Some schools provide advanced ICT as a learning support tool, in combination with innovative methods of learning to facilitate students' acquisition of skills and competencies. So, the innovation teaching project at UOC aims to provide students with the labor skills needed for their jobs, combining ICT with new methodologies and learning resources.

This innovative project is defined as a mean to develop and assess competencies professionals required in business environment, such as critical thinking which is a fundamental ability in decision making. The project uses different innovative teaching methodologies, such as: learning-by-doing and case studies based on ICT. Therefore, its main aim is to help students develop and apply critical thinking competences immediately in their work.

An appropriate identification of factors that encourage students to embrace new learning methodologies and resources is the prior step to implementing a new education model. Just like that, drivers of students' technology adoption that contribute to students' acquisition of key competencies are analyzed in this work.

This paper is organized as follows. Firstly, we present UOC's educational model and a profile of its students. UOC is a completely virtual university that uses ICT intensively. Further, the reasons why UOC uses a teaching innovation model though new technology resources to support student learning. Then, a theoretical model for predictions about technology adoption is determined. This done, we carry out an

exploratory study to test for the applicability of our theoretical model to actual learning resource quality by means of an empirical analysis. The findings show what factors encourage students to adopt new learning methodologies and resources, based on ICT use, and suggest that these methods improve student understanding and increase their motivation to acquire and assimilate key competencies. Eventually, we highlight the effects of students' age and degree level on the obtained value from this new methodology.

2. THEORETICAL FRAMEWORK

The conceptual foundation for this study comprises both the broader academic priority to methodologies to help students effectively develop competencies required in business environment, as well as the specific challenge of this effort for online universities, such as UOC. It is certainly necessary to continue to innovate in education, incorporating new methods and approaches of psychology area where the education and learning can be adapted to students' demands, such as: their online education needs and for their professional life, beyond simple willingness of students and UOC to adapt to the reality.

2.1 ICT Use at the University Level

Because of ongoing social shifts, companies demand increasingly knowledge and competences related to the use of ICT in work setting, which encourages universities to adapt their educational model. Any university graduates should be able to use ICT as well as find, process, understand, interpret and analyze relevant information for decision making. Accordingly, ICT can be seen as a learning support tool which builds a positive learning environment and, in turn, leads to improve students' acquisition of relevant skills and competencies, if it is effectively used along with new learning techniques, such as learning-by-doing and case studies. Concerning the UOC model, based on collaborative learning, offers an appropriate setting in order to analyze whether students develop distinctive competencies, such as critical thinking, through teaching that uses audio-visual cases [12].

2.2 The UOC's Educational Model

People between the ages of 30 and 50 years demand increasingly university and post-graduate education, and traditional university models cannot be able to face it. Furthermore, the student's profile has evolved; most of them live far from any school and must reconcile work and family life [13,14]. Consequently, the Open University of Catalonia (UOC) was created in 1995 as an institution of a digital society, with the goal of supporting lifelong learning endowed with a flexible structure and a specific educational model, based on the intensive use of ICT.

The student is the key element for the educational model of UOC [15,16]. Thus, it focuses its efforts on aligning personal and professional students' needs through the use of technology and in accordance with the requirements of business and society in general. In this sense, UOC's educational model relies on five main principles: dynamism and flexibility for adapt to students' needs; cooperation among different agents in the teaching–learning process, to enable knowledge generation; interaction among all agents involved: students, teachers, staff, and so on, in order to generate community; and personalized student attention. Additionally, it takes into account emerging student profile concerning age and professional experience. As shown in Table 1, the average age of UOC students is over 30, and exceeds the average age for other Spanish universities.

There is a high participation of UOC students in the labor market, approximately 90%, which impacts significantly on the required training and educational models. In fact, the students assert that the principal goal for continuing their university studies is career success; only 23.3% of UOC students continue their education for personal enrichment. In other words, the main reason for choosing UOC relates directly to the students' occupation.

While, only 8.0% of UOC students indicate that they are employed, an internal satisfaction

Table 1. Average age "UOC students"

	2005	2006	2007	2008	2009	2010	2011	2012
Average ages	30.3	30.9	31.2	31.9	31.9	32.8	33.4	32.4

Source: UOC data

questionnaire of the UOC reveals that 70% of its students have a job, so we suppose that a part of these students probably is working. It is important to highlight that 30.5% of UOC students are self-employed. Thus, these findings show a clear difference between UOC and traditional students' profiles.

In brief, the UOC pedagogical model aims to facilitate students' acquisition of knowledge and skills required to develop competences in their professional life. Moreover, students enroll in UOC, rather than other universities, pursue reconcile its personal life, work life and their education, so they can be defined as "forced digital emigrants". A characteristic feature is that UOC student is over 30 years; it emphasizes the need to achieve the conciliation.

3. THE TEACHING INNOVATION PROJECT

As discussed earlier, this aim of this project is to develop a methodology based on audio-visual case studies in an e-learning environment. The content of management courses often resonates well with a case study method, because the realistic presentation enables students to explore a topic in a real-world setting. In this way students are better able to appreciate and understand the difficulty facing managers in decision-making. Currently, the most common form cases present in a paper version. In this regard, Harvard Business School is the largest single producer of business cases, and its case-based management training programs date back to the beginning of the last century. However, modern undergraduates often have trouble working with long, written cases, such that they cannot analyze or apply the relevant elements. Audio-visual communications offer an appealing alternative [17-19]. Therefore, UOC has adopted an audio-visual case methodology that was developed in traditional higher education settings and applied it to a virtual learning environment.

3.1 Project Methodology

The educational innovation project consists of several phases.

Phase 1: Define and implement the methodology. To enhance teaching and students' performance, an audio-visual case methodology has been adopted in the management accounting course, required for a business administration degree at UOC. This course is fundamental to help students develop their critical thinking skills, so we created audio-visual clips relevant to our teaching goals in order to facilitate students' acquisition of theoretical concepts. Further, we also fostered teamwork skills, because students had to work together to resolve different cases. In an online learning environment, student groups can be more challenging, so we had to define clear rules for functioning and interacting at the very start of the semester.

Based on past experiences in audio-visual cases methodology, we chose to use them to achieve two purposes, beyond developing students' critical thinking competence:

1. To explain course material, and so, student can understand and assimilate them in an entertaining way.
2. To teach how to detect and solve organizational problems to students.

The first step was to explain the lesson (or lessons involved in that clip). After that, we advise students that they would be working with an audio-visual clip to detect and define an organizational problem, and create a solution.

Before assigning the questions to each group of students, we presented the case, along with a deadline for delivering the case solution. In this case, students had to carry out a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. Groups could view the audio-visual case to answer the question as many times as they believed necessary, because it was uploaded to their virtual classroom. Once they answered the questions, they sent their resolution, via the virtual campus, to the lecturer. Subsequently, every solution of each group was shared with the rest of students, so a feedback in the form of a peer review was generated. Students had 10 days to review and return the other group's solution. In the last step, they discussed the results with the entire class which provided general feedback on a class forum.

Phase 2. Create the audio-visual case database. To make available various clips, we build an audio-visual case database, based on based on different theoretical concepts concerning this subject. Clips, of a maximum length of 20 minutes, was taken from films, based on real facts. It was edited through the QuickTime software (Apple). The exact number of cases to create will depend on the topics and films available that relate to the key topics.

Phase 3. Development of students' competence. Groups consisted of 5 or 7 students whose work was to provide solutions for the audio-visual case. They likely will rely on virtual platform tools, such as wikis. To evaluate the students' work, they must be able not only to develop critical thinking competences and link theory presented through the course with the case situation, but also to make timely, effective, well-reasoned decisions. Additionally, student participation will be taken into account in the evaluation, according to the online platform, measured as the number of procedures performed by each student.

Phase 4. Evaluate students' perceptions. In this phase, we will evaluate students' perceptions, reactions to, and suggestions about the implementation and use of this methodology with a questionnaire which consists of 30 questions with multiple answers. Only one answer will be correct for each question, though in some cases, the correct answer will be "all of the above" or "none of the above." We distributed this questionnaire at the end of the semester, so students could assess and themselves and their colleagues. In doing so, we used the virtual platform, which eliminated the potential for errors in transcribing data and automatically estimated the time spent by each student on completing the questionnaire.

As noted previously, this project aims to increase students' acquisition of critical thinking skills by means of the use of audio-visual cases. The success of this process mostly depends on students' uses of audio-visual resources. Therefore, we must identify not only what factors encourage them to use the technology, but also assess how technological resources contribute to students' competence acquisition. Accordingly, in the next section, we review theoretical models of technology adopting in a learning context.

4. DRIVERS OF STUDENTS' TECHNOLOGY TOOLS ADOPTION

Understanding how people accept and use technology in various contexts (e.g., investments, study, purchasing) is a major concern for both scholars and practitioners [20]. Several studies compare the predictive abilities of different technology adoption and use theories and indicate that a model's explanatory power increases if it incorporates concepts from multiple theoretical frameworks [21-23]. Most methods start with the theory of reasoned action (TRA) as formulated by [24], which states that a person's behavior depends on his or her intentions, which in turn depend on social influences (subjective norms) and attitudes toward performing the behavior. Any other factor that influences behavior does so indirectly, through subjective norms and attitudes.

The TRA was applied widely in the 1980s; its strong explanatory power and consistency with other studies allowed it to predict a wide range of behaviors [25]. It also prompted two influential models: The theory of planned behavior (TPB; [26]) and the technology acceptance model (TAM; [25]), both of which corroborate the role of individual intentions as triggers of behavior. For example, according to the TPB, the intention to act is the best indicator of performance, because it indicates the effort that people are willing to undertake to bring about an action. The model features three exogenous variables that explain behavioral intentions: Attitude toward the behavior, subjective norms, and perceived control. In turn, the TAM—which has received perhaps the most academic attention—adapts the TRA to focus on new technology usage behavior. With its analytical simplification of previous models, the TAM evaluates factors that affect people's attitudes and intentions, proposing that the decision to adopt a technology is based on the technology's degree of functionality and interface features [27,28]. In particular, the TAM predicts that the use of ICT is conditional on two beliefs about that technology: Perceived usefulness (PU) and perceived ease of use (PEOU).

Perceived usefulness refers to the degree to which the person believes that using a particular system will improve her or his performance in the activity; PEOU indicates the degree to which she or he believes that using a particular technology will enable her or him to exert less effort while performing duties [25]. The TAM indicates a dual effect of PEOU, leading to both greater intentions to use technology and greater perceptions of value. Following this logic, [25] explains that improving PEOU can be instrumental for contributing to increased performance. The model also acknowledges the existence of external variables, related to individual differences or situational constraints that directly influence PEOU and PU. Through such perceptions, all external variables should have indirect influences on attitudes toward use, intentions to use, and actual usage behavior.

The TAM is the most widely applied theoretical system in information systems research, and it represents a well-established, robust theory. It consistently exhibits greater explanatory power than other models [29,30]. Therefore, the two key variables in the TAM likely trigger attitudes. Studies have applied the TAM to analyze the adoption of online banking [31] web-based training models [32], and current and future Internet uses as a learning environment [33,34,35]. In accordance with such studies, we ask:

RQ1. How does the perceived utility of technological tools used during learning processes influence students' attitudes?

In addition, PEOU should influence attitudes through self-efficacy and instrumentality. The easier it is for a user to interact with a technological system, the greater his or her sense of self-efficacy and personal control will be. This influence is especially important when the technology's use is intrinsically linked to the performance of specific duties, consistent with the initial TAM precepts of [25] who postulate that PEOU indirectly affects usage intentions through PU. In learning environments, [35] find a positive effect of PEOU on students' intentions to adopt technological tools. Thus,

RQ2. How does the perceived ease of use of technological tools used in learning processes influence students' attitudes?

Despite its widespread acceptance, the TAM suffers from several limitations, mainly because it ignores the influence of other types of variables. [36] and [30] call for efforts to increase the explanatory power of this model by incorporating additional variables. According to [25], identifying variables such as those in TAM can increase the explanatory power of system users' acceptance [29], which is particularly important in the field of higher education, where elements such as tools–learning–environment fit and personal or socioeconomic traits likely affect adoption decisions.

As well as, by accounting for the contributions of models that stress the importance of users' profiles, including the TRA and TPB in the model, we analyze an expanded model that includes students' age, gender, and professional experience in predicting their uses of technology. [37] similarly recommend incorporating variables that define student profiles and might determine their ICT use in learning activities.

RQ3. Do student profiles influence their intentions to use technological tools in learning processes?

Finally, the technology tool (as a learning resource) for adopting a virtual learning environment is a required condition for two reasons: ensure its proper functioning, as well as to guarantee obtaining a satisfactory result. The context that surrounds the learning process determines the types of resources in use and their characteristics. For example, in contrast with a conventional learning context, an online learning environment enables the use of advanced technological resources, such as wikis, chats, or videos, such that students have a more active role in the learning process [38,39]. Students can set the pace of their learning, as well as the place and times they engage in their schoolwork, which requires them to adopt resources specific to the environment in which their learning process takes place [40].

RQ4. How does the adaptation of the technological tool to the learning environment influence students' attitudes?

5. INITIAL EVIDENCE

5.1 Methodology and Study Variables

As stated at the beginning of this paper, this is an exploratory study, and for this reason, with the objective to prove our theoretical model, it was performed on a small sample of business students, particularly, in the subject of management accounting (Degree of Business Administration), using a simple random sampling The study specifications are shown in the following table (Table 2).

Table 2. Study specifications

Sampling universe	32 enrolled students
Sample	27 students
Interview	Electronic
Margin of error	$\pm$ 7.6 (p = q) at the 95% confidence level
Fieldwork dates	May 2012

To respond to our study, we consider the dependent variable "perception audio-visual material use". It is a dichotomous variable where 0 indicates a negative valuation and 1 is a positive valuation. For the other hand, the variables that appear in the Table 3 and which are part of the theoretical model, serve as independent variables.

Table 3. Variables of the study

Dimension	Variable	Type	Definition
Student profile	Perception of the uses of audio-visual material	Dichotomous	Positive or negative perception of the use of audio-visual materials. Where 0= negative 1= positive
	Age	Categorical	1 = 18–25 years; 2 = 25–35 years; 3 = 35–45 years; 4 = 45–55 years, and 5 = older than 55 years
	Gender	Dichotomous	0 = male, 1 = female.
	Professional experience	Categorical	1 = no experience; 2 = experience less than 1 year; 3 = 1–3 years; 4 = 3–5 years; 5 = 5–10 years; 6 = 10–15 years; and 7 = more than 15 years' work experience
Perceived utility	Students can identify the problem	Categorical	After viewing the film clip, the student can understand the problem to be solved; 1 = strongly disagree to 4 = strongly agree
	Students can understand the problem	Categorical	The use of audio-visual material in the practical cases made it easier to understand the problem; 1 = strongly disagree to 4= strongly agree. The variables have 4 values, where 1= strongly disagree and 4= strongly agree.
	Students finds Ideal solution	Categorical	The contents studied in the subject allowed students to find an ideal solution to the raised problem; 1 = strongly disagree to 4 = strongly agree
Perceived easy of use	Students obtain information	Categorical	Unlike other types of resources, audio-visual materials allow students to gain much information, with less time and effort; 1 = strongly disagree to 4 = strongly agree.
	Student devote attention	Categorical	Students attend to the information over the short duration; 1 = strongly disagree to 4 = strongly agree.
	Funny work	Categorical	Work with audio-visual cases seemed more funny and stimulating than using other types of resources; 1 = strongly disagree to 4 = strongly agree
Tool adaptation to learning environment	Adapted to the classroom	Categorical	Audiovisual cases were adjusted to virtual classroom model; 1 = strongly disagree to 4 = strongly agree
	Appropriate time	Categorical	The time for the activity was sufficient; 1 = strongly disagree to 4 = strongly agree.
	Activity design	Categorical	The activity was designed and planned correctly; 1 = strongly disagree to 4 = strongly agree
	Adjustment model UOC	Categorical	Audio-visual materials fit UOC's educational model; 1 = strongly disagree to 4 = strongly agree

Source: Own formulation

Thus, the variables which we have chosen as a reference point to audio-visual case design were: quality of the information, time available, content of the course, the virtual classroom and

educational model of the university. The analysis conducted for evaluating if students assimilate practical skills shown that students are capable to carry out the problem posed, proposing a solution to the problem. Furthermore, they perceived that this type of cases is a fun way to learn and, accordingly, students prefer this material on others. Demographic variables were also included. Such as: age, work experience, gender, and, finally, time enrolled at university under study.

Once we established the different variables, we considered necessary that variables: age, and work experience were two dichotomous variables with the objective of clarifying the influence of both variables on students' responses. So, the age variable appears with five categories and the work experience variable with nine. In this context, if the student did not show in the particular category the value will be equal to 0 and 1 otherwise.

5.2 Data Analysis

Below in Table 4 shows the analysis performed considering student profile and how it can effect on the perception of students in respect of: the design of audio-visual case and its effects on their academic activities.

Due to it is exploratory study with its small sample, we conducted a data analysis method that used non-parametric statistical techniques. From this sample we extracted that 43.5% are men. With respect to age, more than 60% are in the range corresponding to 25 and 45 years of age, and within a same interval, 53% are more than 35 years old (Table 4).

Continuing with the analysis of work experience, just as shown in Table 5, students exceed 15 years but this variable does not reveal a meaningful impact on the perception of this new format of cases. Rather, students in the age range between 25 and 35 have shown very positive perceptions of the use of these types of materials. Curiously, this impact increases as a student's age. So, in the case of 35 to 45 years old, the percentage is about 76.5%, meanwhile, if we look at students with an important professional experience, we can observe that the percentage is about 58.5%.

Then, Mann-Whitney U test[1] has been used to assess students' perceptions regarding the design of material and whether they had had any effect on the development of their academic activities. In line with the effects on academic activities, in Table 6, a positive perception at the 73.9% is observed. Moreover, students aged between 25 and 45 years and with more than 15 years of work experience showed that have understood the problem and have found entertaining, in consequence, they prefer this format of material over others, at the 99% or 97% confidence levels.

Next, we provided if students obtain information, devote attention and find this format fun, namely, perceived easy of use. The results –as shown Table 7 - evidence that students prefer these cases to others, because these cases are more attractive to understand and resolve. On the other hand, students consider them in line with UOC's educational model.

The planning processes, based on using this type of activity and its adequacy for supporting virtual classroom models, and thus UOC's educational model, does not have significant effects on students' perceptions of these types of materials (Table 8).

Table 4. Age and gender

	Student profile					
	Age 18-25	**Age 25-35**	**Age 35-45**	**Age 45-55**	**Age More 55**	**Gender**
Mann-Whitney U	45,000	30,000	29,000	43,000	48,000	35,000
Wilcoxon W	66,000	51,000	182,000	196,000	69,000	188,000
Z	-.860	-1.843	-1.865	-.783	-.594	-1.303
Asymp. Sig. (2-tailed)	.390	.065	.062	.433	.552	.192

[1]Among non-parametric statistical techniques, the Mann-Whitney U and the Kruskal-Wallis statistics are equivalent to analyses of variance. The Mann-Whitney test is suitable for variables with two samples of different sizes and for samples with fewer than 30 individuals.

Table 5. Work experience + time

	Student profile			
	Not professional experience	**Experience less 1 year**	**Experience 1 - 3 years**	**Experience 3-5 years**
Mann-Whitney U	51,000	51,000	51,000	45,000
Wilcoxon W	204,000	204,000	204,000	66,000
Z	.000	.000	.000	-.860
Asymp. sig. (2-tailed)	1.000	1.000	1.000	.390

	Student profile		
	Experience 5-10 years	**Experience 10-15 years**	**Experience >than 15 years**
Mann-Whitney U	47,500	39,000	29,500
Wilcoxon W	68,500	60,000	182,500
Z	-.343	-1.279	-1.738
Asymp. sig. (2-tailed)	.732	.201	.082

Table 6. Perceived utility

	Perceived utility		
	Students can Identify the problem	**Student can understand the problem**	**Student finds Ideal solution**
Mann-Whitney U	33	24,5	30
Wilcoxon W	54	45,5	51
Z	-1.409	-2.062	-1.612
Asymp. sig. (2-tailed)	0.159	0.039	0.107

Table 7. Perceived easy of use

	Perceived easy of use		
	Students obtain information	**Students devote attention**	**Funny work**
Mann-Whitney U	39,000	49,000	16,500
Wilcoxon W	60,000	70,000	37,500
Z	-1.000	-.151	-2.628
Asymp. sig. (2-tailed)	.317	.880	.009

Table 8. Tool-adaptation to e-learning

	Tool adaptation to learning environment			
	Adapted to the classroom	**Appropriate time**	**Activity design**	**Adjustment model UOC**
Mann-Whitney U	47,000	36,500	49,500	17.500
Wilcoxon W	68,000	57,500	70,500	38.500
Z	-.332	-1.104	-.131	-2.508
Asymp. sig. (2-tailed)	.740	.269	.896	.012

6. CONCLUSIONS, LIMITATIONS AND FURTHER RESEARCH

Teaching and research have to date been the main activities of any university, but attention is increasingly paid to knowledge transfer. In fact, it is seen as a key factor for the future sustainability of university education, as well as for the social and economic development of localities, although academics and professionals have some doubts about the effects and influence of transfer knowledge over research and teaching.

Universities as social agents recognized by the EHEA, must learn the new requirements of the society and, based on this, provide education to their students to meet those needs, competently

and professionally. The development of suitable knowledge, skills, and attitudes to perform a task can lead to achieving desired outcomes within a specific context and according to established standards or conditions. Thus, students are the core of competency-based training systems who have an active role in the learning process, and knowledge co-creation is key. Consequently, teaching models focus on students' learning models which must be dynamic, flexible, cooperative, personalized, and interactive, since business market increasingly demands professionals with specific and distinctive competences to apply immediately at work.

In this innovative model proposed, students decide what gets learned and how according to their needs, besides it also requires students to have up-to-date technological knowledge through the intensive use of ICT. Accordingly, students who provide with profiles that differ from those at traditional universities, this online character is attractive to them. Because of several factors such as the need to combine personal and professional life, and the particular age of UOC students, they increasingly demand a practical education that enables them to:

(1) Build distinctive and professional competencies.
(2) Implement these competences immediately in their work.
(3) Use ICT tools not only make the learning process more motivating, attractive and fun, but also simplify and speed up it.

Critical thinking is one of the competencies that UOC students must develop and put into practice. New teaching methodologies and tools, such as learning-by-doing and audio-visual case studies, are helpful in ensuring the acquisition of such competences. The results from a pilot sample of students reveal that students have positive perceptions of the use of such materials and prefer them over other materials. They offer relevant information for identifying and analyzing problems, and they facilitate the development of practical activity, by making it more fun.

We attempt to kindle this research line with our study, but it is only an initial phase. Although the findings are interesting, further research should seek to test them, focusing on other types of student. Furthermore, it would be interesting to carry out a parallel study involving a larger sample, to determine whether the results can be generalized, since using this methodology, students acquire not only competencies, such as: critical thinking, but also teamwork and negotiation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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