



## **Information and communication technologies in university teaching: Implications in European higher education space**

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### **Abstract**

The use of Information and Communication Technologies (ICT) in Higher Education is considered a pre-requisite for adaptation to the European Higher Education Area. The objective is to assess the didactic possibilities of these resources in attaining the objectives sought. Pedagogical reflection about ICT should focus on how these resources can benefit students, what they represent in the curriculum, and what learning, competencies, attitudes, etc. they can foster in students, without losing sight of the kind of citizens and professionals that our present society demands. To make this change successfully, it is necessary to satisfy the training demands of the lecturers. The research is characterized by being a descriptive study based on interviews of lecturers, whether employed by the government or under contract, belonging to the various areas of specialty of the Universidad de Salamanca. Among the competences that the lecturers believed to be determinant in the European Higher Education Space, they consider that it is important to become familiar with new programs to help them with their subjects, to know how to create web sites, and to know how to use virtual environments. On the other hand, they stress the importance of being able to link the use of ICT to educational practice.

**Keywords:** Use of ICT in higher education; training demands of the lecturers

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## Introduction

Our universities must fulfill the expectations of a new society, which is characterized by being more open, flexible, and competitive, and they must promote the use of Information and Communication Technologies (ICT). They must respond to students' needs, begin to think globally and to create new alliances, design new programs, restructure their conceptions on the characteristics of learning environments, rebuild their conceptions on the value of knowledge, and develop internal policies to encourage innovation, experimentation, and lecturers' creativity. The setting in motion of this vision presupposes the considering of the potential of ICT to the benefit of education and the strengthening of its administration and financing. The new functions and competences required of lecturers lead us to consider their formative needs. Teachers point out their need for being trained in the use of ICT in new teaching methods and in the assessment of learning (Cebrián de la Serna, 2004; Paredes and Estebanell, 2005; Pablos Pons, 2007).

The integration of ICT in teaching, linked to educational innovation processes has as one of its pillars the adequate training of teachers. Without teachers well-trained in technological competencies and without the necessary support for incorporating technology into educational practice, the endowment of resources will not achieve the objective proposed (Phelps, Graham, Kerr, 2004).

Different European reports have pointed out the importance of this training variable (Commission of the European Communities, 2000), defending the need to improve the technical aspect of the training offered, to train teachers throughout their careers and to promote structured services of exchange and support as well as educational multimedia contents.

However, based on what we know from different studies, it seems that many teachers have not received initial training in this area and the continuing education offered to them seems to be insufficient. It is excessively technical and instrumental as regards the contents and has little orientation towards the pedagogical aspects that would permit a methodological change capable of creating different kinds of learning contexts. The format in which this training is received is also considered unsuitable, given its limited impact on educational practice. It is often focused on courses, attended by teachers from many different educational contexts, and they are taught a computer application that is difficult to transfer to classroom

practice. Many teachers, therefore, attribute any technological competence they have to informal and autonomous activities.

In regard to the training contents and standards, that is, the establishment of the competencies that teachers should acquire to make productive use of ICT in their classrooms, diverse proposals have already been made at the international level, such as that of the Teacher Training Agency (2001), which sets out as objectives in teacher training the following skills:

- When to use ICT in teaching and when not to use them
- How to use ICT in teaching the whole class
- How to use ICT in lesson planning
- How to organize ICT resources adequately
- How to evaluate student work when using ICT
- How to use ICT to keep up to date and share practices.

For its part, the Society for Information Technology and Teacher Education (SITE, 2002) established the following large modules as training standards:

- Technological operations and concepts
- Planning and design of learning environments and experiences
- Teaching, learning and study plan (how to maximize learning)
- Learning assessment
- Productivity and professional practice
- Social, ethical, legal and human aspects.

Concerning the training contexts that should be covered, highlights the following (Kook, 1997):

- Networks (access to online services with navigators, use of e-mail, video-conferencing, creation of web pages, use of cooperative working tools, etc.)
- Use of materials (online training courses, design of electronic presentations, educational software, product evaluation, etc.)
- Use of peripheral units (DVD, scanner, cameras, video, etc.)
- Office software (text processors, databases, graphics, etc.)

- Strategies for communication and cooperation in technological environments (group work in telematic environments, interdisciplinary work, development of teaching networks and learning networks, etc.).

Nonetheless, if the training contents are an aspect of maximum relevance, so is how they are to be learnt and what circumstances should accompany the training processes in order to achieve the real integration of ICT in the classroom. Experiences in the context of teacher training for applying the new technologies in the classroom (Isman, Yaratán, Caner, 2007) point out as keys to success, besides good information on technological and teaching aspects, ease of access to ICT, diversity of quality digitalized contents, the exchange of experience and support materials, the creation of support networks and direct contacts among the different participating sectors, the organizational structures of the facilitating centres, availability of places to collect digital material produced by and for teachers (learning objects).

Training is truly needed, but to achieve successful innovation processes, it is also indispensable to create pedagogical teams aimed at fostering the participation of teachers in groups committed to the introduction of the new technologies in education, which will put into practice the dynamics of collaboration and reflection (Urwin, 2007).

The training should be understood as a continuous process, not as a one-time activity, and in accordance with the technological means and the needs that arise among the teachers. It should be a training that permits the creation of learning communities, a culture of collaboration in the use of ICT and appropriate organizational structures.

## **Method**

The data presented here are part of a research project, now coming to an end, which has been carried out by the GITE-USAL research group and is entitled “The integration of ICT as teaching tools for universities within the framework of the European space”. The project was sponsored by the Ministry of Education and Science as part of the 2005-08 R+D+I program. Its objectives include becoming familiar with the use being made of ICT in university teaching, the teaching competences that must be developed to ensure efficiency, and training needs in this field.

### Research Objectives

The proposed objectives of this research are as follows:

- Discovering the use made of ICT by university lecturers.
- Discovering lecturers' beliefs and attitudes concerning the use of ICT in higher education.
- Identifying conceptual, operational, and organizational difficulties encountered by lecturers of the Universidad de Salamanca when making use of ICT as teaching tools.
- Discovering the ICT training needs felt by lecturers of the Universidad de Salamanca.

### Research Design

The research is characterized by being a descriptive study based on interviews of lecturers, whether employed by the government or under contract, belonging to the various areas of specialty of the Universidad of Salamanca. This survey considers 30 lecturers who were purposely selected according to established criteria in such a way that the sample can be guaranteed as being representative. The research sample is distributed by faculties as shown in table 1.

**Table 1.** Research sample

<b>Studies</b>	<b>Faculty</b>	<b>N° teachers</b>
Letters and Humanities	Geography and History	2
	Philology	2
	Philosophy	2
Experimental and Technology	Science	2
	Chemical	2
	Industrial Engineering	2
Economic-Legal	Tourism	2
	Law	2
	Economic	2
Biomedical	Pharmacy	2
	Medicine	2
	Biology	2
Social	Psychology	2
	Sociology	2
	Education	2

The interview was structured in nature and followed a pre-established script that was sequenced and guided. Data were collected by means of the interview towards the end of the 2005-2006 academic year.

## **Results**

Most teachers have a favorable or positive opinion of ICT, despite the multiple disadvantages that these may generate; they consider them to be essential, necessary, useful, interesting, and to represent an aid to the teaching/learning process.

### **Use of ICT in their teaching activities**

83% of those interviewed replied that they used them, arguing that they are useful in teaching classes, make teaching easier, are an ideal complement, allow more precise control of what students are doing, etc. Lecturers who do not use them included among their reasons lack of time, too many students, and lack of knowledge: "...we do not have full knowledge. But I think that the teaching process would improve; I think that we should use them although I am not using them at the moment". "... I don't use them because I have a heavy work load..."

### **What ICT are used for**

They are mainly used to present information, to design teaching material (including PowerPoint slides), and as a means of communication. There is a certain trend for the use of resources to revolve around activities relating to information (presentation, searching, and transmission) to the exclusion of other possibilities, which have been mentioned by Fernández and Cebreiro (2003) and Ruiz, Sánchez, and Palomo (2005), such as the development of cognitive skills, the encouraging of individual discovery, the creation of virtual environments of group work, and the assessment of students' knowledge/skills, etc. On the subject of student assessment, one of the lecturers who used ICT commented: "... this year I have included assessment questionnaires on the web site. For example, in group work students assess their fellows by using a questionnaire from the web site which I receive in the form of an e-mail and can subsequently assess. For the next academic year I will include a virtual space." These results coincide with those of the study carried out at various Spanish universities and presented by Cabero et al. (2002, 2003). The conclusions include the consideration that the most novel uses, such as their application to student assessment, are little used.

### **Technological resources used in teaching**

The most frequently used computer resources include PowerPoint slides, which is in accordance with the fact that the most common use given to these techniques is the presentation of information. Other computer resources such as simulators, video cameras, and voice recorders are little used by lecturers. Internet is the most frequent resource both for sending contents and in the interaction between lecturers and students and/or the search for information. The placing of programs and contents online to be distributed on their personal web sites and in particular through the online platform is common practice. In regard to communication between lecturers and students, the main method used continues to be e-mail, followed by forums and finally by the use of videoconferences. In this respect a lecturer comments: "...I use the webcam to provide guidance on doctoral theses so that people do not have to travel and time can be saved".

### **Lecturer/student motivation regarding ICT**

In common with the findings of other research (Cabero et al., 2002, 2003; Hernández, Borges y Prieto, 2007)) the teaching staff of the Universidad de Salamanca has a positive attitude to ICT and is conscious of the need for them, and feels that it is worth making the effort to introduce them into the classroom. When they were asked what had encouraged them to use these tools, their replies were as follows: "In principle doing something new and not getting bored always doing the same thing; by the same token, also being confident that technology can help us not only to make life easier and more comfortable, but very often also richer in methodological terms". As far as the relationship between lecturers and students is concerned, lecturers with a positive attitude declare that this relation is improved as lecturers and students can rapidly communicate and express themselves. Some lecturers are not in favour and are afraid of new things, reluctant to receive training, and see the use of ICT as an imposition: "...I don't feel sure of myself, I don't handle the programs well enough, and I'm afraid of doing things wrong or of computer failure or of not knowing what to do if a problem arises. I don't feel comfortable either, because I have the feeling that they may fail and that class time will be lost". As for the students' attitude, lecturers agree that they react well to ITC and are motivated and show a positive attitude in the use of these resources. However, there are also unmotivated students who owing to a lack of training and interest prefer to be given contents in the traditional manner.

### **The role of lecturers and students concerning TIC**

Most lecturers believe that a university context favors the use of these technologies in the classroom. They are conscious of the role change expected of them and the initial use of ICT has guided them towards it; however, some teachers resist this role change and use these resources in a traditional manner (García-Valcárcel, 2007). Texts on this subject state that a change towards greater communication is being perceived. They admit that the lecturer has to work harder initially, but once this has been done everything becomes easier, updating is improved, etc. Relevant comments include the following: "...rather than transmitting knowledge to the students... it is now essentially a case of being a kind of catalyst. The lecturer used to be the one with the information on a discipline because he was the only one to have access to the sources; he was a kind of priest who transformed mysteries that were incomprehensible to students, information that students could not understand. Now on the other hand the information held by lecturers and students is almost the same and the latter can access the sources directly. Nowadays the lecturer's job is therefore to ensure that the student knows how to use this information".

### **Didactic criteria for the selection and use of ICT**

When lecturers were questioned as to the didactic criteria used to select the resources, their replies turned around subject contents, the students, existing resources and installations, improved knowledge transmission, and finally intuition as a teacher or professional experience.

### **Use of ICT by students**

Most teachers say that they involve their students in the handling of these tools, practicing in the computer rooms, including them in their way of working, designing their own material, etc. The most common activities carried out include the search for information, work presentation, expounding work with the use of PowerPoint presentations, electronic tutorials, laboratories, and to a lesser extent the use of forums and the production of videos. These initiatives coincide with the data found by Martínez and Aguaded (2004) and Coll, Rochera, Mayordomo and Naranjo (2007).



### **They improve the Teaching/Learning process**

To the question “Do you think that your teaching-learning process has improved with the use of ICT?” 24 of the 30 lecturers said that it had. However, most of them said so timidly, adducing that they do consider that they have improved their teaching-learning process, but that they are waiting to see results as many of them have only recently started to use these tools. The following paragraphs include some of the appraisals of the lecturers when they say that the use of ICT has improved their teaching-learning process: “... I have used ICT from the beginning; you always try to improve although not from using ICT in themselves, but perhaps because of the creation of new activities and innovations based on ICT. This year I see that things have improved...” “Yes, especially because you approach things in a different way; you reflect on what you are doing and then you realize that you are doing things that are of no use and that you can change them...” “...for me the various computer programs allow me to expound things more clearly and to get my students to see them better in the form of diagrams, figures, the connection to other resources on the Net...” There is another type of lecturer, those who use the resources but do not know or are not sure whether their teaching process is improving; they attribute this to the fact that it is very difficult to assess oneself. As far as learning achievements are concerned, despite their comment that students have a positive attitude to ICT, it can be appreciated that many lecturers are not sure whether learning achievements are improving.

### **Difficulties in using ICT**

Almost all of the lecturers interviewed thought that the difficulties in the use of ICT were of their own making, a third saw difficulties with the students, and a fair number mentioned other factors (too many students, the type of subject, and lack of time). The difficulties identified concerning lecturers are of three types: technical, methodological, and pedagogical. Technical difficulties are those that most often affect them in the use of ICT in the classroom, with methodological and pedagogical ones being of secondary importance. These technical difficulties include the lack of resources, the physical infrastructure, and the lack of preparation and knowledge of the programs. When teachers refer to the lack of technical support, they mean the fact that no specialist is available to support them in their teaching work when they use ICT. On the one hand, the methodological difficulties they mention are in keeping with the permanent updating that is required in order to use these

technologies, as owing to the large number of resources and programs that continually appear on the market, they do not make full use of them. On the other hand, lack of time is another of the difficulties faced by teachers; they have to spend time preparing activities and working with greater dedication, and their time is limited. In the long run, however, they recognize that this is a worthwhile investment.

### **ICT and the new Higher Education model**

Do you consider that the use of ICT in the new Higher Education model will be more necessary and usual within a university context? The replies were conclusive as the lecturers affirmed that these were necessary and usual within a university context orientated towards new methodologies, they concentrate on the student and learning can be followed up more closely, based on the strengthening of the lecturer-student relationship.

### **Competences related to ICT**

As for what teachers must know and know how to do in order to make adequate use of ICT, it emerged that lecturers attach great importance to technical preparation; to a lesser extent they consider the methodological factor to be important if good use of the ICT in the classroom is to be made. Those interviewed frequently lacked methodological/didactic training; on this subject one of the lecturers interviewed said that being familiar with computers is not enough and that one should also know how to design contents, activities, etc., considering it important: "...to know how to establish different communication channels with the students, to know how to create spaces with the use of new technologies with which students can work and collaborate together, and to know how to generate specific materials for new technologies. The self-study programs that the students will have to develop will need to be proposed, and we as teachers will then have to direct these learning processes; in order to do so we will have to use the technologies for these processes".

### **Themes that must be covered by teacher training on ICT**

The most valued points are three in number: being familiar with new programs, the creation of web sites, and the use of virtual environments. The programs that lecturers mention are those related to the designing of activities: Java, Html, Flash, Dreamweaver, and PowerPoint. As for virtual environments, those interviewed said that they are most attracted by communication tools, as in the new Higher Education model the use of these tools will be

essential for the holding out of tutorials. They declare that they need general ICT training to keep up-to-date.

### **Training Modes**

It can be affirmed that 90% of those interviewed wish to attend training modes attended by a teacher, and secondly are interested in self-learning, adducing that lecturers need their own learning space within the university; this must be independent and e-learning platforms must be used. Distance learning would seem to be more valued by lecturers with ICT experience. This is hard for lecturers with less experience. Within training modes attended by a teacher, lecturers prefer courses. Suggestions as to the contents of training courses indicate that they must be precise and limited to groups of teachers with basic practical training needs. Many express a wish for training courses in specific areas of knowledge, arguing that some aspects may be very useful for some people and not at all for others.

### **Discussion and Conclusion**

The results of the interviews give a great deal of information on the opinions and attitudes of university teachers regarding the integration of ICT within their teaching activities. A favorable environment is perceived from two fundamental pillars: lecturers and the institutional organization. As to the use of ICT, activities related to the search for and transmission/presentation of information continues to predominate, together with the use of e-mail as a communication tool. Among the difficulties encountered, the lecturers feel that technical problem prevent the use of these tools, and mention among others the lack of resources in some centers and the lack of preparation. Another important limitation is the lack of time to initiate ICT activities. As for methodological-didactic difficulties, they say they lack pedagogical training. Nevertheless, despite these limitations many teachers overcome any difficulties so as to make use of these tools. Among the competences that the lecturers believed to be determinant in the European Higher Education Space, they consider that it is important to become familiar with new programs to help them with their subjects, to know how to create web sites, and to know how to use virtual environments. On the other hand, they stress the importance of being able to link the use of ICT to educational practice.

### **Recommendations for the adaptation of the European higher education space**

*Relating to infrastructure:* Technological resources must be at the service of the teaching, learning, administration, specialties, and research of all teachers. Although much progress is being made, the existing technological infrastructure in universities must be improved insofar as classroom access to Internet and the virtual platform used are concerned. To guarantee efficient use of these resources, technical and didactic support teams must be created so that the latter can help lecturers with any difficulty in the handling of these tools.

*Relating to teacher training and that of students:* Teachers must be trained in and committed to the use of ICT. Given their formative characteristics however, different training plans are required to meet different needs and demands. A formative offer must be structured to include both lecturers who already use ITC and those who do not yet do so; in other words at least two training levels should be provided. Likewise, in order to guarantee that students can handle the ICT and learn on their own, formative activities aimed at them must be carried out.

*Relating to institutional support:* As to institutional measures, these must be capable of supporting both lecturers and students. Among organizational institutional measures it will be necessary to: 1) Improve the distribution of the number of students per class, 2) Distribute resources equally among the various faculties, 3) Encourage lecturers who are innovative in their use of ICT, either by acknowledging their work when assessments are carried out or by paying them a bonus, 4) Create spaces for exchanging experiences between lecturers both from their own centre and from different Spanish and international universities and 5) Provide technical and economic support to various university research projects designed to plan training activities by combining standard and virtual methodologies.

All of these recommendations have been generated by the reflections of the teachers taking part in the study, and should be taken into account in any institutional project designed to achieve the integration of ICT at the University.

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