PEDAGOGICAL OBSTACLES IN TEACHER TRAINING ON INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

ABSTRACT: Recognizing the key role of the teacher for the application of technology in education, this study investigated the nature of the *epistemological obstacles* that hinder the acquisition of *Information and Communication* Technology *(ICT)* skills by teachers.

Our research was implemented among a group of teachers who participated in a training program that took place in Greece. The program was of a national scale and was named "*In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education*" (Pedagogical Institute 2002). Teachers who participated in the first phase of this program were expected to acquire basic skills in the use of ICT. It is anticipated that through later phases of the program (which is still in progress) participants will acquire the appropriate skills in the use of *ICT* so as to be able to effectively use this technology for educational purposes.

Data collection for our research was brought together through two separate questionnaires which were answered at the beginning and at the end of the program by secondary and primary teachers of the Dodecanese Islands. Useful conclusions were reached concerning *pedagogical obstacles* (the form of *epistemological obstacles* within educational contexts) which are shaped during the didactical process. According to our research the primary obstacles were proved to be related to verbal expression. Additionally most obstacles were found to differ in respect to some participant characteristics (such as gender, speciality, whether teachers work in primary or secondary education, age,). In order to detect ways to overcome such obstacles, further research will be required.

Keywords: *Epistemological Obstacle, Pedagogical Obstacle, ICT, Teacher Training*.

1. INTRODUCTION

Adopting *Information and Communication technology (ICT)* in education can be influenced by

technological, organisational, social, cultural, economical and teacher development factors (Schofield 1995; Siemer 1998, Mau 1999; Weikart and Marrapodi 1999, Hossain, Pouloudi and Magoulas 2000, Ward 1999; Selwyn 2000; Leask and Younie 2001). Teacher development in ICT skills and knowledge is interrelated to three basic needs: access to ICT, training and ongoing support (Williams, Coles, Richardson, Wilson and Tuson, 2000). This paper focuses on the teacher training factor and in particular to obstacles internal to the learning process; these obstacles are called "*pedagogical obstacles"* according to Bachelard (1970) and hinder teachers' attempts to familiarise themselves with the use of ICT and to apply technology in their classroom. These perceptions are elicited from an empirical research study, which was implemented in Greece (Dodecanese Islands) within the frame of a national training program on ICT known as "*In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education*". The results provide a description of the difficulties, which are often encountered by teachers who are trying to become proficient in ICT skills. Apart from the external appropriate conditions that must be ensured, our analysis shows the need to consider didactical issues during teachers' training to enhance ICT adoption in the education environment. The discussion in this paper aims to shed light on pedagogical factors that influence the efficiency of teacher training programs.

2. TEACHER TRAINING IN ICT IN GREECE

Programs of further training on ICT in Greece, especially those ones that especially target teachers, are characterized by enormous variety due to the fact that no standard course structure and content exists for such programs. Additionally no unique educator's profile exists either, and programs vary with regard to the organizer, the trainers, the duration, the content.

Given the trends of adopting ICT in education both in the USA and Europe, Greece also followed suit by introducing ICT lessons in secondary schools during the late 1980s. Since then, many programs for teachers' further training on ICT have taken place. They were mostly based on the model of education in training centres, as seminar courses and rarely on the model of in-service training and even less on distance education. A variety of criteria were used in order to select the teachers who would attend these programs as the capacity for the number of participants was limited. In addition, the courses were characterized by diversity in content. Some of these had focused on the general use of ICT, several on educational software, some others on Computer Science introductory issues. Certain programs tried to utilize the potential of the network technology in general and of the Internet specifically. Usually these courses were very intensive but with a very short duration.

The Greek government leads a number of initiatives and projects for the wider dissemination of ICT in secondary education schools. Although several promising training programs have taken place, on the whole, the programs do not sufficiently cover the teachers' needs (Vosniadou & Kollias, 2001, Politis, Roussos, Karamanis, & Tsaousis, 2000). Apart from a few notable exceptions, teacher training programs lack organisation, duration and pedagogical direction. It is important to note that until now in Greece, ICT in pre-service teacher education has been almost non-existent (only some optional courses are provided in undergraduate programs) and in-service education has been ad-hoc and of an informing nature rather than aiming to support the development of educational practice (Kynigos, 2001).

A teacher training program in Greece known as "*In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education*" has been in progress since 2002. Teachers-participants in this program are expected to acquire basic skills in use of technology in order to utilize ICT for educational purposes, in accordance with the *eEurope* initiative (Commission of the European Communities 2000, 2001). According to the original planning by the Greek Pedagogical Institute, a plethora of training programs are supposed to take

place all over the country aiming to attain, within certain discrete phases, the following goals for teachers:

Phase A: To acquire the basic skills in using ICT.

Phase B: To be able to integrate new technology in the educational process.

Phase C: To acquire the appropriate knowledge and skills in order to participate in the planning of lessons and to be able to produce scenarios for educational activities using ICT.

Until today only the programs of phase A have been implemented. The original planning states that the training process will not be constrained to seminar courses. The teacher participants will have the opportunity for daily practice with technical support during the 4 months after the course completion. After this practice takes place they will participate in a certification process in order to certify that they have acquired the necessary technical skills. For the training program's implementation teachers can choose the model of their training among the following options: in service training model, training in centres, distance training mode, or even self–training for those teachers that have already sufficient ICT skills. In summary, the program "*In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education*" is the most recent and the most widespread in Greece as far as the teacher training in pedagogical use of ICT is concerned.

3. THE NOTION OF THE EPISTEMOLOGICAL OBSTACLE

The main study of this article consists of how epistemological obstacles are being shaped during the process of further education of teachers in ICT. Our theoretical framework is based on Gaston Bachelard's work on epistemological obstacles (Bachelard, 1970). A basic hypothesis in Bachelard's theory of epistemological obstacles is that knowledge is constructed in a dialectical manner. Therefore "new" knowledge is derived from former knowledge but is simultaneously in conflict with it as well (Artigue, 1992). The inertia that appears by ingrained cognitive schemas in

every attempt for readjustment or replacement by new schemas can be considered an epistemological obstacle. The replacement of a schema takes place with greatest difficulty when the schema has been in use for a long time. An epistemological obstacle can be considered the existence of a particular piece of knowledge instead of the lack of it. This knowledge must have been satisfactory for an adequate time period, helping one solve problems and giving answers in a certain context, thus becoming anchored in one's mind. If such an "anchored" knowledge is proved inadequate, when applied in another context and in solving new types of problems that are being faced, then an "epistemological obstacle" is often created (Brousseau, 1983, Tall, 1989). In essence, teachers find it difficult to alter existing patterns of cognitive behaviours or revise their current knowledge base. The theory of epistemological obstacles challenges two fundamental tenants of scientism; it refutes:

a) The traditional consideration to which empirical and scientific knowledge are unified (Kouzelis, 1991). According to the above mentioned theory, empirical knowledge is a product of senses, while traditional scientific methods are constructed through a process of elaboration, reconstruction and rejection;

b) The perception of the history of science according to which the construction of science is considered a continuous linear evolution (Kouzelis, 1991). The model suggests science should be considered in terms of obstacles rather than in terms of linear sequencing. (Bachelard, 1970). Applications of the theory of epistemological obstacles are not constrained in references from the history of science but can be expanded in the field of education as well. Epistemological obstacles formed in education are defined as pedagogical obstacles (Bachelard, 1970, Kouzelis, 1991). The concept of an obstacle can be examined both in terms of the historical evolution of scientific thought and of the act of education. Bachelard observed the devaluation of pedagogical obstacles in education (Bachelard, 1983). Teaching is a process of destruction and revision of empirical knowledge; therefore a cathartic process should take place before the production and construction of scientific knowledge (Bachelard, 1970).

Within the construct of the pedagogical obstacles, two primary obstacles to teacher training were identified and are discussed in this article. They are the obstacles created through *primary experience* and *verbal expression*.

4. THE OBSTACLE OF PRIMARY EXPERIENCE

The obstacle of *primary experience* concerns the experience that is placed before and above criticism, which is necessarily an integral part of the scientific mind. Therefore, *primary experience* cannot be regarded as utterly reliable (Bachelard, 1970). The obstacle of primary experience derives from former teacher training and teaching experience and their existent learning methods.

4.1. FORMER EDUCATION - TEACHING EXPERIENCE

Teachers already have a preformed theoretical background and various professional and teaching experiences, which, in association with the generalizations that have taken place, constitute a potential obstacle to new knowledge. Teachers' pedagogical education and their professional experiences have solidified teaching models, which can be hard to revise. They show resistance in any process that questions their knowledge, especially when their teaching methods are doubted (Vratsalis, 2003). The majority of teachers, during their service in education, have already formed a didactical model without computers and ICT. Teachers prefer having control of the instruction and rarely doubt their teaching methods (Kordaki, 2000). Even if teachers decide to use ICT, research suggests that they fit technology into their established ways of teaching, rather than establishing a completely new method of teaching by taking into account the new technologies (Simpson et al., 1999).

4.2. PRE-FORMED LEARNING METHODS

Every teacher has adopted ways and methods that help him/her learn more effectively. Learning ICT demands specific knowledge and methods, which may contradict the already formed teacher learning models. Such methods are forced by the requirement of particular skills. These skills correspond to knowledge but the acquisition of this knowledge does not ensure the achievement of the necessary practical skills. In order to develop such a competency, drill, practice, and repetition are demanded. A teacher needs to invest time and hard work, in order for benefits deriving from the use of ICT to appear in the long run. The technology is time-consuming and laborious for the beginners. Yet, there is a threshold of initial knowledge in ICT beyond which tasks implemented by using technology are facilitated extensively.

5. THE VERBAL EXPRESSION OBSTACLE

The verbal obstacle is an obstacle deriving from linguistic-expressions. Words do not transfer the same meaning for all people that hear or read them (von Glasersfeld, 1987). Thus, meanings attached to a word differ from teacher to teacher according to their former knowledge and experiences (Kordaki, 2000).

The development of information technology has passed through many stages. The use of machine and assembly language are continually being replaced by more and more friendly interfaces. A type of language for messages and instructions that resembles to natural language is now usually used in order to interact with computers. Yet interaction between user and computer still demands the former to follow specific rules, processes and technical language. Teachers have to familiarise themselves with computers' culture and technology's terminology.

In most ICT applications certain natural languages, especially English, have dominated and therefore linguistic problems arise for teachers who are not sufficiently fluent enough to speak these languages. Within the process of rapid evolution of information technology, new

definitions, terminology and concepts are being created and often used in their original form without any translation. Usually the original terminology remains active even after their interpretation and translation. This extended use of the English language provokes misapprehensions and generalisations for teachers. Additionally the unfamiliarity of dominant languages, such as English, restricts Greek teachers from using or learning how to use a plethora of ICT applications.

6. FACTORS AMPLIFYING PEDAGOGICAL OBSTACLES

The formulation of pedagogical obstacles can be influenced by several factors. Such factors can be of an internal nature, that is factors that concern teachers and the particular characteristics of their profession, for example: their age, their professional experience, their cognitive subject, their former education. Some external conditions might also prove to be influential, such as perceptions and stereotypes that are socially acceptable. Another external factor that amplifies the pedagogical obstacles during teacher training is technology itself and its rapid evolution. Teachers need to invest a great deal of effort in order to keep informed of the latest advances in ICT, due to the continual changes in technology. Acquired knowledge can soon become obsolete and new applications or even new fields of application arise (Kalogeropoulos, 2000). The need for teachers to adapt to a multitude of changes due to the speed at which technology is evolving can have a negative effect on the willingness of teachers to introduce new technological innovations in their classroom (van Braak, 2001).

This rapid rate of technology development can also deeply affect the organization and implementation of training courses. The context of education changes rapidly along with technology development and the didactic transformations (converting the scientific knowledge into school knowledge, Chevallard, 1985, Astolfi & Develay, 1989) are often not developed

rapidly enough. The delay that characterizes the processes of converting scientific knowledge of ICT into a workable syllabus hampers educational innovation.

7. DISCUSSION

The aim of this study was the investigation of the pedagogical obstacles that teachers face when trying to familiarize themselves with the use of ICT in educational practices. The research program took place in a region of Greece called the Dodecanese Islands. Within this research, teachers of primary and secondary education who participated in the program "In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education / Initial Training of Teachers in ICT", phase A, were included.

Data during this research was collected via the answering of two different questionnaires. The first questionnaire was answered on the first day of the training program and concentrated on the study of the teachers' initial training, their previous knowledge, and their attitude towards the use of ICT in education. Difficulties that teachers had faced in previous courses or during self-training in ICT were also examined. The second questionnaire, which was answered on the last day of the program, focused on the investigation of difficulties that arose during the particular program and methods used in order to overcome these obstacles.

The questionnaires were given to 170 secondary and primary teachers and were finally answered by 133. 76 teachers participated in programs implemented in 7 different Training Centres of the Aegean University in Rhodes, while the rest (57) participated in programs implemented in 2 different Training Centres on the island of Cos.

7.1 SUMMARY OF PARTICIPANT DATA

The group of teachers, who answered the questionnaire, consisted of 133 teachers; 35% of the group were men and 65% were women. The majority of the group, 75%, was aged between 31 and 50. 54% was aged between 31 and 40. By investigating previous employment and didactic experience, we found out that the majority of the group, 81%, had been employed as teachers from 3 to 20 years. Roughly half of them, 41% had at least 11 years and no more than 20 years of classroom experience.

As far as the teacher *specialities* are concerned, 56% of the group were primary teachers and 44% (59) were secondary teachers. 22% worked in High Schools and 20% in Lyceums and Technical

Schools. 13% taught practical sciences (physics, chemist, mathematics etc.) and 21% taught theoretical sciences as theology, literature, history, foreign languages.

The distribution of teachers per speciality is analytically presented in table I.

WHICH TABLE IS THIS? TABLE 1? -> it is placed in the end of the document. You can place it here if you wish…

Finally, by examining general previous knowledge, we found out that 76% of the teachers spoke English, at least in a fair degree, while 30% spoke satisfactorily a second foreign language as well. Only 7% of the group had attended some postgraduate program in the past.

7.2 RESEARCH RESULTS: PREVIOUS KNOWLEDGE, EXPERIENCE AND ATTITUDES OF TEACHERS

A sequence of questions in the questionnaire focused on appreciating the teachers' previous knowledge of ICT. Forty-eight percent of the teachers had attended another training program in the past. The overwhelming majority of the group had mainly attended courses concerning word processor use (95%) and spreadsheet use (70%). A great number had attended courses on the use of the Internet (mainly about browsers and email use, 47% and 49% respectively).

62% of the teachers had a computer of their own (at home) and 51% used a computer at least on a weekly basis. It was recorded that 50% knew how to use the Internet and 37% declared that they use Internet at least on a weekly basis.

92% believed that the Internet could play a determinant role in education, and a higher percentage of 93% believed that using ICT would improve teaching, at least if specific conditions were satisfied. This attitude towards the Internet and the use of ICT was expected, as the training program was discretionary and teachers had freely chosen to participate in the course. General conclusions concerning all teachers cannot be made. In order to be able to extract safe conclusions concerning the educational staff as a whole, it would be necessary to study the opinions and attitudes of the teachers who did not apply to attend the course as well. Besides, the favourable attitudes toward general computer use do not directly imply favourable attitudes towards the use of specific computer applications in the field of education (van Braak, 2001).

Although a large percentage of the group had previous experience with the use of computers, only 15% had ever used one in a classroom. A mere 3% of them frequently used ICT in educational practices. Such teachers who had attempted to introduce ICT in their instruction had mainly used presentation tools (software) or certain educational software (applications such as electronic encyclopaedias).

It is a great challenge for teachers to integrate ICT in teaching, instead of using it only for supportive tasks. Until now in Greece there has been no real integration of ICT into teaching practices on an organized, nationwide scale. ICT applications have only been used for supportive tasks. The acquisition of the fundamental skills on ICT is not by itself sufficient for the constructive use of it in the classroom. To integrate technology into the classroom practice, teachers must not only learn how to use technology, but they must also fundamentally change the way they teach (Fabry & Higgs, 1997).

According to the teachers, 60% of them cited the lack of direct and permanent technical support is a decisive factor that prevents them from using the technology in teaching and reduces their desire to be trained on ICT. When using ICT in a classroom, it is quite common that unanticipated, sudden and annoying problems can appear and this is a source of stress and insecurity which teachers will try to avoid.

It is an impressive fact that 62% of the teachers believed that they would be able to integrate ICT in their teaching after the end of the course. Yet the training program was explicitly intended to help them acquire basic knowledge and skills concerning the use of ICT. This leads us to the conclusion that the teachers of the group were not properly informed about the objectives and the goals of program, or they did not realise what it takes in order to integrate ICT in the classroom in an effective manner. Since 93% of the participants were optimistic that ICT could improve teaching, it seems that the expectations between the teacher participants and the organisers of the program differ in regard to knowledge and competencies that participants would (or could) acquire by the end of the course. In the long run such differences in expectations may cause disappointment, even dropping out of such programs.

7.3 RESEARCH RESULTS: THE DIFFICULTIES TEACHERS FACED

According to the teachers' perception the most important difficulties that they had to cope with during their training, were of verbal origin. At the beginning of the program 32% of the educational staff stated that they considered the special technical terminology that is required in learning how to use ICT as the most common difficulty for their familiarization with ICT. This percentage had decreased to 28% by the end of the program. This obstacle was even greater for teachers of theoretical sciences. Over half of them (53%) considered technical terms to be complicated. A small difference appeared between the two genders: women seemed to find it

harder to become familiar with technical terms (35%) while men appeared to find them easier (28%).

The second obstacle was also of a verbal nature and concerned the use of terminology originating from a foreign language, mainly English. At the beginning of the program 29% of the participants stated that the widespread use of foreign languages in ICT might cause difficulties, and this percentage increased into 34% by the end of the program. This difficulty seemed to be very important for the older teachers (over 50 years old). This category selected this difficulty as the greatest obstacle (46%) for them. Among younger teachers this percentage was lower (20% for ages up to 30 years and 21% for ages 31 up to 50 years). Younger teachers appeared to be more familiar with English. Again a differentiation between the two genders existed: men seemed to be less familiar with foreign language terms (34%) while the percentage of women having problems was only 27%.

22% of the teachers considered the unceasing pace in technology development and the continual effort of adaptation that is required, as an inhibitory factor for their training in ICT. The phenomenon seemed to concern secondary education teachers (32%) more than primary education ones (13%). This percentage increased to 53% for the experienced secondary education teachers who mainly teach mathematics physics, chemistry and gymnastics. It could be characterized as a secondary obstacle as it concerns teachers who have already enough knowledge and experience on ICT. Again a gender difference existed with 24% of women considering technology development an obstacle, but with only 17% of men.

Several teachers (18%) believed that ICT is a cognitive subject that differs radically from their previous education and their familiar ways of learning. However, this percentage increased to 27% by the end of the program. As far as teachers of theoretical sciences were concerned, this percentage was a high 43% and for teachers of foreign languages is was 33%. Fourteen percent of primary education teachers shared this conviction. As far as this consideration was concerned, a great difference existed between women (23%) and men (9%).

A mere 7% of the group of teachers thought that technical skills required could be considered an obstacle. However, this percentage was 22% for theoretical and foreign language teachers. It is a remarkable fact that exclusively women teachers stated that this was an obstacle.

Another problem for 26% of teachers was the lack of computer access and of the opportunity for practice. This need for further practice appeared to be more intense by the end of program (39%). This could be expected because of the cancellation (or postponement) of the (previously mentioned) 4 month practice period that was initially planned to take place after the training.

The main difficulties which teachers faced are presented in figure 1.

This figure is based on their answers, both in the beginning and in the end of program. Nearly all teachers (95%) considered further training on ICT necessary, adopting the point of view that ICT can and should be used in the educational process. This fact is in harmony with international studies that point out the indispensability of effective and manifold training and continual support in the everyday use of ICT in the teaching process (Cuban, 2001, Aviram, 2001).

Some interesting conclusions can be derived by examining the efforts of teachers to overcome the previously mentioned difficulties. Before starting the program 22% of the teachers declared that they had not overcome difficulties that they had faced in the past. By the end of this particular program however, only 2% declared that they did not overcome difficulties met during the specific course. 30% supported the view that the obstacles met had been overcome with the help of their instructors. 75% of them declared that some obstacles had been overcome due to their self-training as well.

This study has shown that difficulties that teachers confront in their training on ICT differ in respect to their gender, their speciality, whether they work in primary or secondary education, and their age. Important differentiation appeared in the opinions of the teachers at the beginning and at the end of the program. Additionally, different kinds of difficulties could be distinguished by studying the answers of teachers, depending on their initial level of competence on ICT skills. This fact highlights the necessity for further differentiated education with regard to each cognitive subject and according to previous experience of teachers. Finally, the teachers agreed that ICT can and should be used in the educational process and for this purpose they consider their ongoing training in ICT as a basic necessity.

8. CONCLUSION: AREAS FOR FURTHER STUDY

Teachers need access to a considerable range of knowledge and skills in order to be able to keep up with technology innovation to provide students with the best education possible. The results of the research detected various training factors which contribute to the slow adoption and the lack of exploitation of ICT in schools. It is important to continue this survey, on a larger scale and through different research methods, in order to learn more about the different obstacles that teachers face during their training and also to record ways to overcome such difficulties. A more in-depth diagnosis of the way pedagogical obstacles are formed and the way they affect instruction, would allow instructors to choose and plan more effective instructional strategies.

As previously mentioned, the successful introduction of ICT in education depends on several factors, which include infrastructure, training, organisational and technical supporting issues. We believe that an integrated strategy that recognizes the complexity and interrelations of these issues is needed in order to successfully exploit the capabilities that ICT can offer within an educational context.

REFERENCES

Artigue, M. (1992) Functions from an algebraic and graphic point of view: cognitive difficulties and teaching practices, in E. Dubinsky & G. Harel (Eds) *The Concept of Function: Aspects of Epistemology and Pedagogy,* M:A:A Notes Series, 25, pp. 109-132.

Astolfi J.-P. & Develay M. (1989) *La didactique des sciences*, Paris:P.U.F.

Aviram, A. (2001) From 'computers in the classroom' to mindful radical adaptation by education systems to the emerging cyber culture, *Journal of Educational Change*, 1, pp 331-352

Bachelard, G. (1970) *La Formation de l'esprit scientifique*, Paris: Vrin, 1970.

Brousseau, G. (1983) Les obstacles epistemologiques et les problemes en mathematiques, *Recherches en Didactiques des Mathematiques*, 4.2, pp. 164-168.

Chevallard, Y. (1985) *La transposition didactique – du savoir savant au savoir enseigne*, La Pensee Sauvage, Grenoble.

Commission of the European Communities (2000) *e-Learning – Designing tomorrow's education*, Brussels. Available at:

http://europa.eu.int/eur-lex/en/com/cnc/2001/com2001_0172en01.pdf

Commission of the European Communities (2001) *The eLearning Action Plan Designing tomorrow's education,* Brussels. Available at:

http://europa.eu.int/comm/education/programmes/elearning/comen.pdf

Cuban, L. (2001) *Oversold and underused. Computers in the classroom*, Cambridge: Harvard University Press.

Fabry D. L. & Higgs J. R., (1997) Barriers to the effective use of technology in education: current status, *Journal of Educational Computing Research*, 17(4), pp. 385-395.

Hossain S., Pouloudi A. and Magoulas G.D., (2000) Issues of IT adoption in schools. In R.Hackney (eds), *10th Annual Business Information Technology Conference (BIT 2000)*, November 1-2 2000.

Komis, V. (2001) *Didactis of Informatics*, Greek Open University, Patra (in Greek).

Kordaki, M. (2000) Informatics as a subject and learning tool. A social-cognitive approach. Patra (in Greek).

Kouzelis, G. (1991) *From the empirical to scientific word*, Critic Scientific Library (in Greek).

Kynigos, C. (2001) New practices with new tools in the classroom: Educating teacher trainers in Greece to generate a 'school community' use of new technologies. *Themes in Education Journal,* 2 (4), pp. 381-399.

Kynigos, P., Karageorgos, D., Vavouraki, A. & Gavrilis, K. (2001) The opinions of the teachers of "Odysseas" relative to the use of the new technologies in education, in V Komis (Eds), *Proceedings of the 2nd Panhellenic Conference "Information and Communication Technologies in Education"*, Patra (in Greek).

Leask, M. and Younie, S. (2001), Communal Constructivist Theory: information and communications technology pedagogy and internationalization of the curriculum. *Journal of Information Technology for Teacher Education,* 10(1) and (2), 117-134.

Mau, R.Y. (1999), Implementing IT into the School Curriculum Perspectives and Experiences from Singapore. In *Proceedings of the Sixteenth International Conference on Technology and Education (ICTE'99): Preparation for the New Millennium-Directions, Development and Delivery*. Edinburgh, Scotland. 28-31 March 1999, 226-229.

Pedagogical Institute (2002) *Information Society*: *In-service Teacher Training in the Use of Information and Communication Technology (ICT) in education*. Available at: http://www.pi-schools.gr/programs/ktp/english.html

Politis, P., Roussos, P., Karamanis, M. & Tsaousis, G. (2000) Evaluation of teachers' training in the context of program "Odyseas", in V Komis (Eds), *Proceedings of the 2nd Panhellenic Conference "Information and Communication Technologies in Education"*, Patra (in Greek).

Schofield, J.W. (1995), *Computers and Classroom Culture*. UK: Press Syndicate of the University of Cambridge.

Selwyn, N. (2000), Researching computers and education- glimpses of the wider picture. *Computers and Education* 34 (2), 93-101.

Siemer, J. (1998) The Computer and Classroom Teaching: Towards New Opportunities for Old Teachers, in Baets, W. R. J. (Eds), *Proceedings of the 6th European Conference on Information Systems,* 4-6 June 1998, Aix-en-Provence, France, pp. 710-721.

Simpson, M; Fran-Muro, R. (1999), Using information and communication: Technology as a pedagogical tool: Who educates the educators? J*ournal of Education for Teaching,* 25 (3) 247-262.

Tall, D. (1989) Different cognitive obstacles in a technological paradigm, in S. Wagner & C. Kieran (Eds) *Research Issues in the Learning and Teaching of Algebra.* N.C.T.M. Erlbaum.

van Braak, J. (2001) Factors influencing the use of computer mediated communication by teachers in secondary schools, *Computers & Education*, 36 pp. 41-57.

von Glasersfeld, E. (1987) Learning as a constructive activity, in C. Janvier (Eds), *Problems of representation in teaching and learning of mathematics.* London: Lawrence Erlbaum associates.

Vosniadou, S. and Kollias, V. (2001) Information and Communications Technology and the problem of Teacher Training: Myths, Dreams and the Harsh Reality. *Themes in Education,* 2(4), pp. 341- 365.

Vratsalis, K., (2003) The Pedagogical Obstacles in Teacher Training of Primary Education

    Teachers who had attended a biennial undergraduate course, in K. Vratsalis (Eds),

    Didactical Experience and Pedagogical Theory. Athens: Nisos (in Greek).

Vygotsi, L. (1962) *Thought and Language*. M.I.T. Press.

Young, J. R. (1997) Rethinking the Role of the Professor in an Age of High-Tech Tools, *The*

    Chronicle of Higher Education, 3, pp. A26-A28.

Ward, C. (1999), Using and Developing Information and Communications Technologies in a

    Secondary School. *Computer Education: Incorporating Information Technology and*

    Learning, 93, 9-18.

Weikart, L.A. and Marrapodi, M. (1999), The Missing Link: The Technology Infrastructure.

    Computers in the Schools: the interdisciplinary journal of practice, theory and applied

    research, 15 (2), 49-60.

Williams D., Coles L., Richardson A., Wilson K. and Tuson J., (2000) Integrating Information

    and Communications Technology in Professional Practice: an analysis of teachers' needs

    based on a survey of primary and secondary teachers in Scottish schools, *Journal of*

    Information Technology for Teacher Education, vol. 9, No.2, 2000.

CAPTIONS

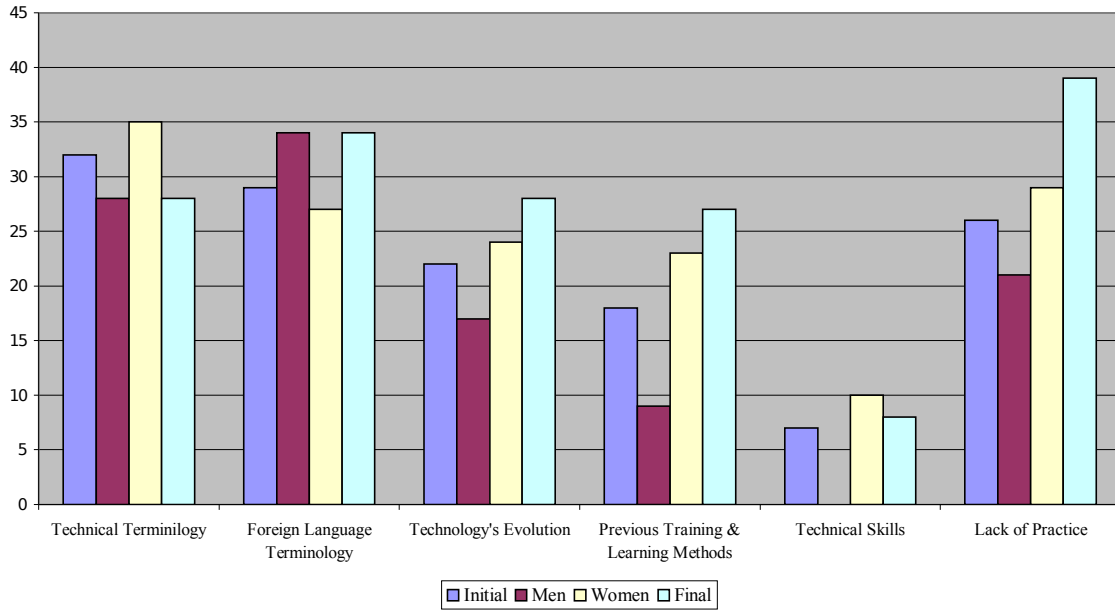Figure 1: Teachers' Difficulties

Figure 1**: *Teachers' Difficulties***

Table I: Subject of teachers

TABLE I: SUBJECT OF TEACHERS			
	Subject	**Number of teachers**	**Percentage**
Secondary Education Teachers	Theology	1	1%
	Language-History	18	14%
	Mathematics	8	6%
	Physics-Chemistry	9	7%
	English language	10	8%
	French Language	2	2%
	Gymnastics	6	5%
	Music	3	2%
	Total	59	44%
Primary Education Teachers		74	56%