TEACHING INNOVATION AND USE OF ICT IN UNIVERSITY EDUCATION

E. Rosales-Asensio¹, E. González²

¹ Departamento de Física. Universidad de La Laguna (SPAIN)
² Departamento de Ingeniería Química y Tecnología Farmacéutica. Universidad de La Laguna (SPAIN)

Abstract

To adapt to the needs of today's society, higher education institutions must become more flexible and develop ways of integrating information and communication technologies into training processes. At the same time, it is necessary to apply a new conception of student users as well as changes in the role of teachers and administrative changes regarding communication systems and the design and distribution of teaching. All this implies, in turn, changes in the teaching-learning standards towards a more flexible model. To understand these processes of change and their effects, as well as the possibilities that the teaching-learning systems entail changes and technological advances, it is convenient to place ourselves within the framework of innovation processes.

Keywords: Teaching innovation; ICT; higher education; teaching learning system.

1 INTRODUCTION

Institutions of higher education have undergone a change of some importance in the educational system as a whole in today's society [1]: a shift in training processes from the conventional to other areas; a generalized demand that students receive the necessary skills for continuous learning; the commercialization of knowledge and the simultaneous generation of opportunities for new markets and skills in the sector, etc. The scope of learning varies dramatically. Traditional educational institutions, whether face-to-face or distance learning, must readjust their distribution and communication systems [2]. They go from being the centre of the educational communication star to being simple nodes of a network of networks between which the student-user moves in more flexible coordinates and which we have called cyberspace [3]. On the other hand, changes in these space-time coordinates bring about the emergence of new educational organizations, which are consortia or networks of institutions and whose teaching systems are characterized by modularity and interconnection.

All of this requires institutions of higher education to make their procedures and administrative structure more flexible, to adapt to alternative training modalities more in line with the needs that this new society presents. The existence, as we began to get used to seeing, of on-line offers and courses on the Internet, or the experimental projects of some professors and/or departments, do not presuppose a more flexible university.

Neither is the fact that an institution is investigating the latest advances in telecommunications or the application of information and communication technologies. In order for both existing institutions and those who are being born ex professo to truly respond to this challenge, they must review their current references and promote innovative experiences in the teaching/learning processes using ICT's and emphasizing teaching, changes in didactic strategies of teachers, and in the systems of communication and distribution of learning materials; that is, in teacher innovation processes rather than emphasizing the availability and potential of technologies. At the same time, these flexibilization projects are to be understood as institutional, global educational strategies that involve the whole organization. In short, universities need to be involved in quality improvement processes and this, in our field, translates into processes of educational innovation supported by ICT.

In our universities, we can find a multitude of experiences of "virtual teaching," "virtual classrooms," etc. including institutional projects isolated from the general dynamics of the entity itself, which, though laudable, respond to particular initiatives and, in many cases, can be difficult for its generalization by not being assumed by the organization as a global project. Thus, this type of private initiative does not reveal the rigidity of university structures to integrate the use of ICT's in the teaching/learning processes in their daily functioning. It requires the active participation and motivation of teachers, but it
also requires a strong institutional commitment. The university culture promotes production and research often to the detriment of teaching and innovation processes in this field [4]. And yet, processes of this sort seem to be the ones that will oxygenate the universities in some way.

It is common to speak of this time of changes, propitiated by the advances of information and communication technologies, and of the beginning of a new era, which is often called the information society. We can highlight four important issues that converge at this time:

- The importance of knowledge as a key factor in determining security, prosperity and quality of life.
- The global nature of our society.
- The ease with which technology - computers, telecommunications and multimedia - enables the rapid exchange of information.
- The extent to which informal collaboration (especially through networks) between individuals and institutions is replacing more formal social structures such as corporations, universities, and governments.

All of them directly affect the role that universities play in society. These changes of paper reveal the need for public debate, since we can often find positions of uncritical acceptance of technology. But the response of universities to these challenges cannot be standard: each university must respond from its own specificity, starting from the context in which it finds itself, considering the society to which it must serve, taking into account the tradition and the strengths that has.

Complex organizations, such as universities, change significantly when there are three conditions: important external pressure, people unsatisfied with the existing order and a coherent alternative presented in a plan, model or vision. Thus, as any organization that seeks quality, the university, to carry out real changes and true processes of innovation, must first of all pay attention to the environment and its messages. The changes that are affecting higher education institutions cannot be understood without reference to the context of changes occurring in different orders and constituting that external pressure:

- The changes in the way of organizing university education promoted by the European Higher Education Area, by the approaches of this teaching in relation to competences, by ECTS, etc.
- The changes caused by ICT.
- Changes in knowledge (in the generation, management and distribution of the same).
- The changes in the student, in the citizen, in what can be considered today a formed person, etc.

Obviously, faced with the pressure of these changes, institutional responses of different types occur, among others:

- Teaching innovation programs in universities, mainly related to the incorporation of ICT in teaching / learning processes.
- Modification of university structures, as soon as these technologies are considered in the organization chart and in the management bodies of universities.
- Innovative experiences of all kinds, related to the exploitation of the communicative possibilities of ICT in university teaching.

The challenges they pose to the organization of the teaching-learning process will depend to a large extent on the learning scenario (home, work place or learning resource center); That is, the space / time frame in which the user develops learning activities.

Similarly, the role of teaching staff also changes in an ICT-rich environment. The teacher ceases to be a source of all knowledge and acts as a guide for students [5], facilitating the use of the resources and tools they need to explore and develop new knowledge and skills. It acts as manager of the pleiad of learning resources and to emphasize its role of guiding and mediating.

As a result, the teacher will acknowledge implications in his professional preparation, as he will be required, in his training process - initial or recycling - to be a profitable user of information resources. Along with this, you will need support services from guides and professional help that allow you to participate fully in the exercise of your activity. Teachers are an essential element in any educational
system and are essential when initiating any change. Their knowledge and skills are essential to the proper functioning of a program; Therefore, they must have technical and didactic resources that allow them to meet their needs.

In order to understand these processes of change and their effects, as well as the possibilities that for the teaching-learning systems entail changes and technological advances, it is convenient to place ourselves within the framework of innovation processes.

The processes of innovation regarding the use of ICT in university teaching usually start from the availability and technological solutions that exist. However, a balanced view of the phenomenon should lead us to the integration of technological innovations in the context of the tradition of our institutions; Institutions which, let us not forget, play an important educational role. We must consider the idiosyncrasy of each of the institutions in integrating ICT in the processes of higher education; Also, that the dynamics of society can leave us to the margin.

It should be borne in mind that, like any educational innovation, we are faced with a multi-faceted process: political, economic, ideological, cultural and psychological factors intervene, affecting different contextual levels, from the classroom level to the Universities. The success or failure of educational innovations depends to a large extent on the way in which the different educational actors interpret, redefine, filter and shape the proposed changes. Innovations in education have as their main challenge the processes of adoption by individuals, groups and institutions (material things and information are, of course, easier to handle and introduce than changes in attitudes, Practices and human values).

2 METHODOLOGY

For this research, a survey was carried out on a representative sample of professors from Spanish universities (both public and private) in technical areas. In this survey, the university professors were asked about which they consider are the most important aspects regarding the implementation of educational innovation projects in relation to the support system for teachers: student support, team policy, new relationships and network infrastructure, and hardware and software.

3 RESULTS

It is important to consider the elements that are put in play to carry out the educational innovation. At the Spanish university, activities linked to ICT and teaching have usually been carried out by enthusiastic teachers, who have managed to equip themselves with the necessary resources to experiment. Therefore, there has been no clear location of responsibility for ICT resources in teaching in the institutional organization chart, nor a channel established for funding, management, and development. The computer services have been able, in some cases, to give them some support, but without the essential teaching planning and pedagogical configuration.

On the other hand, a number of experiences in recent years show that isolated initiatives are difficult, costly, and limited in their effectiveness, and that when they do not go forward, they tend to produce discouragement and negative attitudes on the part of both the teachers and the students themselves. Among the most important aspects to consider regarding the implementation of educational innovation projects, we propose:

The support system for teachers, which includes both the actions to be included in the training plan and updates for the teaching staff regarding the use of ICT in teaching, as well as the whole system of personal counselling provided to them and the corresponding actions (coordination of the actions of the various services of the institution, information on available resources, etc.).

These support systems not only focus on the key role of teacher education.

There is no doubt that the university teaching group needs, first, a training process, and its planning and the very existence of trainers are key issues. However, we must also think in terms of continuing education and professional development. The university professor should not only keep abreast of the discoveries in his field of study. At the same time, it must also address the possibilities of ICT and possible innovations in the teaching-learning processes.

There should be support for students. Students need training (communication skills, information selection, organization skills, etc.), but at the same time, technical assistance and policies are required to promote the use of ICTs (purchase plans, soft credits, etc.).
Team policy. The team that will carry out the project of teaching innovation is one of the key pieces. Its configuration, functions, and place in the organizational chart of the institution depend on the culture and history of the entity. For this reason, the policy regarding such equipment is one of the critical elements for the success of ICT integration projects in the teaching-learning processes. The way in which this team will be organized is also important: the role of the content expert, how and who will handle instructional design, digital design, whether we consider the presence of programmers, or what the role of the team coordinator will be, etc.

New relationships. There is no doubt that opportunities in the academic market are broadened by integrating virtual teaching-learning environments into the university institution. This puts us in a different position with regard to new partners that can come from the technological field, from the economic sector, and, above all, from our relations with other institutions (consortia, university networks, etc.).

Network, hardware, and software infrastructure. Undoubtedly, little can be done in the field of ICT-based teaching without clear strategic lines regarding infrastructure. A technological plan of the institution will be a good basis for success. In spite of this, it should be borne in mind that innovation is a human activity, not a technical one.

The practices that are developed and that are the object of innovation, depend on the organization, the elements and resources available to the project, and can be realized in different types. Depending on the evolution of the system and preferably focused on conventional institutions we can find four models:

- **Model of initiation.** It is characterized by offering notes and some other material in web format. Opportunities for interaction or dialogue are generally not provided, and no extra resources are provided. The use of the Internet as a support in learning and teaching requires a change of culture, both in teachers and students. Therefore, it is not surprising that this minimalist model is widely used by those who are more cautious about such a change. In any case, this model is advisable in those contexts of learning where the preparation time is very limited, the space in the web server is scarce, the instructor is new in the web-based distribution and the basic skills related to computers fail.

- **Standard model.** It seeks to use the advantages provided by technology to allow a certain degree of communication and interaction between students and teachers, as well as providing other resources such as electronic resources in the form of links, electronic copies of all printed materials of the course, Classroom slides, classroom lectures, workshops tasks and solutions, activity guides, electronic discussion list for the course, etc. The use of this model is appropriate when the teacher is experiencing for the first time with the management of teaching through the web, or when students are participating for the first time in a course of these characteristics, or when preferred, for some reason, the distribution of paper activities, etc.

- **Model evolved.** It improves the standard by introducing other complementary elements to the teaching environment (student monitoring, electronic management, etc.) and to the learning environment (distribution on CD-ROM, pre-recorded audio classes, animations, live classes as a response to specific demands of students, etc.). This model is appropriate in situations where it is preferable to distribute activities in electronic format, the classes can be pre-recorded, the teacher has sufficient time to ensure the dissemination of the website, the interaction and feedback are intended, and when complex or technical aspects are going to be worked.

- **Radical model.** While the three previous models try, to a different extent, to adapt the classroom teaching pattern to a web format, the radical ignores the concept of classes. Here, students are organized into groups and learn by interacting with each other and using a vast amount of existing web resources, and the teacher acts as a guide, advisor, facilitator, or when required. The differential characteristics of this model would be, for example, the sending of a video to all the students at the beginning of the semester, explaining the way in which the course works. After a minimal traditional instruction, students use the materials and locate other resources available on the web, intensive use of discussion lists, substitution of classes by electronic presentations prepared by the students themselves, the organization of students in Groups, etc. The situations in which the application of this model is advisable would be when group work is considered beneficial, for students who are familiar with the use of the web, communication tools and information search systems, with skills of research and be able to work autonomously, without the continued presence of the teacher. The latter, on the other hand, should be comfortable acting first as a guide and later as a facilitator rather than as a direct distributor of
knowledge; And when there are sufficient and relevant resources for the content of the course in the Network.

The new educational spaces that are created through these types of practices can refer both to the impact that the introduction of ICT has on conventional teaching and to the configuration of new scenarios for learning. Between the conventional classroom and the opportunities to obtain learning materials from any point through telecommunications, there is a whole range of possibilities for access to learning resources and to establish an educational communication that must be considered, especially in a projection of future.

The proliferation of experiences to which we referred at the beginning may sometimes lead to the emergence of new words - in fact, in recent times we have heard of virtual teaching, virtual campus, virtual university and, more recently, e-learning, Blended learning, etc. - in the educational world only, without being another innovation. The sophistication of technologies, the brilliance of multimedia should not dazzle us, as these phenomena must be approached with rigor. All these developments raise serious questions: What is the new role of teachers? And the students? How is educational communication established through these new channels? Can the interaction in the classroom be reproduced by electronic means? All these questions demand, at least from the pedagogical perspective, study and reflection. They require research if we want contrasted answers.

But they also demand that different institutions promote innovative projects in this field, since the important thing in this kind of processes is the use of a variety of technologies that provide the necessary flexibility to cover individual and social needs, to achieve effective learning environments and to achieve the interaction of students and teachers. Experiences have different kinds of effects on institutions (which will depend on decision making regarding the constraints we have been talking about), and although they are difficult to transfer, many of them may contribute to define our teaching-learning model based on ICT.

The results have been obtained from questionnaires made to professors from different Spanish universities located in different socio-cultural and economic contexts. On the other hand, it is contemplated the study of both universities with face-to-face and distance education, which gives a general character to the results. These results showed that most of the respondents think that innovation based on new technologies is a fundamental aspect in the processes of development and improvement of educational quality. Likewise, teachers try to learn how to combine activities or specific classroom tasks with on-line activities. It should be noted that most of them intend to use a teaching methodology based on ICT in some of their subjects in the next course. Finally, and as one might expect, from the answers obtained by teachers from universities with distance learning, there is a greater relative importance of the use of ICT and virtualization in teaching. In the case of universities located in different socio-cultural contexts, but with a face-to-face teaching, the results obtained are similar.

4 CONCLUSIONS

The success of ICTs will depend, among other factors, on the prestige and innovation capacity of institutions, the flexibility of their teaching staff, the quality of the content, the communication environment, or the reconstruction of personal communication environments. To the extent that we consider the tangible aspects (platform, communication, materials, network operation) and intangibles (pedagogical communication, teacher role, interaction, design of activities, evaluation process, and degree of satisfaction of students, teachers, and managers), we will be able to build a closer alternative than distance education that is different from face-to-face teaching. We believe that education through the network offers new possibilities for open and flexible learning. But, teachers and students need good working conditions, the adequate functioning of the network, efficiency in the functions that make up the virtual campus, quality of content, pedagogical appropriateness of activities, fluency in pedagogical communication, and consistency with the evaluation and accreditation process. Flexibility should be an option compatible with the teaching routine that offers security of connection and entry to the virtual campus at any time desired. Only in this way can we ensure the quality that provides efficiency and satisfaction to students and teachers.

During the first years of ICT use in training, projects have focused on technical innovation to create technology-based learning environments. Now, the focus is the student himself, as well as the methodology. The new thinking implies a demand for a solid methodological foundation and, at the
same time, a student-centered approach. Thus, from an institutional perspective, the real objectives to be achieved would be:

a) To be a means of solving conditions for a more individual and flexible education, related to individual needs (combination of work and study, recycling, related to learning pace, frequency, time, place, peer group, etc.). As social (training to specific groups, differentiation of study programs aimed at a new and better qualification in the labor market).

b) Improve access to advanced educational experiences, allowing students and instructors to participate in remote learning communities at appropriate times and locations, using computers at home, on campus, or at work.

c) To improve the quality and effectiveness of the interaction using the computer to support collaborative learning processes, understanding as a collaborative learning process that emphasizes cooperative or group efforts between teachers and students and that requires active participation and interaction through part of both teachers and students against the traditional models of cumulative learning.

REFERENCES


