

Analysis of Information and Communication Technologies in Higher Education: A Case Study of Business Degree*

LAURA VARELA-CANDAMIO and MARÍA TERESA GARCÍA-ÁLVAREZ

University of A Coruña, Faculty of Economics and Business, Department of Economic Analysis and Business Administration, Campus Elvina s/n, 15071 A Coruña, Spain. E-mail: {laura.varela.candamio, mtgarcia}@udc.es

The aim of this study is to analyze the role of information and communication technologies (ICTs) in the development of new teaching methods that allow the acquisition of new skills by students. In the current context European High Education Area, developed with Bologna Declaration, higher education institutions must adapt to it by promoting innovative experiences in the teaching-learning processes, changes in teaching strategies of teachers and communication systems distribution of learning materials. It supposes a special emphasis in the learning where an approach based on an active and dynamic role of students is necessary. The development of educational software, with an appropriate teaching strategy, becomes an essential support in the formation of future graduates in Business degree in both classroom education and distance education. The final idea is to create an educational larger environment of general character with an easy access and the use of ICTs to promote student motivation.

Keywords: European High Education Area; information and communication technologies; teaching based on learning

1. Introduction

We are merged in a context of reconsideration of the university functions in the society. There are many causes that motive these changes [1]: a) survival (the flexible organizations are the only companies that can have hope in surviving and having success), b) necessity of compatibility, comparability and competitiveness in the European higher education and c) the new technologies (with the development of information and communication technologies (ICTs), the objective of higher teaching is favoring and stimulating the rigor in the information selection, promoting the rational organization of that information and supporting their possible interpretation).

In this context, The Bologna Declaration (June, 1999) is developed. It entails the convergence beginning of the structure in the European education systems by means of the creation of the European High Education Area (EHEA). It seeks to promote, among others, the following specific objectives:

- Recognition in the degree system in order to promote the mobility of graduates. Thus, it seeks to establish a system of comparable qualifications between countries of the EHEA.
- The implementation of a qualification system based on three cycles (bachelor, master and doctorate), which represents degrees with different levels of qualification and specialization.
- Focus of qualifications based on The European Credit Transfer System (ECTs). This involves the development of a system of student-centered education where it is necessary to determine the

competencies that the students are expected to acquire once the learning process is completed. In this context, we seek to redesign the curriculum that will bring the knowledge of students to business needs.

- Promoting mobility of students, teachers and administrators of European universities.

In short, the Bologna Declaration involves the search for three major strategic objectives: improving quality and efficiency of education systems providing global access of individuals to make the educational system and education system accessible worldwide [2]. In this context, ICTs can play a key role.

The aim of this study is to analyze the role of such technologies in the development of new teaching methods that allow the acquisition of skills by students. To do this in the next section we will review the impact of ICTs in education based on learning. Next in this paper we will analyze the main characteristics of the review process of educational innovation. After that, we propose a teaching methodology in the Grade of Business, based on these technologies, allowing the acquisition of knowledge needed by students to develop their career. Finally, the main conclusions are drawn from the study.

2. The role of ICTs in education based on learning

Traditionally, the emphasis was given to teaching in education. However, based on the characteristics that accompany the establishment of the EHEA

puts a special emphasis on learning needed to be more focused on the student.

To facilitate this change it requires an intrinsic and extrinsic motivation of teachers and students. The internal reasons are related to personal and social expectations of the act of learning. Moreover, the external reasons given by the rewards come to good institutional teaching and learning in the classroom.

These features highlight the need for the development of new roles by university staff. Thus, their traditional role was based on transmitting knowledge to students. However in this new context we approach the student-centred teaching in which both the school and the teacher no longer are the source of knowledge. Professors require a series of activities based on the advice of students, development and supervision of learning activities and coordination of teaching [3]. Therefore, professors must perform three types of roles: a) *organization*, that is, designing an active learning environment and proposing ground rules for its operation, b) *social*, which refers to the search for a environment of student interaction that promotes collaborative work and c) *intellectual*, where the teacher questions, challenges and introduces students questions to promote knowledge construction process.

In this context, ICTs pose interesting possibilities for university education due to the amount of information, both qualitative and quantitative, allowing it to be placed virtually. This enables for more flexible environments for learning, removing barriers to space-time interaction between teacher and students and promote the development of scenarios and interactive environments conducive to learning where this process is achieved through the acquisition-and non-reproduction-knowledge by the students being required it to adopt a more active role [4, 5].

In addition, ICTs are a key element in obtaining and transmitting information about the different types of knowledge: tacit and explicit. Tacit knowledge refers to personal knowledge, formed from the experience, making it difficult to transmit, reproduce and materialize. However, explicit knowledge is formal and codified so that you can define and pass with relative ease [6]. Thus, such technology facilitates the creation of explicit knowledge through the collection, storage, aggregation and quantitative data [7]. Moreover, ICTs facilitate the creation of tacit knowledge, using various tools [8]; [9], such as video conferencing and simulation technologies. However, the simple contact between people with explicit knowledge is not sufficient for the generation of tacit knowledge, but requires interaction between individuals through which they can make judgments and intuitions.

In the context of higher education, the develop-

ment of ICTs has brought new educational methods, as reflected in the concepts of 'virtual university' and 'virtual learning' environments, which enable teachers and students a new dimension for access to knowledge and communication interactivity [10].

The literature shows that there is a consensus about a suitable use of ICTs that involves a positive effect on attitude and results for students [11–13, 2, 14] obtained that such technologies also facilitate the relationship between teachers and students and they also help the flow of information and improves the learning process. [3] establish that ICTs encourage the development of skills associated with creative thinking and self-learning and interaction skills that facilitate collaborative learning. Similarly, [15] shows that e-learning environments involve adequate results, by students, due to an increase in teacher-student contact and greater student participation in the discussion of issues proposed.

3. The processes of educational innovation

In the current context of globalization and development of ICTs, higher education institutions must adapt to it by promoting innovative experiences in the teaching-learning processes, changes in teaching strategies of teachers and communication systems distribution of learning materials.

The organization of teaching-learning systems in virtual environments is seen as a pedagogical innovation process based on the creation of conditions to develop the ability to learn and adapt both the organizations and individuals [16].

Innovation can be thought of as an international process and planned to be based on the theory and thinking and responding to the needs of processing practices to better achieve the objectives. Therefore, educational innovation is not characterized as spontaneous or accidental but rather intentional and deliberate.

Thus, it requires a corporate strategy that involves the formulation of a joint approach to the teaching and learning model. In this context, it requires a rethinking of the internal organization of the business reengineering, information flows and products by which its work can be focused [16].

This strategy must consider a number of elements that will determine to a large extent, the success of educational innovation, among them [17]: a) physical presence of technology, b) existence of revitalizing centers, c) production of quality learning objects, d) change in the conception of university education, e) overcome the uncertainties that any change results, f) digital literacy, g) teacher training, h) educational research, i) model transformation evaluation. Then we will discuss the main features of

such factors and their impact on the innovation process.

a) *Physical presence of technology*. It requires that the technology is close and easily accessible for teachers and student. So until a technology does not acquire the characteristic of 'invisible' is not perfectly integrated in the training of teachers, to the extent that technology is common, it will be invisible in the educational because we are accustomed to their presence and use [17].

b) *Existence of revitalizing centers*. It is important to establish resource centers to assist the penetration of technology in universities because the teacher does not have to be a dominating instrumental in the latest technology or the latest versions of computer software.

c) *Production of quality learning objects*. The concept of learning objects mention of any digital resource that can be used as a support for learning and therefore should have a set of basic features-reusable, interoperable, easy to operate at different levels of complexity in environments instructional and assemble-ability environments [18].

d) *Changing the concept of university education*. The innovation process in higher education should be based on a changing role of university professors. Thus, it requires the teacher to be a mediator in the construction of an own knowledge by students, rather than a transmitter of knowledge to students. Therefore, it should promote students' personal growth and emphasize the facilitation of learning rather than transmission of information.

e) *Dealing with the uncertainties that any change results*. Any changes in educational institutions resulting uncertainty makes it difficult to the use and also the adoption by the people and the culture that goes. It is therefore necessary to establish clear measures for inclusion and encouraging their use.

f) *Digital Literacy*. The success of educational innovation process will also depend largely on the existence of favorable attitudes and skills, by teachers, for the use of ICTs. Thus, it requires a high proficiency in the so-called digital literacy, concept defined as a *sophisticated repertoire of skills that permeate the workplace, community and social life, among which it is included the skills needed to manage information and the ability to assess the relevance and reliability of what you want on the Internet* [19].

g) *Training of teachers*. It is necessary that this training goes beyond the mere knowledge of the nominal or instrumental information and communication tools. Thus, it requires training that allows teachers to make instructional decisions when considering the use of ITCs (not only from an instrumental point of view), such as knowledge of the basics of design and production material as a possible evaluation strategies [20].

The basic elements that training should cover are given by [21]: 1) *instrumentation* (development of a minimal competence in the use of ICTs to enable its management), 2) *semiotic aesthetic* (the understanding and management of the various codes or verbal and iconic languages used in education with such tools), 3) *curriculum* (includes issues related to planning, selection and sequencing of content and materials, structuring of the courses or evaluation systems), 4) *pragmatic* (possibility that allow teachers to have access to other experiences to date and learn from the experience of others), 5) *psychological* (issues related to the development of cognitive skills associated with the use of ICTs tools), 6) *producer/designer* (capacity to design, produce and/or adapt materials for use in their own contexts), 7) *coach/evaluator* (selection and evaluation of means and tools that best fit each of their needs and contexts), 8) *critical* (development of a critical and reflective of the media as mediators of knowledge and communication), 9) *organizational* (analysis of the changes introduced by the use of ICTs in school organization and class), 10) *attitude* (an element that implies basic changes in the educational system is the development of a change in culture/attitude between the agents thereof) and 11) *research* (knowledge of the use and relevance of ICTs for teacher research work).

h) *Educational research*. The interest of the tools provided by ICTs has been more dominated by technical aspects (technical potential, image quality, programming languages, environments, file transfer. . .) that the teaching-educational (message design based on the characteristics of its recipients, strategies and techniques to use, impact of assessment strategies, . . .).

i) *Transformation of assessment models*. To a process of educational innovation using ICTs for students to construct knowledge in interaction with learning objects that facilitate both the teacher and the other participants, it is necessary to develop new evaluation strategies.

4. Proposal for a model of university education based on learning through ICTs. Application for the Degree of Business

Given the characteristics discussed in the previous paragraphs, it is important to consider the introduction of a Personal Learning Environment (PLE) to allow universities to promote education based on learning. This concept can be defined as a set of sources, people and pooled technological tools to serve a great deal of activities. Its main contribution is to facilitate access to knowledge, promoting the integration and interaction of individuals.

Within the field of education and, specifically,

focusing on Business degree, PLEs are very useful, both in the area of faculty and among students, as well as the interaction between them. In the case of distance education creates a flexible work environment to the student's circumstances and the possibility of interaction and possibilities of teacher-student contact that would otherwise not be possible. Here, we present the main features in this area.

In the area of teachers to:

- Encourage learning courses using interactive presence of chats, blogs and social networks for sharing opinions and develop ideas on the subject of debate. This allows the development of international networks of educational and collaborative projects between universities.
- Integration of sources to update developments of major publications on economics.
- Develop and share the management of educational activities for students (for example, if a student must do work on the operation of a business will need the help of a professor of finance, marketing, economics, etc).
- The development of a schedule to synchronize the work of students and encourage, on one hand, the achievement of learning objectives in a more gradual and controlled way and, on the other, a regular class attendance.

Within the area of students in Business, the PLE can create attitudes within personal learning through communication-relationship-management objectives, as discussed below:

- Managing your own learning. Given the volume of information provided by the web, the student must develop skills such as content filtering, selection of relevant information, reading, drawing the substance to build the knowledge, etc.
- The communication in the learning process. Social networks are generated to foster interest in knowledge and the need the students to express themselves correctly as a means of communication. This allows you to create networks of valuable learning.
- The achievement of objectives. The participatory work develops students' motivation as the final achievement that will depend on the sum of individual efforts. The feed-back is the best mechanism as a means of evaluating results.

Therefore, from these features, we suggest that this learning system can develop a set of capabilities that will undoubtedly serve the students of Business at the time of joining the workforce. Among these, include:

- *Self-esteem*. This tool minimizes the search time and acquisition of knowledge-oriented learning and new technologies to achieve this.

- *Autonomy-self*. The students themselves freely manage its business.
- *Understanding critical*. It allows you to select only that information which really is relevant to the topic at hand.
- *Ability to communicate*. It facilitates student-student communication, teacher-teacher and student-teacher greatly improving the understanding and learning process.
- *Ability to transform the environment*. It encourages interaction among students to prepare papers, theses, etc. as well as collaborative projects among teachers and between teachers and businesses that result in higher levels of human capital and R&D.
- *Social skills and for coexistence*. It promotes participation in a controlled and respectful peer and involvement in achieving the ultimate goal.
- *Moral reasoning*. It allows Exchange opinions, discuss opposing views, respect for others and learning from mistakes and valuing the work of others.

Thus, once shown the importance of developing a learning environment in Business degree, we propose the following as a classification of ICTs proposals for implementation to the degree of Business in the EHEA: digital portfolio, social networks and applications on the network.

a) *The digital portfolio*. Defined as a 'continuous assessment of student learning and teacher education through the systematic collection of data, analyzing them and making timely decisions that take place while the process itself'[22]. The portfolios will generate a student's interest in the evaluation process by allowing you to analyze the degree of achievement of the objectives and shared responsibility between teachers and students for their shortcomings.

Their use has served to guide the tool in a triple perspective: learning, assessment and presentation [23]. The portfolio presentation is the most important for the degree of Business, given its strong orientation towards communication and in line with the objective of improving public exposure. This would allow the students to place online the contents of the work they have done in a particular subject and share them on the network, resulting incentive to work since it would be their letter to the business world. A portfolio can also 'freeze' the exhibition of work by the media (for example, posting a video of the exhibition of the student in Moodle so that it can be reflected) in order to awaken self-critical spirit in students and analyze their progress, not only knowledge but skills and attitudes [24].

b) *Social networking*. Using these tools, indivi-

duals have a profile oriented theme that is intended to interact with other users. So, you have blogs, chats, photos, videos and other personal information and/or professional who facilitates interaction between students and faculty. In this type of tool it prevails 'learning to learn' or 'improve for improvement', without more incentive than knowledge itself. Indeed, the very reward will come from feedback received from other students. In the case of blogs, for example, the positive commentaries will provide satisfaction and the negative ones will be seen as an opportunity for improvement.

Therefore, these tools encourage student motivation which is a fundamental goal in higher education. We also believe that is important in a market-oriented training and finance, as in the degree of Business, to create a professional platform in the university area similar to the current LinkedIn (social network that allows the communication between enabling professional business or labor relationships). Thus, given the need of establishing links between university and enterprise, it would be very useful to have a network of contacts among professionals and academics. One example is Mendeley that consists in documentation an opinion exchange between researchers of higher education that would be extended to the contact between researchers and entrepreneurs.

c) *Applications on Internet.* Such tools are known by the term 'cloud computing'. Educational level, these environments create a perfect space for the shared construction of knowledge. In some contexts, they are becoming an indispensable tool to share materials and resources and work collaboratively doing projects and research experience, regardless of distance and time. There are several ways to implement this tool in education. The university asks for a server, you create a specific package that contains exercises and educational contents. One advantage is that you can control

the content and actions of students. It also offers direct and free web applications on your server, the same mode of Google or Zoho. In Catalonia (Spain) this web operating system (EyeOs) has been implemented in over 2,500 schools (EyeOs), intending to be developed further in future.

The adoption of these three types of ICTs could promote the development of scenarios and competencies required for Business Degree.

In this context, we must consider that the incorporation of such technologies requires major changes in the methodology used to teach the subjects (see Fig. 1). To decide the same, consider the steps it up (planning, development and evaluation of the subjects) and the potential effects of ICTs will lead on them.

- 1) *Planning.* The teacher should plan to provide early learning activities that will be used to achieve the objectives proposed in the subject they teach. This can be used: a) individual activities (to be completed by the student in a particular way, Reading, problem solving, self, etc) b) group activities (involving the interaction between various students-depth work, projects research, etc) y c) large group activities (by the whole group, including the teacher-debates, round tables, etc) [20]. Also, for each of such activities, the teacher must determine that use ITCs (e.g., autonomous learning may come as using the web and cooperative learning through the use of chat, forums and videoconferencing).
- 2) *Development.* It carries the possibility of restructuring the activities according to the needs that arise during the implementation. For this, the teacher must assume a role change in teaching to become a guide, facilitator of learning and boost participation.
- 3) *Evaluation.* In this new context, it is essential to use a continuous assessment of training char-

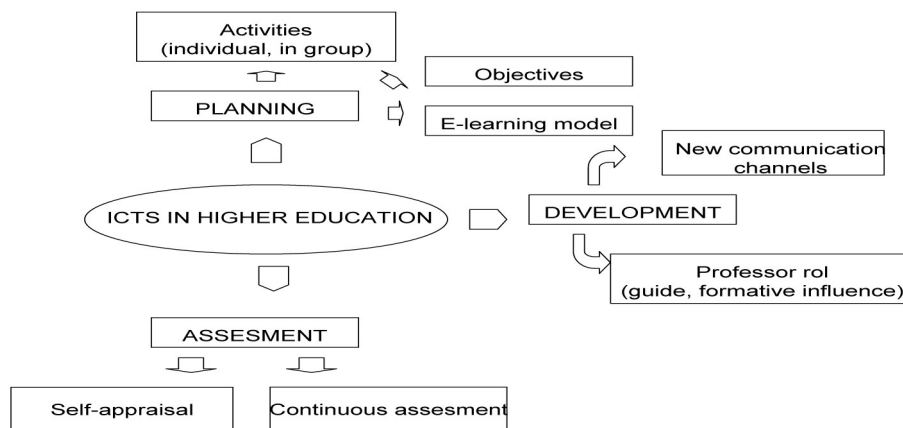


Fig. 1. Methodological repercussions of ICTs in higher education. Source: [20].

acter (which serves as feedback to the student and the teacher). This is to inform the teacher and the student learning progress and provides students with a motivating factor in their continued and active learning [20].

With the implementation of the methodologies and tools of ICTs for teaching mentioned above for Business degree, it is expected a greater motivation. In the same way that ICTs develop, the techniques to get the motivation of students is also evolving. Not enough to arouse students' interest in lectures it is necessary to complete it in other ways. It is here that an educational software plays a role that combines two basic educational functions: the tutorial system based on the transmission of objective knowledge and the training system, which applies the knowledge gained to awaken a certain ability in students. Examples of these are electronic (audio-visual presentations, animations, etc) that seem closer to the daily lives of future generations. When doing any work, they have more information through group work, undoubtedly, contribute to a significant increase motivation and therefore their formation.

5. Discussions

The creation of the EHEA has important changes in European university education, such as the moving from a teacher-centered teaching to a student-centered teaching. In this context, students must acquire a number of competencies to the development of their career. To this end, it takes a more relevant education based on learning.

A support element for the development of new teaching methodologies that would meet the objectives of the Bologna Declaration is the ICTs. Such technologies are supporting the creation of more flexible environment for learning and removing barriers in the space-time interaction between teacher and students. In fact, the development of e-learning has generated a multitude of applications and technology platforms have become a regular part of daily instruction in universities. However, not always the use of new technologies affects the process of educational innovation.

In this paper, we take a further step on the path of learning that fosters creativity and student participation, essential in the new EHEA. Our analysis of the main tools shows a continuous knowledge-oriented vision, interactive learning, especially in the Business degree, focusing on market orientation (both in terms of research into the R & D in the university- business or at working level in employment-oriented student-company). This allows you to adjust the profiles of students to business require-

ments, and all this, a virtual environment built around ICTs.

The main limitations of our paper are given by the necessity of the existence of various conditions for the application of the proposed teaching methodology based on ICTs. So, it is necessary that a) there is a physical presence of technology, b) teachers have a dominating instrumental in the technology used in the classes, c) a change in the role of teachers because they have to be a mediator in the construction of own knowledge by students but not a transmitter of knowledge to students, d) the application of a new educational model based on new methodologies and evaluation systems. However, any change in educational institutions involves uncertainty that makes it difficult its application. Therefore, the necessity of establishing new measures for the inclusion of this new educational model is a key element that should promote the presence of ICTs in the different faculties and the development of courses for teachers about the use and application of such tools and the training of teachers towards the new educational model. Besides, our teaching model based on ICTs should be assessed by students, with the aim of knowing its main advantages and problems from student view point. It will be one of our future research lines.

Finally, we propose recommendations for similar implementations in engineering education. Our department teaches business in engineering degrees of various specialties. In these cases, besides the use of the proposed tools in the paper (digital portfolio, social networking and applications on internet), we consider necessary the use of another ICT. It is especially relevant because our engineering students have only a business subject. So, the development of software that allows the execution of simulations from different strategies made by students could be interesting. In this context, students could learn, by means of their own decisions, the results that would obtain virtual companies. It could allow the reinforcement of business knowledge and entrepreneurship skills of our engineering students.

6. Conclusions

The aim of this paper has been to analyze the role of ICTs in the development of new teaching methods that allow the acquisition of new skills by students in higher education. The development of educational software together with an appropriate teaching strategy becomes essential supports in the formation of future graduates in Business. Our paper designs the guidelines leading to a successful PLE, with the possibility to be incorporated in a virtual platform (as Moodle), which is in line with the teaching-learning process developed in the current

EHEA, based on an active and dynamic students' role.

The process of educational innovation in higher education institutions requires a corporate strategy that involves the formulation of a joint approach to the teaching and learning model. In this context, it is necessary a rethinking of the internal organization of the business reengineering, information flows and products. The instruments to achieve a satisfactory process must be, among others, physical presence of technology, existence of revitalizing centers, production of quality learning objects, change in the conception of university education, overcome the uncertainties that any change results, digital literacy, teacher training, educational research and model transformation evaluation.

Focusing on the degree of Business, a PLE must develop a set of capabilities for the students within personal learning through communication-relationship-management objectives, very useful for their long-life as workforce. These attitudes are mainly self-esteem, autonomy-self, understanding critical, social skills and ability to communicate and to transform the environment. An appropriate PLE must also create a flexible work environment adapted to their circumstances and the possibility of interaction among them and with their teacher in a very accessible way. The key aspects behind this system proposed are the exposure in public and the critical sense. The ICTs for its implementation are digital portfolio, social networks and applications on the network. Besides, a PLE requires a feed-back process with three phases: planning, development and evaluation.

In order to get these results, professors should take these guidelines into account and do a greater effort to incorporate them in their subjects. Even when these new ICTs have been widely adopted in most universities, they are often underused, either by the lack of awareness of their benefits, or the mere difficulty to adaptation to these new methods and tools. On the one hand, the lack of adaptation to widespread use of these new technologies can be solved through the provision of courses that allow teachers to find out and seize all opportunities these virtual tools can offer. On the other, the literature shows a consensus in the sense of ICTs involves a positive effect for students both on attitude and results. Such technologies facilitate the relationship between teachers and students and ease the flow of information and the learning process. Moreover, ICTs encourage the development of skills associated with creative thinking and self-learning and interaction skills that promote collaborative learning and greater student participation in the discussion of issues proposed in the classrooms.

Therefore, professors in higher education must

perform three types of roles: *organizational*, designing an active learning environment and proposing ground rules for its operation; *social*, which refers to the search for an environment where students interact by means of collaborative and intellectual work and *intellectual*, where teachers introduce questions and challenges to the students to promote the knowledge construction process. The final goal is to create an educational method with an easy access at any place and at any time using ICTs to promote students' learning and motivation.

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Laura Varela-Candamio is an Assistant Professor in the Department of Economic and Business Administration from the University of A Coruña. She is also an Assistant in Jean Monnet Research Group Competition in EU. Her research interest includes public finance, taxation, economic geography, economic development and environmental issues. Within the educational field her research is focused on student-centered methodology, e-learning and the use of ICTs in higher education. She has published the results of their research in different congresses and journals.

María Teresa García-Álvarez obtained a university degree in Business from the University of Oviedo and a PhD in Economy from the Economic Analysis and Business Department of the University of A Coruña (Spain). She is Assistant Professor in that Department. Her research interests include Information and Communication Technologies, Teaching based on Learning in Higher Education and Knowledge Management. The main research results have been presented and published in different congresses and journals.