NEEDS AND KNOWLEDGE REQUIRED BY PROFESSORS OF HIGHER EDUCATION IN THE APPLICATION OF ICT IN TEACHING: A SURVEY

Araiza, María de Jesús[1], Dörfer, Claudia[1], Kutugata Armando[2]

[1] Universidad Autónoma de Nuevo León (MEXICO)
[2] Universidad de Monterrey (MEXICO)
araizav@gmail.com, cdoerfer@gmail.com, akutugat@intercable.net

Abstract

This design dissertation was applied in response of the need to support the training of the body of professors of a Mexican university of higher education in the use and application of the Information and communication technology (ICT) in their classes. In order to do so, a study of mixed methodology was design to identify the needs of training and supported required to the staff of professors in relation with the ICT. The process of information gathered was conducted by the use of surveys and semi-structured interviews applied to three groups of professors that form the sample of this research. The questions of this research are: What are the needs of training in the area of ICT required from professors? And what type of support do these professors need in order to be able to use the ICT in their daily work? In a general sense, this research identified the needs and support required from the professors in the application of ICT in their daily work as well as the need of the authorities of the Mexican university to establish a policy in regard of the limits and criteria to train the staff of professors in the use and application of these new technologies.

Keywords: Information and communication technology (ICT), Higher Education, Training of professors of higher education.

1 INTRODUCTION

The changes of the new era where society now days uses more and more the ICT has provoke the use of the ICT in the traditional educational system of higher education, changing the process of teaching and learning using the ICT in the classrooms of universities. In this sense, universities require changes in their administrative and training programs of professors in order to fulfill these needs. As a result of all these changes, in the last couple of decades new virtual universities have been created around the world. As well as traditional universities with a face to face teaching methods are now day designing their classes using the ICT, using educational platforms like Moodle, Blackboard and WebCT, as well as others to offered virtual, online and blended courses.

Taking into consideration the pressure the ICT have on society, Universities are in the constant need to use and improve the use and application of ICT, considering the fact that they are in charge of producing and reproducing knowledge as well as up to date professionals with specific skills and abilities in relation with the use of ICT.

Therefore, universities must become active agents of change reinforcing their role as producers of knowledge with the use of technologies in the social and economic process as society now days are demanding. Unfortunately, universities have had a slow reaction in their own processes of adjusting their own structures in their academic and administrative procedures in the need of including the ICT in their daily work in terms of their teaching experiences.

In order to reverse this situation, universities must promote within their own process of teaching and learning using the ICT with outstanding and positive experiences, as well as, making changes in didactic strategies and instructional material used by professors having an outcome of new communication systems and distribution of the knowledge produced. These new techniques in forming of professionals supported by the use of ICT, demands also a new way of teaching and learning process where the student becomes an active responsible member of his/her own educational learning process.

On the other hand, the teacher's role also changes, where he/she must acquire new skills and abilities within his/her training in order to perform with success in the use and applications of the ICT in his

courses. The professor will become a tutor giving support to these students and letting the students act in an active way, being able to become responsible of their own learning experiences where he must complete specific tasks design by the professors using the ICT along the way.

Therefore, the constant experts' concern in the design of instruction methods and planning of courses using the ICT is transforming the professor's thinking and actions in his teaching and learning academic activities. The research motto was developed by the concern in which is considered, the distance that exists between the real necessities and the curriculum gathering, in the professors working in the education institutes.

1.1 Description of the community, object of the research

The present research was developed in a public Mexican university, conformed at that time by 467 professors, where 258 had a contract by course, 72 had a part time contract, and 137 had a full time contract. In regards to the experience working in the university, 52% were new staff members with less than 10 years of teaching experience in this university, 12 % had between 10 and 20 years of experience, 24% had experience of a range between 20 to 29 years, and 12 % had a 30 years or more of teaching experience in this university.

A total of 168 professors (36% of the total number of professors) are part of a generation of professionals who did not use the ICT in their own studies of higher education, taking into consideration that the use of personal computers were first used after the 1980's. This 36% of these professionals were trained in the use of the ICT in their working fields such as industries and companies of diverse branches. From the 467 professors, 265 of them (56.74%) had a master's degree.

The professor's staff is constituted by professionals who work in industries and companies having the chance of transmitting the reality of the working field to their students. Unfortunately, they do not have the time and commitment in relation to the training and studies offered by the university to actualize the academic staff in relation to didactic and methodological courses.

1.2 The working field and role of researchers

The members of this research team are professors with experience teaching in the ICT in diverse courses of higher education. Three out of four are part of the university taken as, the object of the study design and one work in a private university using the ICT in online courses and face to face courses with the use of educational platforms, such as, WebCT and Blackboard. Having active members of the professor's staff, gives the research team, access to direct contact with professors, academic and administrative members as well as high authorities being able to gathered relevant data during the process of this investigation. Therefore the needs and requirements were taken from the professors, taking into consideration the real atmosphere of the university as well as the training required to implement the ICT elevating the use and application of the ICT in their academic development.

1.3 Nature of the research problem

Taking into consideration the success or failure of the ICT in higher education depends directly with the acceptance and involvement of the professor within the process of implementation and domain of the technology involved in a user's degree, as well as, the level of capacity in the use of this technology (Maestre, Fonseca & Valdés, 2007).

The application of the ICT in Mexican universities, has been a slow and complicated process (Andión, 2002), considering the acquisition of technological equipment and the training required to the professor's staff, applying educational platforms and other courses to become up to dated in the use of this technology. This occurs because some professors have been working for the past decades in a traditional way without the use of the ICT, some do not have the skills of knowledge of the new technology and others have a hard time coping with new paradigms, in terms of education and the use of the ICT (Alonso & Fracchia, 2009). We can also find professors having the skills and abilities using the ICT but their lack of didactic knowledge is affected in terms of methodology and designing educational platforms (Collier, 2001).

Another factor that might explain the main cause of the impediment to have professors adapting to the use of the ICT, is the difference in generations. This can be the reason why professors over 40 years

might have a difficult time coping with the use if the ICT, according to the organism known as the OCDE [Organization for the cooperation and economic development] (2001). The OCDE stated that professors over 40 years old would not have the skills or training in the use of new technologies. Therefore, the implementation in Mexican universities would take a long process, with a substantial effort from academic authorities and technical personal. The Mexican university selected for this research fits into this category having 35.9% of his teaching staff over the age of 40.

According to several studies (Aduviri, 2007; Martin-Laborda, 2005; Ortega, 2005) in order for the higher education universities to have outstanding implementations of ICT in their curriculum and courses, they must change the attitude of their teaching staff towards new educational models based on the use of the ICT, the best way to do so, it's the constant training courses and incentives received by the institution in the use and application of the ICT in their classes.

When a university has a strategic plan to integrate the ICT in their programs and curriculum the reaching of objectives become a reality. That is the case of Penn State University who in 1997 elaborated a successful plan in the use and design of its courses with the ICT. One relevant factor found was the constant training of its teaching staff using the World Wide Web provided with didactic material for their use in the classroom as well as the media to check and provided with feedback to their members in order to implement the new technologies in their classes. Nowadays, the Penn State University is considered one of the best traditional universities with an outstanding distance programs in their virtual campus (Sangrà, 2002).

1.4 Defining the research problem

During a review of the bibliography found on the subject, authors such as Mioduser, Tur-Kaspa & Leitner (2000) y Ronen & Eliahu (2000) state that the use of ICT in the curriculum has benefits in relation to the learning experience. However, Kiridis, Drossos & Tsakiridou (2006) reported that the impact of the use of ICT in higher education has been lower than expected. Dawes (1999) and Watson (1997) have reported the failure of implementation of ICT in their classes. Studies conducted by Williams, Coles, Wilson, Richardson & Tuson, (2000) reported the failure of successful implementation of ICT even though the effort of some universities in offering training courses to professors with the objective of increase their abilities and skills required to apply the ICT with success.

The university selected for this research has in their entire classrooms electronic boards, computers, projectors and 7 rooms equipped with 50 computer equipment up to dated with the software necessary to carry out the demands planned. They also have an educational platform to design their courses using all this technology to their advantages. The university have a department of education continues, to qualify to his personnel. However having this is not enough to have a successful implementation of the ICT in their programs.

According to Crys (2000), the professors require more time to learn and practice new skills as well as instructional designers; technical personal specialized in new technologies, graphic designers and experts in didactical context working with the professors in order to use successfully the ICT in their courses.

1.5 Purpose of the research

The main objective of this research is to identify the needs in terms of the training and support required for the professors' staff in order to implement the ICT in their academic programs. The questions answered in this research are:

What are the needs in the training area required from the professors' staff in order to implement the ICT in their programs?

What are the types of support needed by the professors' staff in order to use with success the ICT?

2 METHODOLOGY

2.1 Type of research

Mixed study design using instruments such as surveys and interviews as well as systematic sampling, key informant, casual sampling and random sample techniques.

2.2 Population and sampling

The size of the sample was taken using the following formula:

n=((Z (s))/E)2 where n is the population of 467 subjects, Z is the value degree of confidence determined in a 95%, having a normal curve according the a value of 1.96, where S is the standard deviation and E the error considering by the research team of 5%.

The standard deviation (S) was considered using the results of a previous study with the determination of 50% of the professors not using ICT (Araiza, et.al,. 2003). According to this data, 233 professors are up the media and 233 are lower the media having a standard deviation of 116. This gives us a sampling of 95 professors.

In order to select the sample, the systematic sampling technique was applied. Having access to a list of all the staff professors, the first subject was taken by random and from that point, the rest was chosen taking the fifth of every member in the list until a list of 95 subjects was formed.

Other groups of professors were formed using the following techniques:

Key Informant Technique: selecting 3 professors who had the profile and relevant administrative responsibilities inside the university had the following positions: head master of the faculty, sub-principal and academic secretary of the institution.

Casual Sampling Technique: selecting 3 professors who where available and willing to participate in the research.

Random Sample Technique: another 3 professors were invited to participate and were chosen randomly.

2.3 Instruments and its validation

The instruments applied in this research were the surveys and the semi-structured interviews in the samples. The surveys were validated and reliable with a descriptive view design by Canales (2006) with the respective authorization by its author, given the needs professors demand and required in order to implement the ICT in their academic programs. The semi-structure interviews in situ where applied in the working atmosphere, in the daily situations surrounding the academic staff of the public university researched, having three types of semi-structured interviews A, B & C. The A type was used with the objective of gaining data from the academic authorities of the university regarding the need and requirements in the application of the ICT within the daily work of the professors in their fields. The B type was applied to the three professors to triangulate the data from all the instruments used and the C type was applied to the all those professors claiming they use the ICT in their classes and registering their experiences in that use.

2.4 The validation

The first type of validation was the constructs "needs training, support and use". The second type consisted in the validation of content of each question of the interviews. The judgment of experts was used for both procedures; a psychologist and professor of the Psychology Faculty Postgraduate school, a PhD in education of the Nutrition Faculty and an educational psychologist from the Postgraduate School of the Educational Sciences School. All of the questions from the script of the interviews where addressed to this academic group having several recommendations such as: distribution of items, rephrase of questions and use of concepts to avoid confusion to the participants.

2.5 Ethics - protecting privacy of participants

All of the professors participated in a voluntary way. All the information regarding the use and process applied in the research was discussed with them. A calendar was formulated to avoid disturbances with their daily work in and out of the classrooms. A transcript was written from the interviews and all the information codified using pseudonyms to preserve their identity. All the notes, paper work and logbooks were kept guarded by the research team.

3 RESULTS

In the first group of academic authorities the results of the interviews gave the following information: the ICT are effective tools to promote a quality in the learning and teaching experience in classrooms. The use of ICT gives access to the students at all times and any place. The uses of the ICT in academic programs are essential in these days considering the working atmosphere in today's companies and industries.

The effectiveness of the ICT depends on the skills of the students and professors in the effective use of it. Its use promotes an active and motivating class for the students increasing their learning of different courses. The academic staff has access to computer equipment 15 hours a day from Monday through Friday and 8 hours on Saturday and Sunday.

The variety of technologies available to the academic staff consists of: computers in all the classrooms, academic platform where the professors can upload material for their classes, interactive boards, access to Internet, projectors and specialized software. Offering a professional major in ICT, the faculty has access to equipment and software actualizing all of these in a regular base.

Nevertheless, it's also considered the need to increase a more effective training in the use and application of the ICT mixing the pedagogical and technical areas required part of the staff. One of the mayor problems in the academic staff are those professional who besides teaching part time or by courses, they also have a professional working life in the field. Working in other companies and industries adds experience and knowledge to their courses but limits their available time to train and learn more in terms of the implementations of the ICT and continuous training courses to increase their areas of expertise.

It was also considered a relevant need to add stimulus in the academic staff to increase and keep up their training programs offering diverse advantages to those who have a genuine interest in their performance as outstanding professionals in the academic field.

The need of creating a constant supervision in their training was also considered, increasing these courses with practical courses with pedagogical, technological and didactic courses in order to implement with the quality requested by the academic authorities of the institution. According to Marcelo (1999) when training professors in the use of ICT, it is relevant to consider the didactic knowledge on content, the pedagogical knowledge transmitted as well as the way this information is given to them.

In the second group of interviews (3 full-time professors) the answers were: the academic staff has a profound need for training courses regarding the use and implementations of the ICT. They also admit that even thought the institution offers equipment and software they require courses and training programs providing support in the use and integration of this technology into their courses.

Even though they have access to several courses regarding teaching and pedagogical themes, they require courses related with the use of ICT. They also mentioned the need for flexible hours for these courses considering the faculty offers 3 different schedules for the classes having the morning period, afternoon and nocturnal. One professor mentioned the constant use of the projector and computer in his classes but felt he was not really talking advantage of the educational platform and all the other tools the platform offers. They also feel that the institution is the one responsible of being an example with the use at all times of the ICT in their daily work.

The third and last group (95 professors) answered a survey of three segments as it follows:

The first segment gathered personal information regarding their personal and professional profile with information as: age, gender, educational degree and years of experience in the teaching field. From the sample the results are: 60% males and 39% females, (see figure 1), with an range of age between 20 up to 60 years presented as it follows: 8.42% have between 20 and 30 years, 32.63% have between 31 to 40 years, 22.10% have between 41 to 50 years, 21.05% have between 51 to 60, 15.78% have 61 or more (see figure 2).In terms of their teaching experience the ranges are: 40.23% has between 1 to 10 years, 16.83% has between 11 to 20 years, 29.26% has between 21 to 30 years and 13.68% has 30 or more years(see figure 3). In terms of their educational degree the participants showed diverse areas such as: accounting, administration, finances, costs, law and economics as the most represented in the sampling.
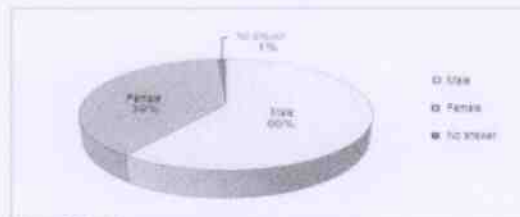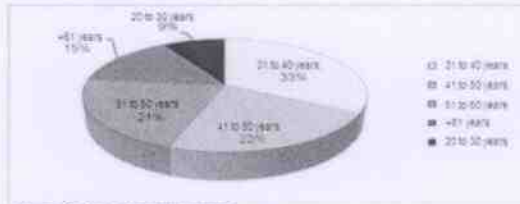
Figure1.Participants
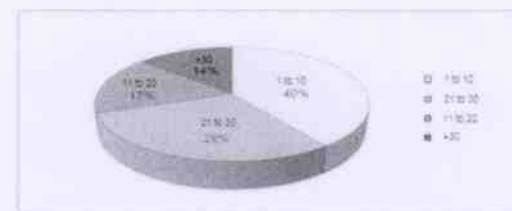

Figure 2.Age of participants

Figure 3.Years of teaching experience of the Participants.

The second segment registered the experience in the use of the ICT and the strategies to apply them in academic courses, 35.7% considered their use and knowledge in a basic level, 35.78% in a medium level, 12.63% under a basic level and 15.78% in an advanced level (see figure 4).
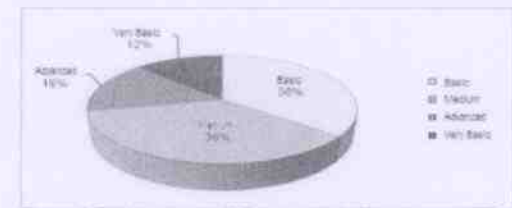

Figure 4.Training level in ICT Applied to the Education. a=.772

On the other hand, in relation with the application of the ICT in courses improving the learning experience of students, the results where that 9.47% considered themselves being in a range of advance level, 37.89% placed in a medium level, 36.84% in a basic level and 15.78% placed under a low level. (See figure 5)
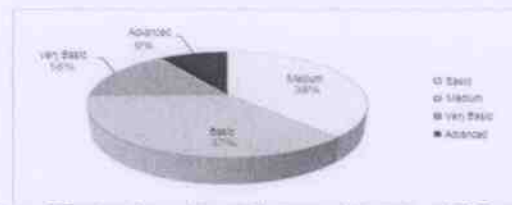

Figure 5.Teachers' experience in the use and integration of ICT. a=.772

The third segment of the survey revealed their opinion in relation with their perception of the integration of the ICT in the curriculum, the resources they have in the institution, the competence they required, the specific use they must have in order to maximize its exploit and the need of training in relation with the handling and integration of the ICT in their daily work.

In a general sense, the sample believes the use of the ICT would increase their level of learning in students when integrating the ICT in a holistic way. This is considering the pedagogical, didactic and technical view; considering the nature of their courses and semester place of their subjects according the major design. When these areas are not considered, the application and implementation would lack of efficiency as other studies offered a similar point of view; (Becker, 2001; Cuban, Kirkpatrick & Pack, 2001; Fisher, 1996; OCDE, 2004, Rodriguez, 2000; Fernandez & Cebreiro, 2003) mentioning the deficiencies done by professors in the right application and implementation of the ICT. Most trainees focus in the technical use of the media avoiding the pedagogical implications required to consider in the implementation of the ICT (Sanabria, 2004; Ornellas, 2007). Therefore the acquisition of technology in universities and training in its use is not enough to implement with success and excellence the ICT in their learning and teaching process.

In the tables 1 and 2 we show a partial part of the results of the third part of the survey, (for being very wide) but the obtained results are inferred in the draft.

Table 1. Training needs in ICT use of teachers (part 1).

Training needs in the use and / or creation of	Strongly Disagree	Disagree	Agree	Strongly Agree	No answer
	%	%	%	%	%
Utilitarian Tools	0.00	3.16	31.58	65.26	0.00
Multimedia Presentations	0.00	2.11	32.63	65.26	0.00
Integration Strategies ICT in the classroom	0.00	1.05	32.63	66.32	0.00
Websites	1.05	13.68	36.84	48.42	0.00
Educational Software Multimedia	2.11	14.74	35.79	47.37	0.00
tools audio and sound	3.16	4.21	41.05	51.58	0.00
Currents learning with ICT supported teaching	1.05	4.21	35.79	58.95	0.00
Internet and Web Environment	2.11	3.16	32.63	61.05	1.05
Communication experiences in a learning community	2.11	4.21	33.68	58.95	1.05
Formación que demanda la sociedad del conocimiento	1.05	33. 68	33.68	62.11	0.00

Note: The information contained in Tables 1 and 2 is part of a group of results has been divided into two parts

*p<0.01.

**α= .940

Table 2. Training needs in ICT use of teachers (part 2).

Training needs in the use and / or creation of:	Strongly Disagree	Disagree	Agree	Strongly Agree	No answer
	%	%	%	%	%
Specific sites for integration into the teaching	2.11	2.11	32.63	63.16	0.00
Use of ICT in virtual learning environments	0.00	3.16	28.42	68.42	0.00
Basic ICT skills Integration with specialized virtual	0.00	1.05	31.58	67.37	0.00
learning communities ICT integration didactic	0.00	6.32	31.58	62.11	0.00
proposals Training for ICT	0.00	2.11	34.74	63.16	0.00
curriculum integration	0.00	5.26	28.42	66.32	0.00

Note: The information contained in tables 1 and 2 is part of a group of results has been divided into two parts.

*p<0.01.

**α= .940

4   CONCLUSIONS

In a general sense, the authorities and academic staff of the institution analyzed in this research agree that the application and use of the ICT in their programs increases the student's learning process, and allows having a stronger communication between peers and student-professors in and out of the classrooms.

They also believe that a certification for academics is required in order to learn the pedagogical and didactic use of the ICT in the curricula. Not only the technical use of the ICT but also to considered a holistic acquisition of skills and abilities in the process of implementation and application of an educational platform having a profound commitment from the staff to increase the quality of their performance.

Having access to equipment, Internet, platforms and software would help to achieve the goal of increasing the integration of the ICT in the entire curricula considering the profile and characteristics of the academic personal.

Therefore, this research team suggests the creation of a Certification for the academic staff in a process of 14 months offering several courses; every 3 months, in a mixed format using the institutional platform with the following courses:

Stage one: Introduction to the ICT (academic platforms and educational   techniques: AC, POL, PBL & Cases). [12 weeks]

Stage two: Strategies and tools in an educational platform: mixed Online and virtual courses in higher education; Discussion groups; online exams and quality of feedback in emails and chats; use of multi-media in virtual communities. [12 weeks]

Stage three: Instructional Design: Theory & Practice. (Theory: ASSURE, DPIPE, and others). Practice: designing their academic course using the educational platform of the institution. [12 weeks]

Stage four: Implementation of the course to a pilot group: Feedback and redesigning their academic course: Review and evaluation from the Center of training of faculty staff. [12 weeks]

Stage five: Final Evaluation: Application and analysis of surveys to measure the levels of satisfaction from the students and authorities of the academic department of the institution. [8 weeks]

Stage six: Certification of the professor completed: Diploma with an institutional value from the authorities of the institute.

Requirements to have access to the certification process:

1. Contract by hours or course having been assigned at least two groups in undergraduate or master degree level.

2. Teaching experience of at least 2 semesters previous to this certification program.

3. Commitment to participate actively signing up a personal commitment letter. In order to obtain the certification diploma the professors must conclude with a passing evaluation the 5 stages of the certification program.

4. Laptop or computer equipment with Internet access.

5. 100% attendance to the initial and final sessions of the five stages. Deliver of 90% of all the assignments of each stage in order to have the passing grade to the next stage.

6. In the case of failing or leaving one stage, he or she may take the stage in a second round continuing its certification process. The professors will justify their absence and have written authorization to continue the certification process according to the standards of quality of the certification program.

Once the professor concludes the certification process he or she may apply to an increasing process of courses to teach, and a bonus on his/her income per semester, according to the regulations validated by the authorities of the institution.

REFERENCES

[1] Maestre, U., Fonseca, J. & Valdés, P. (2007). *Entornos virtuales de enseñanza aprendizaje*. Ciudad de Las Tunas: Editorial Universia.

[2] Andión Gamboa, M. (2002). Universidad nodo: modelo inteligente para la sociedad en red. *Reencuentro*. Diciembre, 9,23

[3] Collier, C. (2001). Staff development for technology integration in the classroom. En J. F. LeBaron & C. Collier (Eds.), *Technology in its place: Successful technology infusion in schools* (pp. 61-72). San Francisco, CA: Jossey Bass.

[4] OCDE. (2001). *Les nouvelles technologies à l'école : apprendre à changer*. Paris: OCDE.

[5] Aduviri, R. (2007). Nuevas tecnologías de la información y la comunicación (NTIC) en educación. *Proyecto Educativo*. Recuperado el 13 de marzo de 2010, de http://www.slideshare.net/ravsirius/p-r-o-y-e-c-t-o-e-d-u-c-a-t-i-v-o?nocache=1805

[6] Martín-Laborda, R. (2005). Las nuevas tecnologías en la educación [Versión electrónica], *Cuadernos/Sociedad de la Información 5*. Recuperado el 19 de diciembre de 2009, de http://www.scribd.com/doc/214644/cuadernos-05-rocio

[7] Ortega, R. (2005, marzo 05) ¿Cómo perciben los profesores la capacitación y actualización? [Versión electrónica], *E-Formadores/Red Escolar México*, 5. Recuperado el 05 de junio de 2010 http://e-formadores.redescolar.ilce.edu.mx/revista/no5_05/rebe_actua.pdf

[8] Sangrà, A. (2002, mayo). Educación a distancia, Educación presencial y usos de la Tecnología: Una tríada para el progreso educativo. *Edutec, 15*. Recuperado el 17 de septiembre de 2010, de http://www.uib.es/depart/gte/edutec-e/revelec15/albert_sangra.htm

[9] Mioduser, D., Tur-Kaspa, H. & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning, 16*(1), 54-63.

[10] Ronen, M. & Eliahu, M. (2000). Simulation – a bridge between theory and reality: the case of electronic circuits. *Journal of Computer Assisted Learning, 16*(1), 14-26.

[11] Kiridis, A., Drossos, V. & Tsakiridou, H. (2006). Teachers facing information and communication technology (ICT): the case of Greece. *Journal of Technology and Teacher Education, 14*(1), 75-96.

[12] Watson, G. (1997). Pre-service teachers' views on their information technology education. *Journal of Information Technology for Teacher Education, 6*(3), 255-270.

[13] Dawes, L. (1999). First connections: Teachers and the national grid for learning. *Computers and Education, 33*, 235-252.

[14] Williams, D., Coles, L., Wilson, K., Richardson, A. & Tuson, J. (2000). Teachers and ICT: Current use and future needs. *British Journal of Educational Technology, 31*(4), 307-320.

[15] Cyrs, T. (2000). College courses in cyberspace. NEA Members in Higher Education, 17(3), 5-7.

[16] Araiza, M., Madrigal, M. & Treviño, V. (2003). Conocimiento y uso de las herramientas básicas de tecnologías de la información por el docente para la impartición de su cátedra. *Boletín Cuerpos Académicos de la Facultad de Contaduría Pública y Administración de la UANL, 1(1)*, 6-7.

[17] Canales, R. (2006). Estudio de opinión y necesidades formativas de profesores, en el uso e integración curricular de las TIC, para sustentar una propuesta de formación orientada a la innovación didáctica en el aula. *DIM Revista Didáctica, Innovación y Multimedia, 5*(2). ISSN: 1699-3748.

[18] Marcelo, C. (1999). *Formación del Profesorado para el Cambio Educativo.* Barcelona: Ediciones Universitarias de Barcelona S.L.

[19] Becker, H. J. (2001, abril). *How Are Teachers Using Computers in Instruction?* Documento presentado en las reuniones de la Asociación Americana de Investigación Educativa, Seattle, WA, EE. UU.

[20] Cuban, L., Kirkpatrick, H. & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal 38*(4), 813-834.

[21] Fisher, M. (1996). Integrating information technology: Competency recommendations by teachers for teachers training. *Journal of Information Technology for Teacher, 5*(3), 233-238.

[22] OCDE. (2004, 3 de febrero). *Completar las bases para una educación a lo largo de la vida.* Recuperado el 12 de abril de 2009, de http://www.oecd.org/dataoecd/59/1/ 39732493.pdf

[23] Rodríguez, F. (2000). Las actitudes del profesor hacia la informática. [Versión electrónica], *Píxel Bit.* 15. Recuperado el 15 de octubre de 2010, de http://www.sav.us.es/pixelbit/pixelbit/articulos/n15/n15art/art158.htm

[24] Fernández, C. & Cebreiro, B. (2003). La integración de los medios y nuevas tecnologías en los centros y prácticas docentes [Versión electrónica], *Píxel-Bit. Revista de Medios y Educación,* 20. Recuperado el 12 de Octubre de 2010, de http://www.sav.us.es/ pixelbit/pixelbit/articulos/n20/n20art/art2003.htm

[25] Sanabria, A. (2004). *La formación permanente del profesorado para la integración de la tecnología de la información y la comunicación en la Comunidad Autónoma de Canarias.* Disertación doctoral no publicada. Departamento de Didáctica e Investigación Educativa. Universidad de la Laguna, Tenerife, España.

[26] Ornellas, A. (2007). *La formación permanente del profesorado de secundaria en tecnologías de la información y la comunicación: el caso de Cataluña.* Disertación doctoral no publicada. Universidad de Barcelona, Barcelona, España.