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ICT IN HIGHER EDUCATION: AN EXPERIENCE WITH E-BOOKS

Abstract

The present paper seeks to explain the diverse advantages of virtual books and also the main barriers that make it difficult their implementation in the classroom. A brief review of the literature on ICT, e-learning, distance education and e-books will be complemented with a case study about the preparation, development and implementation of an e-book. The paper could be helpful both for systems analysts and for teachers when they are developing and implementing e-books.

1. INTRODUCTION

Recent years have been characterized by an extensive growth in the use of Information and Communication Technologies (ICT) in the education. These technologies not only have provided tools for data analysis or access to huge scientific resources, but also enable students to communicate with each other or with their teachers or instructors through email, electronic forums etc. [1]. E-books represent one of the recent applications of ICT in the educational arena.

Although the expression "e-book" or "electronic book" is not new, its meaning is not completely clear either. The definition of e-book is not confined to any digital text which can be read on an LCD screen. In fact, it implies many more concepts. The first attempts that were made in the development of e-books took place in 1970 with the so-called Gutenberg Project, at Illinois University [12]. E-books were usually published in CD-ROM or made to be used in PDAs (Personal Digital Appliances) at the time. Nowadays, e-books are accessible in a wide range of devices, including PCs, PDAs, BlackBerry's, pocket PCs, tablets, mobile telephones and iPods [10].

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In the early 21st century, the e-book industry has grown to a considerable extent, but the e-book market on a European level has not been too successful yet. In fact, many publishers have not launched themselves into the world of e-books because they fear the effects on their revenues. However, they have invested in the production of supplementary electronic material, such as CD-ROMs or links to web pages, meant to support the sale of their conventional books. Vassiliou and Rowley [12] propose a definition of the e-book concept in two parts. The e-book is a digital object with textual or another type of content which arises as a result of adding the characteristics provided by an electronic environment to the familiar book concept.

Furthermore, e-books typically have features such as the search and cross-referencing function, links to hypertext, bookmarks, notes, underlining or highlighting, multimedia objects and interactive tools [8].

While the first part of the definition is quite well-defined, the second one gradually changes as e-books are further developed [12].

The present paper discusses electronic books and the broadest concept of ICT, e-learning and distance education, especially supported on mobile technologies. For this purpose, a brief review of the literature about these topics will be complemented with a description of our experience in the preparation, development and implementation of e-book publishing software.

2. LITERATURE REVIEW

E-learning can be defined as the delivery of educational and learning programs through electronic means, including the Internet, Intranets, audio/video tapes, interactive TV and CD-ROM. This term is utilised as a synonym of the expression "technology-based teaching" and implies a greater variety of equipment and facilities than on-line education or teaching alone. E-learning comprises not only synchronous teaching, such as real-time chats, video/auto conferencing, web-based conferencing, etc. or asynchronous teaching, but also self-learning methods, the mere exchange of e-mails with mentors, instructors or lecturers, or the use of an electronic discussion group [2]. In short, e-learning implies the full integration of ICTs into educational processes.

The concept of e-learning has been linked to that of mobile technology in recent years [7] because the miniaturisation of ICTs has led users to demand all the possibilities that these technologies can offer us in a mobile format. Hence the idea of mobile learning, or m-learning, which consists in the type of learning that occurs through different locations and benefits from the opportunities provided by portable technology. Mobile learning takes place on actual students' demand because they can make the best of their time in their learning processes anywhere and at any time.

Several aspects related to mobile technology make it different from the point of view of teaching and learning. First of all, mobile devices are nearly always with students. There are three things that people always carry with them today: the keys, the wallet and mobile technology, which includes the mobile telephone and the PDA. They usually have these mobiles on them not only because they want to be reachable but also because they are a tool for taking down notes, finding a place or searching for information. Thanks to its easy access, mobile technology makes it easier to study anywhere and at any time. Students can somehow guide their own learning, through which that learning can become more efficient [2].

Mobile technologies are not restricted to informal learning. Numerous schools and universities use it to manage tasks such as calendars and timetables, task assignments, reminders, announcements, enrolment and communications between the household and the study centre.

The utilisation of ICTs in teaching processes presents multiple advantages, like the following ones:

Interaction: ICT-based learning is interactive. Using an interactive learning system can increase the student's enjoyment and can also enhance aspects such as understanding, effectiveness and efficiency in the long term. It additionally helps to improve their motivation and confidence. The learning environment can be referred to as interactive if it allows the student to perform tasks such as navigating through it, receiving feed-back from his own actions, selecting information, answering questions using the keyboard or the mouse, touching the screen or via voice, solving problems, creating presentations, collaborating with others, and thus becoming involved in all sorts of learning activities. Learning interaction can occur at three levels: a) student-instructor, when the student interacts with an expert; b) student-content, when interaction only exists with information and various contents; and c) student-student, when students have the chance to interact or cooperate with one another [9]. The interaction between students and teachers through ICTs reduces the cultural and communication barriers that separate these two human groups.

Cooperation: ICTs are naturally social technologies, which is why they improve cooperative learning. Therefore, they can help students to share information through the creation and upkeep of their own social networks. Data exchange as well as the collaboration with other students allows students to satisfy their innate need for communication. A shared environment can be created by connecting students' PDAs or their computers to data collections or to a communications network. Furthermore, different studies [3] have proved that collaborative learning, defined as the activity which makes learning easier through social interaction, leads to better academic results. Students learn more, can better retain what they have learnt, develop a higher reasoning level and feel more valued and self-confident.

Individuality: Many e-learning programs include the possibility of introducing several difficulty levels which can be adapted to different students.

Change of roles: As mentioned above, ICTs promote interaction and communication among students; in other words, they are encouraged to discover the principles by themselves. This means a role change within the learning process that is in keeping with the demands of the new EHEA. In fact, the EHEA at least theoretically leads us to a more student-centred teaching system, as students must become the real protagonists of their own learning [11]. Teachers consequently abandon their role as a "source" of knowledge, assuming another as a "guide" or "counsellor" towards knowledge, as this role can not only be found in the teaching staff but also in multiple formats, both traditional (books, journals, conference papers) and virtual ones. The teacher only gives assistance in learning and design activities meant to ensure a high interaction level between the students themselves and with the learning materials as well. This means that the teacher's role changes to become a facilitator who provides general guidelines and allows students to explore around the course materials without any restrictions. The teacher must explain how to learn and how to use electronic tools effectively, acting as a guide for the student to be able to navigate through the different resources [4].

Time, flexibility: ICT use will most probably reduce learning costs and time through the physical reduction of classroom attendance and its consequences. The aim is not to eliminate face-to-face interaction but rather to reduce it, to complement it with technology [9]. Moreover, the demand for ongoing training among professionals has to face limits regarding time, financial resources and responsibilities that workers have both at work and outside the home. That is why, thanks to their flexibility and mobility, the new technologies represent a suitable tool for us to be able to offer education to those students who have more time-related problems [4].

Competitive advantage: The inclusion of ICTs in teaching-learning processes would be beneficial even if it did not – as it actually does – increase teaching quality, since students acquire a significant competitive advantage in today's globalised and computerised world: these technologies prepare students for the roles and the way of work that they are going to use in their future working environment.

Despite all these advantages, ICT-based teaching is not free from problems and hindrances, both of a technological and essentially of a human nature. With regard to the former, technology developers must place special emphasis on problems related to privacy and security, as these systems can contain different access levels – for instance, a restricted area for teachers, for students, an area for marks and progress – which can be neither visible nor accessible to everyone. Furthermore, technologies must be friendly enough to ensure that learning to use the technological tool is not more complex than learning the

subject matter that one seeks to teach through them. The economy is another basic aspect that needs to be considered; the student must perceive that technological tools are more economical than the conventional media, such as paper books, for instance.

Nevertheless, the most complex barriers for the adoption of ICTs in teaching are undoubtedly of a human nature. Teachers as well as students can have problems when it comes to adopting technology. For example, those students who own more technological skills may have an advantage above the rest and lead themselves to a certain degree of isolation with respect to the less-technologically-gifted ones [14].

As for teachers, some authors [6] distinguish four teaching staff models according to the way in which innovative technologies are incorporated into teaching. The first group is formed by the "entrepreneurs", who are at the forefront both in innovation and in the assumption of the risks associated with it. The entrepreneurs are committed to quality teaching, are up-to-date with educational technologies and have become expert users of those technologies. The second group of teachers can be described as "risk-aversive". Although they are committed to quality in teaching, they are not experienced enough in the field of technology and are therefore afraid of changing their way of teaching. That is why this second group – unlike the entrepreneurs – needs some support and assistance in order to take full advantage of using the new technologies inside the classroom. In third place, some teachers can be described as "reward seekers", that is, they only adopt technologies if they obtain a personal benefit such as promotion opportunities or financial compensations. The fourth group is represented by the "reluctant" ones, who have a low level of technological skills and resist change because they think that they have already invested a great amount of time in the most conventional educational models.

It would be highly advisable to check what kind of teachers we are addressing in order to be able to offer them the support that they need for the implementation of ICTs in the teaching processes. Softening barriers and improving the means and resources available are basic steps when it comes to adopt technologies in the teaching context. ICT-based interactive education requires the existence of training in ICTs not only for students but first and foremost for the teachers themselves, who must learn not only to use those new technologies but also the new teaching methods which are made possible thanks to them [13].

3. METHODOLOGY

The case method was used to observe the pertinence, advantages and drawbacks of ICTs in general and e-books in particular in higher education. This method stands out for being one of the most popular in studies related to ICT implementation inside organisations [5]. Case studies are very well suited to the study of ICTs because they represent a first step in empirical research, especially appropriate when there is little information available about the specific variables to be used. The problem about this method lies in its essentially qualitative nature, which is why it is sometimes criticised for its lack of scientific rigour. To this must be added that it has difficulties when it comes to result generalisation, since it is risky to generalise conclusions from one or a few specific cases.

Despite the aforementioned drawbacks, an effort should be made to eradicate the belief that the *normal* way of doing research basically depends on statistical analyses and large samples. What is more, as opposed to the inflexibility of other scientific methods, case studies are highly flexible, which makes them suitable for the study of phenomena which have not previously received much attention and are therefore ideal for our study object, namely: the implementation of e-books and the advantages and hindrances associated with that implementation.

4. CASE STUDY: LA UNIDIGITAL (THE DIGITAL UNIVERSITY)

Launidigital is a project undertaken by the SIRHO Research Group and financed by the Prosegur Chair of the University of Alicante (fig. 1). Its main goal is the development of software meant to encourage the publication of virtual materials oriented to teaching at all its levels, from primary education to university. The aim is to make authors assume a starring role in the production and edition of their own teaching materials.

Fig. 1. LaUNIdigital presentation [source: own study]

The reasons which led to its development within the group at the end of 2011 are listed below:

– The great disappointment and little interest currently found among the potential authors when it comes to quality book publication, mainly because this activity does not bring any significant economic returns. The big business is done by the publishing companies which take the lion's share of the book's retail price.

– The experience of over 20 years that the SIRHO research group members have as authors of teaching textbooks and as classroom teachers both in undergraduate and postgraduate courses.

– The experience acquired in advisory agreements with five important multinationals for research on teaching methodologies in management matters: Tea Cegos, Deloitte, Randstad, Sage and Walters Kluwer Group.

– The success obtained at the teaching of the course "The community manager in the firm" – which has become a referent in the Spanish-speaking context – through the MOODLE platform.

– The financing provided by the Prosegur Chair of the University of Alicante, which has been used to carry out the acquisition of multimedia material for video recording and editing.

– The economic crisis as an optimum moment to offer alternatives which mean real and significant savings for the student, while simultaneously improving content quality in comparison with the traditional teaching system, a demand fostered by the EHEA.

The results obtained with the project, in the second semester of 2013, can be summarized as follows:

1. A software program in the format of an internet portal (http://www.launidigital.com) which has as its purpose to act as a virtual library in the cloud with five books inside its catalogue.
2. The publication of an e-book entitled "Lessons of Human Resource Management", which includes 150 videos with an average duration of 7 minutes, 400 pages of texts and 60 power point files. More than 500 copies of the e-book have been sold, sales being basically concentrated at the University of Alicante and the Tarragona Rovira i Virgili University.

The experience lived during the development of the launidigital project and the aforesaid e-book is explained next.

4.1. The structure of launidigital software

With regard to project development, the first stage consisted in the analysis of the needs identified by the students enrolled in the Master's Degree in Human Resource Management of the University of Alicante, which was being imparted in a semi-physical format through the MOODLE platform. Based on their experience and their contact with students, the researchers collected the potential requirements for such a portal. A document with technical requirements was drawn up using this information.

Work subsequently started for the design of the portal structure and its functionalities were selected. Once the structure and functionalities had become clear, the attention moved towards the visual line of the portal along with its usability. After determining the graphic line, our next step was to do the design layout in HTML5 for the portal to be visible in any browser. HTML5 was selected because, although it is not a standard for W3C yet, it has been adopted *de facto* by the whole industry. Parallel to the portal design layout process is the development of the computer analysis work oriented to the program structure design.

Our decision to use a database for the project was based on the fact that it allows us to store the data corresponding to students, teachers and books. An estimate for its consumption was carried out in different scenarios, after which a decision was made to use the MySQL technology for its scalability and usefulness in projects characterised by a low simultaneous traffic.

As for the portal, it was necessary to develop two parts: the server part and the browser part. Our decision to use PHP as the development language for server programming stemmed from the fact that it interacts very well with MySQL and also because this language permits to carry out very fast developments. A Linux server – in this specific case the Debian distribution with Apache as web server – was chosen both to execute this language and to install the database.

Portal programming came next. After finishing a first version, a private beta was launched in order to carry out tests internally. These tests revealed a number of bugs that were progressively corrected, ultimately allowing us to launch a public beta that soon became a production version.

This version was launched in September 2012 and, as students used it, they sent us feedback thanks to which new functionalities have been added to the portal.

The software includes a set of modules, each one of which provides the e-book with a number of advantages:

1. Users' system with a student or a teacher profile (fig. 2): The portal allows accessing different functionalities depending on the user profile. Students can buy books, read books and do exams. Teachers can create exams, call for exams and mark them.
2. Storage system for digital books: The portal makes it possible to store books in a digital format and establish security permits to restrict book access exclusively to authorised users.
3. Digital book playback system: Students and teachers can use their browsers to see the content of digital books stored in the portal.
4. Digital book purchase system (fig. 3): The portal provides a payment gateway to buy the books on sale stored in it. Book shopping is connected to the users' system.
5. Book trial system: The portal permits to active a trial mode with the books stored in the portal so that users can see some parts of those books.
6. Exam creation and management: The portal allows teachers to create exams and add questions, either multiple choice test or essay- type ones (fig. 4).

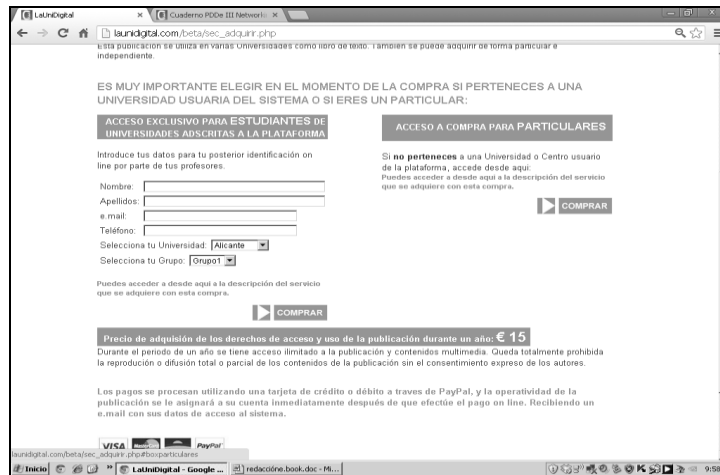**Fig. 2. Teachers' room [source: own study]**

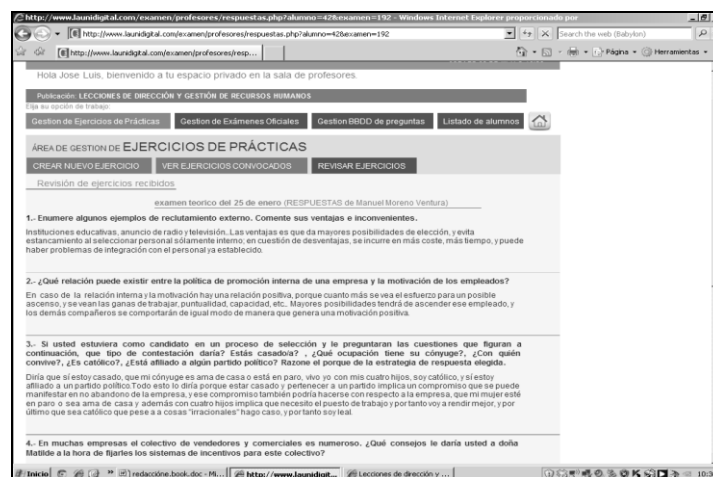**Fig. 3. Shopping (cart) interface [source: own study]**

Fig. 4. Practical exercises [source: own study]

7. Automatic multiple choice test marking system. Test-type exams are self-marked when students answer them.

8. Essay exam marking system: The teacher can mark essay-type exams.

9. User support system: Students and teachers can request technical support to solve any technical incidents through the portal.

10. Multiple media: This portal is accessible from any type of device, whether it is a computer, a tablet or a mobile, even if their design is computer-oriented.

4.2. The book "Lessons of Human Resource Management"

Ever since 1995, the lecturers belonging to the SIRHO group involved in this project have used textbooks in paper format written by themselves and published by Civitas/Aranzadi/Thomson in their classes. The retail price of these books is 35€ at present. As a consequence of the high price, most of the students photocopied the book. The cost of the photocopies with the corresponding coil amounts to 13€ more or less.

A decision was made to prepare an e-book for the purpose of reducing the price and increasing the quality of the book. This e-book would contain all the material from the printed book plus approx. 70-90 minutes of video footage for each unit, a power point per unit and a set of multiple-choice questions so that students could check their degree of comprehension of the topics studied (fig. 5).

Fourteen lecturers specialised in human resource management took part in the video recording process, which meant that content quality was guaranteed. The recordings were carried out at a workshop of the Universidad of Alicante called la FragUA (the initials for a Spanish word meaning "forge"). Each lecturer recorded a specific number of videos with an average length of seven minutes. After their edition, they were lodged in the VIMEO server because it has a very low cost and is more reliable than YOUTUBE (figure 6).
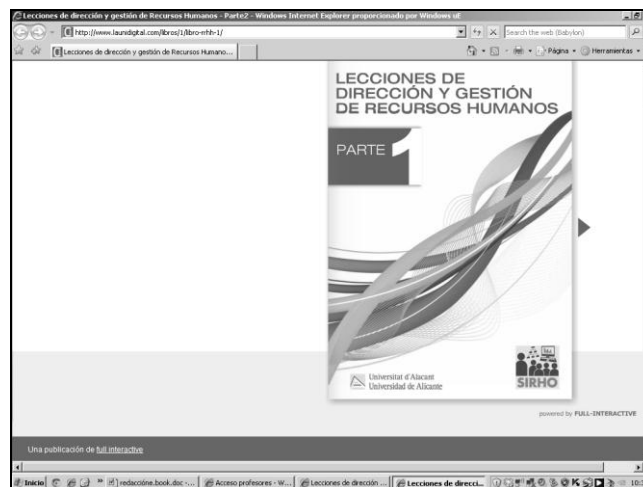

Fig. 5. E-book cover [source: own study]

Fig. 6. Video interface [source: own study]

At the end of the 2012/13 academic year, 400 students enrolled at the University of Alicante and 150 from the University Rovira i Virgili have used the e-book. The experience has been highly positive. The most favourable comments came from those students who had more difficulties to attend classes and the Erasmus students who found it difficult to follow a normal class due to language problems. However, a number of issues have emerged which can influence the effectiveness of these books:

1. The paper culture. The students who have used the book –mostly enrolled in the final degree years– have had physical books all their life; changing that mind-set is hard. The need to underline, to paint with highlighters and touch the folio is still evident.

2. The "totally free" culture. Students are used to paying 30€ for a ticket of a concert or a football match but they have the deeply-rooted belief that everything on the Internet is free and even if it is, it can be copied, even fraudulently. This is the *infringement culture,* which means that computer and internet crimes are so easy to commit that users are very often unaware of the crime.

3. Physical problems. Students usually dedicate many hours to studying. Many students often prefer the paper format when they have to memorise because computer screens cause problems such as tired eyes.

4. Internet access. The online book needs a good connection to the Internet and some students, such as Erasmus students or those with less economic resources, do not have a 24-hour connection to the Internet.

5. Obsolete Technology. Despite being basic Internet users, some students have not updated their browsers or use relatively old computers. These aspects may result in a far from enthusiastic reception of the e-book in the first days.

Regarding the teaching staff, they have hardly shown any resistance to the implementation of the e-book as they have actually taken part in its development and, in that sense, they can be considered entrepreneurs-lecturers according to [6].

5. CONCLUSIONS

The university cannot waste the advantages offered by ICTs in the teaching-learning processes because, although knowledge is the basis and the heart of university and technology alters people's skill to process information, there must be an impact on the way in which universities carry out their mission. Our experience has allowed to identify the multiple advantages brought by the use of e-books, taking into account financial aspects – with a price far below that of a conventional book – and its manifold possibilities: adapted to different profiles, with various access levels, with a simple shopping system, with the chance to generate and do exams, both with automatic marking and with marking by the teacher. Furthermore, the e-book to which this paper is dedicated has an assistance technical support for any problems that can be posed by users and can work in multiple media, including the mobile [14].

Nevertheless, different signs of reluctance to its implementation have been detected, essentially among students. Some of these barriers stem from cultural problems (paper culture, infringement culture), physical problems (above all tired eyes) and technical problems (bad Internet connections and having old or deficient technological media).

Hopefully, thanks to the experience acquired with this e-book and to its proven advantages, it will be possible to help students to overcome the aforesaid barriers.

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