Available online at www.sciencedirect.com
ScienceDirect
Computers & Education 51 (2008) 669–686
COMPUTERS & EDUCATION
www.elsevier.com/locate/compedu

Evaluating computer technology integration in a centralized school system

Nikleia Eteokleous *

Educational Technology, Frederick Institute of Technology, 7, Y. Frederickou St., Palouriotsa, Nicosia 1036, Cyprus

Received 13 September 2006; received in revised form 12 July 2007; accepted 20 July 2007

Abstract

The study evaluated the current situation in Cyprus elementary classrooms regarding computer technology integration in an attempt to identify ways of expanding teachers' and students' experiences with computer technology. It examined how Cypriot elementary teachers use computers, and the factors that influence computer integration in their classroom practices. To address the study's research questions, an evaluative case study design was applied. It employed a mixed method approach through the usage of structured questionnaires and semi-structured, open-ended interviews as the major methods of data collection. Quantitative and qualitative data gathered from a sample of Cypriot teachers who where identified as high and low computer use ones.

The results of the study revealed that computers are not extensively used in classrooms. When they are used in classrooms, it tends to be in a rather sporadic fashion, more as supporting tools or fancy chalkboards than as educational tools. Few teachers were found to use computers in any sort of progressive way. Three categories of factors (personal, professional and organizational) that influence teachers in applying computers in their classroom practices were identified. They shed light in explaining the level and kind of computer integration in Cyprus elementary schools. The outcomes confirm the findings of other studies conducted in different educational settings regarding computer usage as well as the factors that influence computer integration. Consequently, the study suggest ways of expanding teachers' and students' experiences with computer technology, poses questions for further research regarding the potential approaches to computer technology integration and the philosophy that underlies computer integration in schools.

Keywords: Country-specific developments; Elementary education; Improving classroom teaching; Media in education

1. Introduction

1.1. Statement of the problem

In recent years the impact of the "information age" has shifted from occurring primarily within the arena of governments and multinational corporations into the everyday lives of average people throughout the world.

* Tel.: +357 22 431355; fax: +357 22 438234.
E-mail address: nikleia@cytanet.com.cy

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doi:10.1016/j.compedu.2007.07.004

Accompanying this expansion lies a growing belief among the general public which suggests that computers are essential components of the educational and instructional systems. According to many researchers (Goddard, 2002; Honey, 2001; Polonoli, 2001), such public perception is warranted because the computer represents not only an excellent curricular tool, but also a revolutionary classroom approach that can help students achieve important gains in learning and understanding.

The trend is not confined to highly advanced societies. School systems in small nations are also increasingly viewing the computer as a powerful and realistic tool for the classroom (Kozma & Anderson, 2002; Pelgrum, 2001). For example, Cyprus has begun designing new policies and investing large sums of capital aimed at integrating computers into its classrooms. However, questions exist as to whether or not classroom teachers throughout the world, and particularly in Cyprus, possess the knowledge, skills, and attitudes needed to successfully and effectively implement the technologically oriented policies and resources in ways that are meaningful and valuable to students. Even though Ministries of Education around the world are spending enormous amounts of money in order to promote and support computer technology in their practices (Doherty & Orlofsky, 2000; National Center for Education Statistics, 2000; Valanides, 2003), though it is doubtful if teachers take advantage of computer technology? Whether computer technology is indeed a valuable tool in the teaching and learning process remains uncertain? Similarly uncertain is whether teachers integrate computers in ways that transform their classroom computer from primarily a record keeping, reference, or intelligent tutoring tool, into one that can fundamentally alter the way they teach and the way their students learn? In addition, even if teachers possess a reasonable level of technological literacy or use computer applications frequently in their classrooms, the question remains as to whether they use computers in ways that truly reform and revolutionize classroom instruction, or simply reinforce and support more traditional practices. Teachers may be using computer technology within classroom activities or in addition to classroom activities. Such tension often surrounds the implementation of instructional technologies (Angeli & Valanides, 2005; Cuban, 2001; Karagiorgi & Charalambous, 2004; Kazamias et al., 2005) and it is the key focus of this study.

Many argue, however, that supplying schools with ample technology is unlikely to produce any substantial change in core instructional technology. For example, Cuban (2000, 2001) argues that computers do not play a significant role in teachers' instructional practices while they merely play a minor role in students' academic learning. He suggests that it is simply quite hard to incorporate computers as regular features of classroom activities (Cuban, 2001).

Becker and Ravitz (2001) contend, that while Cuban's predictions may be statistically correct, he underestimates the implications regarding the role that computers will play over the next decade. They conclude that Cuban's assertions of minimal impact are likely to be out of date in the near future. Is it possible, though, that Cuban's critics have underestimated the power of traditional organizational structures in schools to limit or rechannel the effectiveness of new forms of educational technology? One study (Zhu, 2003), for example, found that American teachers even in "technology rich" schools seldom used computers in any real integrated way in their classrooms. Cuban's argument appears to be supported by this finding and would receive more support should the present study reach similar results among the Cypriot teachers. On the other hand, should the present study find characteristics among teachers and schools related to using computers as something more than expensive high tech chalkboards, it would support the arguments of Cuban's critics.

1.2. Purpose of the study

The overall purpose of this research work is to identify ways of expanding teachers' and students' experiences with computer technology in Cyprus elementary schools. To achieve the above, the study evaluates the current situation in the Cyprus educational system as regards of computer technology integration and attempts to touch on its causal factors. More specifically, the study seeks to address the following research objectives:

- Investigate classroom computer uses by teachers in Cyprus elementary schools.
- Examine whether the dichotomy of traditional versus progressive computer uses is apparent to the context of Cyprus elementary schools.

- Identify the factors that influence teachers in integrating computer technology into their classroom practices in Cyprus elementary schools.
- Recommend ways of enhancing teachers' and students' computer technology experience.

2. The context

2.1. The Cypriot educational system

The Cypriot Ministry of Education and Culture (MOEC) follows a centralized and homogeneous approach to managing schools. Decentralization was implemented only by giving authority to the local School Boards for managing minor issues of infrastructure and to the school principals for managing issues that concern students' and teachers' behavior in the schools (Panayides, 2003). As a UNESCO report (2005, p. 29) on the case of Cyprus describes it, the Cypriot educational system is a good combination of centralization (of management) and decentralization (some autonomy to schools). It is important to mention however, that decentralization is concentrated on minor issues, regarding the practicalities involved in the functional operation of the schools. The MOEC is responsible for formulating policy plans, which are then examined by the Planning Bureau and approved finally by the Council of Ministers. Financially, the public education sector is supported mainly by the government, either directly or by allocating financial resources to the local School Boards.

Given the above, curriculum-driven practice, content/textbook -oriented activities, evaluation of the educators through the inspectorate system, lack of time, pressure to cover the curriculum, lack of freedom, bureaucratic procedures are some of the characteristics of educators' work in such educational system. Finally, related to the system being mainly centralized is that teachers are "restricted" in applying innovative and progressive approaches in their teaching practices, and that the flow of information and instructions from the government to the schools is continuous and overwhelming for the already multitasking role of the teachers.

2.2. Cypriot ICT policy

The launch of an ICT policy by the Cypriot MOEC took place in the early 1990s; some of the primary schools were then equipped with computers at an experimental level. Also, a Departmental IT group was created as a part of the Department for Programs Development of the MOEC, while the governmental Pedagogical Institute started offering at the end of the 1990s an optional training program for teachers.

'Evagoras' (1999) was the first formal ICT policy document, and describes the action plan for the embedding of new technologies in primary education from 2000 to 2005. It includes economic, pedagogical, and national reasons according to which the embedding of computers in education is necessary. Evagoras has five portals: (1) the update of the national curriculum that will include computer technology applications; (2) teachers' professional development in three levels: computer literacy, use of computer applications as teaching and learning tools, and use of other technological methods and mediums; (3) the use of computers for school management; (4) the integration of Internet applications in primary education, and (5) the continuous provision of hardware, software, as well as provision of support and maintenance within schools. According to 'Evagoras' document, the students should not learn how to use the computer applications as an end in themselves (computer skills as a subject) but learn how to use them as tools that help them to execute their tasks and projects (District Curriculum Developers & Evagoras Team, 1999).

3. Literature review

3.1. Factors influencing computer technology integration

Studies reveal the way in which how many interacting factors influence teachers towards integrating computers in a meaningful, fruitful and progressive way into their professional context. The literature classifies such factors into two major categories: external and internal to teachers. Otherwise, external factors are called first-order, while internal factors are called second-order (Ertmer, 1999). Ertmer points out that "even if all first-order factors that function as barriers were removed, teachers would not automatically use technology"

(p. 57). The existence of the second-order factors, which are intrinsic to teachers, is extremely important and directly influence teachers' decisions regarding computer integration.

3.2. Factors external to teachers

Successful computer technology integration into classrooms requires the continuous and adequate professional development and training of teachers (Becker & Ravitz, 2001; Byrom, 1998; Carvin, 1999; Demetriadis et al., 2003; Dexter, Ronald, & Becker, 1999; Mullen, 2001; Peck, Augustine, & Popp, 2003; Picciano, 2002). Studies suggest that teachers' training needs to go beyond simple computer skills such as word-processing, spreadsheets, presentation and multimedia programs. More important than simply learning how to use computers is professional development in computer curriculum-integration (Brush et al., 2003; Dawson, Pringle, & Adams, 2003; Ertmer, 2003; International Society for Technology in Education, 2002; Thompson, Schmidt, & Davis, 2003; Wilson, 2003).

Other researchers (Byrom, 1998; Meyer, 2001; Picciano, 2002) emphasize the importance of leadership, arguing that it is the key point to successful technology integration. Administrative support is critical to successful computer integration and it can influence other important factors in the process. Other reasons reported as important in the process of computer technology integration are the following: insufficient teacher understanding of methods for integrating technology into the curriculum; insufficient number of computers; lack of software integrated into the curriculum; and insufficient technical support (Angeli & Valanides, 2005; Education Week, 1999, p. 62; Pelgrum, 2001; Smeets, 2005). Along the same lines, other studies indicate other important factors including a positive school environment, adequate school support, adequate technology resources, access to hardware and software, basic technological equipment and facilities, technical support and technical assistants, time for planning, teacher coaching, appropriate teacher evaluation, and sustained funding for technology (Angeli & Valanides, 2005; Becker & Ravitz, 2001; Byrom, 1998; Cuban & Pea, 1998; Demetriadis et al., 2003; Dexter et al., 1999; Earle, 2002; Ertmer, 1999; Honey, 2001; Pelgrum, 2001; Sheingold & Hadley, 1990).

3.3. Factors internal to teachers

Researchers (Becker & Ravitz, 2001; Becker & Reil, 2000; Carvin, 1999; Dexter et al., 1999) argue that teachers' instructional styles, their attitudes towards learning, their teaching philosophies as well as their beliefs on how students learn, influence the way computers are integrated in the classroom. One factor of particular interest is teachers' personal association with constructivist techniques. Teachers whose philosophies favor constructivist-oriented as well as student-oriented teaching practices are more likely to integrate computers in their classrooms in a substantial and intellectually fruitful way.

In addition to the above, teachers who put value on socially mediated learning may be more likely to maintain goals related to the development of students' high order thinking skills and capabilities. Behaviors like that appear to be more in line with the use of computers as integrative mindtools in the classroom (Carvin, 1999; Dexter et al., 1999; Jonassen, 1999b, chapter 10).

Certain types of teacher professional characteristics may also shape behavior. Specifically, Dexter et al. (1999) mention that teachers who easily accept and incorporate new ideas, changes and reforms into their practices are more likely to integrate computer applications in their teaching. Furthermore, teachers' interactions with peers may also shape behavior. Teachers who maintain more frequent personal and professional contacts with their peers may be more likely to encourage students in similar ways through the use of computer applications (Berg, Benz, Lasley, & Raisch, 1998; Carvin, 1999; Dexter et al., 1999; International Society for Technology in Education, 2002).

In addition to these kinds of professional qualities, there is a number of personal characteristics that may influence how teachers use computer applications in their classrooms. For example, teachers who feel that computers are appropriate tools for promoting students' learning are also found to engage their students in using computers more than teachers who did not feel that way (Angeli & Valanides, 2005; Bielaczyc & Collins, 1999; Carvin, 1999; Demetriadis et al., 2003; International Society for Technology in Education, 2002; Smeets, 2005).

3.4. Evolution of computer applications in classrooms

Throughout the literature and over the past decades, differential practices in educational computers have been identified and described. The researcher suggests that the "traditional/transformational" dichotomy runs as an implicit theme throughout earlier literature and remains a useful way of understanding and discerning between different approaches to practice. Even though the following approaches/trends have been developed throughout the past decades, they coexist in various educational settings.

The first wave of computers was characterized by extremely large and expensive mainframes. Their use for educational purposes was confined to mostly administrative and managerial tasks. The second wave started with the advent of desktop computers in the 1970s. Computers became 'personal' and schools first introduced computer literacy courses and subsequently embedded the computer in their curricula. Although the use of computers in schools may have often been viewed as highly innovative and progressive throughout the 1970s, the term "*traditional*" or "*learning from computers*" is probably a better term to describe the practices typically found in most schools that period of time. It included activities such as Computer Assisted Instruction (CAI) and Computer-Managed Instruction (CMI), intended to help students acquire basic skills. Computers are thus viewed as tools programmed to teach students and to direct their activities towards the acquisition of pre-specified knowledge or skills. Drill and practice are emphasized, as well as the acquisition of "lower levels" of learning such as knowledge and comprehension (Bloom, 1956). The most prominent forms of CAI/CMI were tutorials, games and intelligent tutoring systems (CTVG, 2003; Cuban, 1986; Cuban & Pea, 1998; Jonassen, 1999a). During the late 1960s and early 1970s schools introduced computer literacy courses (Becker, 1993; Cuban & Pea, 1998; Jonassen, 1999a). The current form of the trend, called "*learning about computers*" seems more frequently revealed in school classes aimed at teaching students about word-processing, keyboarding, and various hardware and software usages (Karagiorgi, 2000; Karagiorgi & Charalambous, 2004; Nicholson, 1995; Pelgrum & Plomp, 1993).

In subsequent years, computers have been integrated as mindtools in the classrooms to support constructive learning. The use of computers as mindtools describes the "*learning with computers*" or otherwise the "*progressive*", "*transformational*" approach to computer technology integration and represents the third wave. Educators embed or apply computer capacity in the context of on-going teaching and learning in different school subjects. Based on the above, students learn how to use the computer applications not as an end in themselves, but as tools that help them execute their tasks and promote the balanced development of their mental abilities. As a result they do not learn from technology, but technologies support meaning generated by students (Becker, 1993; Becker & Ravitz, 2001; Bielaczyc & Collins, 1999; Carvin, 1999; Charalambous, 2001; CTVG, 2003; Cuban & Pea, 1998; Dexter et al., 1999). The crucial role of computers integrated in the educational systems can be described as follows: "Mindtools are computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the instructor and learner in order to engage and facilitate higher order thinking and learning" (Jonassen, 1999a,p. 10). Along the same lines, Hawkridge (1990) also stresses the capabilities of ICT to innovative schools. According to his conception, the curriculum is extended with a focus on higher-order thinking and problem-solving skills; and this is due to the innovative uses of ICT. Moreover, van Braak (2001) argues that ICT-usage fosters collaborative learning, flexible learning opportunities, independent from time and place, and opportunities that arise from its use in cross-cultural cooperation.

Based on Bloom's taxonomy (1956) analysis, evaluation, and synthesis represent higher-level learning objectives. The studies cited above suggest that these higher-level objectives can be more effectively achieved through the applications of computer technology. Finally, computer technology helps educators develop collaborative, active and authentic learning environments as well as promote critical thinking, problem-solving and increase interactivity among students.

4. Research methodology

The study employed a mixed method approach (Creswell, 2003; Krathwohl, 1997; Merriam, 1988). It made use of both quantitative and qualitative data gathered from a sample of Cypriot teachers. To better 'use' the data gathered, a sequential explanatory strategy was applied, where first the quantitative data were collected

and analyzed and then the qualitative data collection and analysis followed. The two methods were integrated during the interpretation phase of the study. The purpose of this mixed method was to use "qualitative results to assist in explaining, interpreting and further examining the findings of the quantitative study" (Creswell, 2003, p. 215).

The quantitative component was addressed through a survey administered to a sample of Cypriot elementary teachers. The research population of the study consisted of 4th, 5th and 6th grade teachers in Cyprus elementary schools that have had computers in their classrooms since 2000. For reasons of convenience, all teachers were selected from the district of Nicosia, which is the island's capital and the largest of its five school districts. In the academic year of 2003–2004, 765 teachers in the district of Nicosia had computers in their classrooms. Based on a formula developed by Stephen and William (1997), and since the total population falls in the range of 750–800, a total number of 255 teachers was needed, in order to have a representative sample. Through random sampling 500 teachers were selected and sent questionnaires by post in their school address. Two hundred and ninety-three questionnaires were completed and returned. The response rate was 58.6%. We speculate that the same circumstances (regarding computer technology integration) apply in the rest of the districts of the island; since the Cypriot educational system is centralized and homogeneous, all schools in different educational districts follow the same policies and Nicosia (where the data collection took place) is the island's capital and the largest of its five school districts.

Teachers completed a questionnaire of 13 questions. Specifically, the study had five sections: (1) Teachers and School Demographics, (2) Teachers' computer use for different purposes (personal, organizational, and instructional), (3) Students' computer use in their classroom (as assigned by their teachers), (4) Factors that influence teachers in integrating computers in their classrooms, and (5) An open-ended question for more comments (Further explanation can be found in the following section). Version 11 of the SPSS statistical package was used to analyze the quantitative data.

The qualitative approach assisted in the construction of semi-structured, open-ended questions, which encouraged the participants to use their own terminology to describe their experiences and perceptions on the subject under investigation. Given teachers' willingness to further contribute in the data collection, purposive sampling was used in an attempt to draw the subjects for the interviews (qualitative data) (Merriam, 1988) using the results from the questionnaires. In this case, the selected subjects were the two categories of teachers: high and low computer users. Twelve teachers were identified as low and ten as high computer users; consequently two kinds of interviews were developed. Teachers were informed about the classification system and in which group each one was inserted during the interview. The methodological approach applied to analyze the qualitative data was the phenomenology, since it seeks to understand the experiences of individuals and the meaning they make of that experience related to the phenomenon under investigation (Creswell, 1996; Moustakas, 1994). In this case, the phenomenon under investigation is computer technology integration in elementary schools. The study aims to examine teachers' lived experiences and the essence they make of those experiences. The interviews provided the opportunity to explore teachers' perception on various parameters related to computer technology integration. The subsequent interview protocols aimed at providing a deeper level of data, which were used to evaluate, confirm, complement and/or better understand the survey findings (Kvale, 1996; Rist, 1982).

The phenomenological analysis guided the researcher to analyze the qualitative data. The investigator is aware that the methods used, especially the personal interviews, are vulnerable to self-report bias (Maxwell, 1996), thus being conscious of threats to their reliability she worked towards insuring that the information collected was reliable minimizing self-bias in the interpretation of data. The interviews were tape-recorded and the researcher made verbatim transcriptions of these recordings. She achieved the above by applying the concept of epoche, where she set aside her own preconceived ideas in order to better understand the experiences of the participants. Secondly, the interview protocol went through the process of horizonalization, where the researcher listed every significant statement relevant to the topic, looking for themes that helped her in gaining better understanding and more information regarding computer technology integration in classrooms. Then the researcher developed clusters of meanings. Specifically, the data was structured and coded around five categories/clusters: instructional approaches and philosophies, integrating computer in the classroom (teacher and student's role, materials, subjects, approaches), factors influencing computer integration in classrooms, ideal computer integration, and future of computer integration. Consequently, the researcher

developed textural and structural descriptions addressing the questions of *what* and *how* the phenomenon under investigation was experienced, specifically on whether or not teachers use computers in their classrooms, as well as how they use them – what activities, exercises they perform. Additionally, apart from the factors revealed from the literature, it identified the specific factors that influence Cypriot elementary teachers to apply computers in their classrooms and differentiate their classroom practices in terms of computer technology integration (see Creswell, 1996).

Moreover, the interviews complemented and assisted in evaluating information on issues that could not be easily and/or directly addressed through the questionnaire. Those include factors internal to teachers, mostly described by the professional group of factors, specifically through teachers' philosophies/instructional practices, and to some extent by the personal group of factors. The goal was to understand teacher's perspectives along with the meanings they attached to their words and actions, with the least possible bias (Maxwell, 1996). Finally, the researcher strived not to impose her values on the conduct or the conclusions of the study. She worked towards producing an informative report that strives for objectivity and integrity. Each interview was completed within 75 minutes, on average. Data collection took place during January to February 2004.

Using the related literature, the conceptual framework, the study's research questions, as well as the focus groups organized as preliminary research step, the investigator had developed the questionnaire and the interview protocols. The researcher addressed the issue of content validity. To achieve the above, the instruments were given to two experts in the field to be reviewed. In addition, both instruments were pilot tested by elementary teachers, who had been potential subjects of the study. A total of eight teachers evaluated both instruments. Information from the above were given related to examine if the test items measure what they suppose to measure as well as regarding wording, grammar, expressions, and technical terms. The feedback given helped the investigator to revise, modify, and improve the instruments. More specifically, the instruments were adjusted accordingly based on the suggestions of the teachers. Minor changes such as clarifications, better explanations of the questions, terminology, and expressions took place in order to adjust the instruments to the Cypriot teachers' language, culture and perceptions.

4.1. Variables

Independent and dependent variables were used in the quantitative analysis. The independent variables are classified into two major categories. The first category named *Teachers and School Demographics* includes the following variables: school region, teachers' education, experience, age, gender, grade, and finally class size. *The factors that influence teachers' practices* represent the second major category of independent variables, which includes: (1) School climate, (2) Teacher professional behavior, (3) Teacher attitudes towards integrating computers in the classroom and (4) Teacher approaches towards progressive instructional practices. Each of the above variables was calculated by summing teachers' responses to a number of statements. They were treated as continuous variables and centered around their means before being entered into the regression analysis.

The dependent variables were (1) *Teacher-reported computer use in general*, (2) *Teacher-reported student classroom computer use*, and (3) *Teacher-reported student progressive classroom computer use.* The same process was applied in the case of the dependent variables. The first variable, *Teacher use of computer technology in general*, had been created by adding teachers' responses related to their use of computers for different kinds of purposes such as personal, organizational, and instructional. The second variable, *Student computer use in the classroom*, had been created by adding teachers' responses regarding the way students use computers in the classroom. Finally, the third variable, *Student progressive classroom computer use* was created by adding three of the twelve statements that were used to describe student classroom computer usage. The above continuous variable has been centered around their mean, as well before entering the analysis.

5. Research findings

5.1. Quantitative data analysis

In the first section of the questionnaire (Questions 1–8) teachers were asked to answer eight questions related to personal, professional and school demographic characteristics. The majority of the teachers

surveyed taught in urban schools (63%), taught in fifth grade (36%), were females, (72%), have used computer technology in their lives (94%) and particularly at home (93%) and at school (82%), and finally had Internet connection in their home (85%). The average class size appeared to be 16–20 students. Regarding teachers' years of experience, the teachers surveyed were evenly divided into the categories given (from 22 to +61years old). Finally, in terms of teachers' education all of the teachers held a bachelor's degree in Primary Education, 4% held a certificate, 22% held master's degrees and only 0.7% (2 teachers) held a Ph.D. (see Tables 1–3).

Sections 2 and 3 of the Questionnaire (Questions 9 and 10) are related to computer usage by teachers and students. More specifically, Question 9 addressed teacher computer usage in general (for personal, instructional, and organizational purposes); and Question 10 addressed student computer use in the classroom, and student progressive computer use in the classroom, in particular. Under these two sections, teachers had been asked to report on various statements which they had to rate their own experiences regarding computer technology as well as in classroom experience. Respondents rated each of the statements using a 5-point Likert scale. The scale ranged from "Never" (value 1) to "Several times a week" (value 5). Question 9 contained seven statements and Question 10 contains 12 statements. The reliability of both questions was measured using Gronbahs' a. Question 9 had internal consistency of Cronbach's $\alpha = .855$, whereas Question 10 had internal consistency of Cronbach's $\alpha = .913$.

The results indicated that while Cypriot teachers use computers rather extensively for their own purposes, they use them less frequently in their classes. When they do use them in their classes, it tends to be in a rather sporadic fashion, more as supporting or fancy chalkboards. Few teachers were found to use computers as

Table 1
Frequency distribution of teachers' professional demographics

Variable	*N*	%	Central tendency	Dispersion
Region			Mode	Variance
Rural	185	63.1	1	0.320
Urban	108	36.9		
Total	293	100.0		
Grade			Mean	SD
4th	76	25.9	0.38	1.10
5th	105	35.8	0.35	0.48
6th	88	30.0	0.30	0.45
Mixed	22	7.5	0.07	0.27
Total	291	100.0		
Teachers' education			Mode	Variance
Bachelor	293	100	2	0
Certificate	11	3.8	1	0.033
Master's	64	21.8	1	0.173
Doctorate	2	07.	1	0.007
Years of experience			Mean	SD
			2.93	1.38
1–4	61	20.8		
5–8	57	19.5		
9–12	66	22.5		
13–16	59	20.1		
16+	49	17.7		
Total	292	99.7		
Class size			Mean	SD
			2.92	0.96
11–15	31	10.6		
16–20	52	17.7		
21–25	120	41.0		
26–30	86	29.4		
30+	3	1.0		
Total	292	99.7		

Table 2
Frequency distribution of teachers' personal demographics

Variable	*N* (frequency)	%	Central tendency	Dispersion
Age			Mean	SD
22–30	128	43.7	1.72	0.44
31–40	126	43.0		
41–50	18	6.1		
51–60	20	6.8		
61+	1	0.3		
Total	293	100.0		
Gender			Mode	Variance
Male	81	27.6	2.00	0.201
Female	212	72.4		
Total	293	100.0		

Table 3
Frequency distribution of teachers' computer and Internet use

Variable	*N*	%	Central tendency	Dispersion
Computer use			Mode	Variance
			1	0.123
Yes	276	94.2		
No	17	5.8		
Total	293	100.0		
Where teachers use computers				
Home	272	92.8	0.92	0.25
School	239	81.6	0.81	0.38
Library	24	8.2	0.08	0.27
Internet Café	2	0.7	0.00	0.08
Internet connection				
Yes	249	85.0	1	0,128
No	44	15.0		
Total	293	100.0		

educational tools integrated in the teaching and learning process (applying the "*progressive/transformational*" approach to computer technology integration as mentioned in the literature).

The results also reveal that 65% of the teachers seldom use computers in their classrooms, due to the school climate; 94% of the teachers did not tend to apply progressive behavior in their instructional practices; and 53% of the teachers did not have positive attitudes towards computer technology integration in their classroom practices. On the other hand, 96% of the teachers appear to have a good relationship with their colleagues, be active in their profession, and take over responsibilities in their schools.

In Section 4 of Questionnaire (Question 12), teachers ranked the factors that were significant to them in terms of integrating computers in their classroom practices. In this ranking type of questions, teachers were given ten factors and were asked to rank the six most important ones. Teachers reported the following, as the first three important factors: (1) their personal attitudes towards computer technology, (2) their college preparation in acquiring computer skills, and (3) their level of computer literacy. The two factors that appeared to have the least impact on teachers in applying computers in their classroom practices are: (1) the amount of support the principal provides to teachers in terms of integrating computers into the curriculum, and (2) the amount of support and assistance they receive from the district/local technology coordinator.

Moreover the relationship between teacher general classroom computer use and student classroom computer use was examined. Student computer use was measured in two ways: (1) student classroom computer use in general and (2) student progressive classroom computer use. The researcher used correlation analysis

to examine the association among these three types of use (TCHCM, STDCLSCM, and STDPCM). Pearson's *R* was used to calculate the correlations.

The results of the correlation analysis revealed that there is a positive but not that strong correlation between *Teacher general classroom computer use* and *Student classroom computer use in general* ($\rho = 0.339$) as well as between *teacher general classroom computer* and *Student progressive classroom computer use* ($\rho = 0.241$). The positive relation suggests that the higher the teacher general computer use, the higher the student classroom and progressive computer use. In other words, teachers who generally use computers more, tend to assign their students to use computers in their classroom more, either progressively or not. As aforementioned teacher computer use in general, implies computer use for personal, professional and organizational purposes. Both correlations were significant at 0.01 level.

The first set of the regressions examined how teacher demographic characteristics and school factors influence teacher general computer use, student classroom computer use, and student progressive classroom computer use. Specifically, the following demographic variables were used in the regression analysis: grade, years of experience, age, class size, and education. The results are summarized as follows. Teachers' education is significantly linked to all three kinds of uses. Teachers' age appeared to be a significant predictor, at 0.01 level, for teachers' computer use for different purposes. Finally, grade appeared to be significant at 0.1 level in predicting student progressive classroom computer use.

Teacher and school demographics are positively but not highly correlated with teacher computer use in general. They explain only 16.5% of the variation of teacher computer use in general (see Table 4). Once more, teacher and school demographics have a positive but relatively low correlation with student classroom computer usage in general. They explain only 6% of student computer usage in the classroom (see Table 4). Finally, correlation between teacher and school demographics and student progressive classroom computer use is positive, and relatively very low. They explain only 7% of the variation in student progressive classroom computer use.

The second set of regressions examined the effects of four variables, in other words, the four categories of factors (School Climate, Teacher Professional Behavior, Teacher Approaches towards Progressive Instructional Practices, and Teacher Attitudes Towards the use of computers in education) on *Student classroom computer use in general* and *Student progressive classroom computer use*, along with the effect of teacher and school demographics, which served as the control variables. The same demographic variables mentioned above are used at this second set of regressions.

In the first regression, *Student classroom computer use* was the dependent variable. Grade; teacher professional behavior; and teacher attitudes towards computer use in education appeared to be significant predictors for *Student classroom computer use* at 0.01 level. On the other hand, 'teacher education' and 'school climate' was found to be a significant predictor at the .05 level.

Table 4
School and teacher demographics effects on teacher and student computer use

Variable	Teacher general computer use		Student computer use in the classroom		Student progressive computer use in the classroom	
	B	Beta	*B*	Beta	*B*	Beta
TCHEDU	3.94***	0.26***	3.83***	0.17***	0.89**	0.14**
TCHEXP	0.05	0.01	0.16	0.02	0.26	0.13
GRADE	0.55	0.02	18.55	0.51	7.75*	0.73*
CLSSIZE	0.40	0.06	−0.64	−0.06	−0.12	−0.04
TCHAGE	−2.12***	−0.28***	−0.38	−0.03	−0.37	−0.12
r^2	0.165		0.06		0.07	

TCHEDU = teacher education; TCHEXP = teacher experience, GRADE = grade; CLSSIZE = class size; TCHAGE = teacher age.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

Table 5
Effects of school climate, teacher professional behavior, teacher transformational behavior and teacher attitudes towards classroom computer use on student computer use in the classroom

Variable	Student classroom computer use in general		Student progressive classroom computer use	
Regression	I		II	
	B	Beta	*B*	Beta
Controls				
TCHEDU	2.13**	0.09**	0.45*	0.07*
TCHEXP	0.24	0.03	0.28	0.14
GRD	3.36***	0.09***	1.06*	0.10*
CLSSIZE	−0.47	−0.04	−0.07	−0.02
TCHAGE	−0.01	−0.00	−0.26	0.08
Factors				
CLIMATE	−1.73**	−0.12**	−0.57***	−0.15***
PROFESSB	0.98***	0.19***	0.25***	0.17***
PROGRES	0.55	0.04	0.17	0.05
COMPATT	1.35***	0.25***	0.37***	0.25***
r^2	0.16		0.20	

TCHEDU = teacher education; TCHEXP = teacher experience, GRD = grade; CLSSIZE = class size; TCHAGE = teacher age; CLIMATE = school climate; PROFESSB = teacher professional behavior; PROGRES = teacher approaches towards progressive instructional practices; COMPATT = teacher attitudes towards integrating computers in the classroom.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

Finally, in the last two regressions *Student progressive classroom computer use* was the dependent variable. School climate and teacher professional behavior appeared to be significant at 0.01 level. From the control variables, teacher education and grade appeared to be significant predictors at 0.1 level (see Table 5).

5.2. Qualitative data analysis

Teachers were asked to describe how they apply computers in their classroom practices, in other words how they assigned students to use computers in the classroom. Teachers reported using a combination of the classroom computer and the computer lab, but more they used the computer lab. Computers were applied in different subjects such as Greek language and literature, mathematics, science, geography, history, design and technology, and arts and crafts.

Teachers commented on the skills and abilities that students developed while using the computers. Two low teacher computer users mentioned that they did not feel that computers offered them the opportunity to better achieve their educational goals and develop students' abilities and skills. On the other hand, high teacher computer users reported that computer integration improved the teaching and learning process, motivated students, facilitated and promoted the development of important skills and abilities of students such as critical thinking, synthesis, analysis, and discussion. Along the same lines, teachers mentioned that computers gave them opportunities to do a variety of exercises, and assignments that they could have never imagine doing before. Additionally, high teacher computer users discussed students' actions, behaviors and attitudes when they used computers. Students enjoyed the time they used computers, became more interested in their lessons and paid more attention to what was going on in the classroom. Teachers also supported that they managed to achieve their goals successfully by making students part of the learning and teaching process, they achieved collaborative learning and even noticed that students developed confidence in themselves. Specifically, a teacher said: "They are motivated and I am always so impressed by their behavior. They find it exciting, they learn without realizing it, and they discover things by themselves."

Moreover, high teacher computer users mentioned using computers to help weak and gifted students accordingly. Particularly, teachers used the computer so that weak students can be improved by assigning

extra exercises and activities on the computer to help them better comprehend some concepts, and keep up with the rest of the class. In general, teachers reported that computers gave them the opportunity to assign exercises to students based on their level of knowledge and understanding. "Gifted, students get exercises which give them the opportunity to go in depth, and weak students get remedial exercises that help them work more on the basics," a teacher argued. In addition, teachers commented that their role in the classroom changed. "It frees you from the control you have in the classroom; you are becoming a facilitator, a coach. The control of learning is on students, you do not teach anymore but you guide, help students to learn by themselves, you do not control their learning anymore, they do!!", a teacher said.

A general uniformity across the three categories of teachers was revealed in terms of the factors that prevented them from or facilitated them to apply computer technology in their classroom practices. The factors that prevented computer integration can be summarized as follows. Firstly, the lack of resources, which includes the following: one computer per classroom, lack of equipment, educational software language material deficiency from the officials, and material preparation. Teachers focused particularly on the last two. Specifically, a low teacher computer user supported: "We do not have enough material that refers to specific units and goals in each subject of the curriculum. I keep asking myself how I am going to use computers in this particular unit, what activities I need to perform to achieve the educational goals of the lesson, and much much more...". Additionally, a high teacher computer user completed by saying that even though the computer technology team had developed some materials, they did not provide teachers with any kind of guidance, "... where, why, and how to use it, what am I expecting from my students, what my goals and objectives are?".

A second factor appeared to be the tyranny of the curriculum, which includes the volume of the curriculum, the philosophy of the curriculum that is not aligned with progressive instructional practice and does not support in high degree computer integration, and last but not least the direct pressure from the inspectors to cover the curriculum. The volume of the curriculum does not permit you to do much besides that," a high teacher computer user said. Another teacher completed "... we cannot apply constructivist learning theories as much as we like because of the curriculum volume. We do not have flexibility to incorporate modern teaching strategies in our practices or develop different kinds of learning environments".

Another factor that negatively influences computer technology integration in classrooms is the incomplete and inadequate professional development training, which according to a teacher "was an unsuccessful, incorrectly planned training". Due to financial difficulties and the lack of educated instructors, the training was not completed. Another teacher wonders: "There are too many teachers who do not have basic skills in computers. How does the Ministry expect teachers to integrate computers in their classrooms when they do not know how to use them?". Finally, another participant argues that "teachers need to be trained on how to integrate computers as tools in their teaching and learning process and also to realize and comprehend the value of the computers and what they can offer to them as teachers."

Finally, teachers reported a group of factors including lack of guidance, support, and incentives from the officials, technical problems, students' computer literacy level, and the fact that some teachers and policymakers do not realize the use of computer as an educational tool in the classroom.

On the other hand, the factors that facilitated teachers can be summarized as follows: teacher computer literacy, teacher education beyond bachelor in fields related to computer technology, teacher training through their college program of studies regarding computer skills and integration of computers as tools, the support of their schools PTAs, the help from the district coordinator, teacher knowledge on hardware and software issues, their beliefs that the computer is an extremely important tool for students to possess, and their instructional philosophies (i.e. teachers that apply innovative techniques and develop student-centered environments). Specifically, teachers focused on the importance of support and guidance from the district coordinator, a teacher mentioned the following: "... when you get into the classroom if you do not have an expert to help, support, and give you the basics; it is impossible to make it happen. The first time you enter the classroom with the intention to use computers, you face too many problems that you are feeling that you are losing your time, and you are unable to achieve what you want. You are ready to give up and stop any further attempts. I had these feelings!! The coordinator was there, stood by me in the classroom and helped me out. I felt more secure and confident. I saw how he approached and solved the problems that appeared. That's it!!! You can do it, you still need help but it is not as the first time, you need that person at the beginning to be with you to support and guide you in the classroom".

Moreover, teachers commented on what should be done in order to improve the situation. High computer users supported that computer technology integration should be part of a holistic change of the Cyprus's educational system. Particularly, one mentioned that "... computers have to be integrated in relation to other changes such as educate teachers, change methods and approaches in the curriculum, develop appropriate materials, have fewer students and more computers in the classroom, make computers part of the curriculum and part of the books. We cannot make small changes and corrections in a project that has basic foundational problems. We need radical changes!!"

Teachers' suggestions on improving the situation were in agreement across the board and can be summarized as follows. The first two factors deal with enhancing the technology team, and changing the philosophy of computer technology integration. A third factor mentioned by the teachers was the need for labs, classroom computers, and relevant equipment as well the need for the appropriate educational software.

The next factor strongly supported by the teachers was the professional development and training. "Especially veteran teachers that did not have the opportunity to attend computer classes through their college years, they need to have this kind of training", a teacher argued. Another teacher described what they expect from the professional development training: "... demonstrate the computer applications, and the educational software. Additionally, they should give specific guidelines on how to use computers in the classroom and what strategies should be applied as well as address any kind of questions/concerns teachers might have". Another factor mentioned by the teachers was the enhancement of the role and responsibilities of the technology team, the district coordinators, the immediate need for technicians, as well as the identification of technology teacher-leaders in all schools. "Technology coordinators should advise, consult teachers, give ideas and guide them through the process of integrating computers in the classrooms and not just resolve technical issues", a teacher concludes. Lastly, teachers commented on the importance of evaluating computer technology integration in the classrooms by Ministry officials (inspectors).

Finally, teachers can be classified in two categories regarding the future of computer technology integration in the Cyprus educational system: the optimists and the pessimists. The optimists supported that they would move on and improve the situation. The pessimists mentioned that the situation would not get any better, and it would not change until the state policy changed, an organized plan, and a different approach were developed. As they say, "... we are moving too slowly, and we are not making any progress". In addition, there is no motivation for the teachers to use computers, there is lack of coordination, time, energy and training, and also lack of seriousness, organization and professionalism", a teacher reported. Finally, a high computer user said that the situation will change if the state policy changes. The teachers supported that this was difficult because the officials that had the power in their hands "... are narrow-minded, old, bureaucrats, and it is difficult for them to go away until their retirement."

6. Discussion

6.1. Computer use in Cyprus elementary schools

The first question that was under investigation by the current study was to examine the way teachers in Cyprus elementary schools apply computer technology in their classroom practices. Overall, the findings of this study support Cuban's (1986, 2001) arguments about the difficulty in incorporating computers as a regular classroom feature and that in Cyprus efforts to integrate computers in education have been centrally controlled. Interestingly, although Cypriot teachers appear to use computers frequently for personal reasons, the present study indicates a number of attitudinal, professional, and organizational factors that work to inhibit them from using and integrating computers into their classrooms. These results are partly in line with findings of other studies (e.g., Niederhauser & Stoddart, 2001; Smeets, 2005), which suggest that ICT is hardly used to support learning processes.

Addressing the second objective of the study, it is revealed that the *traditional/progressive* dichotomy that runs as an implicit theme throughout the existing literature, is applied in the Cyprus elementary context as well. As concerns the ways that technologies are used in the classroom; when teachers do use computers in their classrooms, they tend to do so in ways that are rather restricted and traditional, more like high tech chalkboards or as supporting than as educational tools. The three technology categories appeared in the

literature make their presence once more in Cypriot educational system. More specifically, the findings suggest that, at best, students in these classrooms are more likely *to "learn from"* or "*learn about*" computers than "*learn with*" them. Few teachers were found to use computers as educational tools integrated in the teaching and learning process (applying the "*learn with computers*" or otherwise the "*progressive/transformational*" approach to computer technology integration as mentioned in the literature). Through the study it has not been proved that teachers apply computers in ways that fundamentally transform and revolutionize education.

6.2. Factors influencing teachers in integrating computers in their classrooms

The third major question that is under investigation by the present study was to identify the factors that influence teachers in integrating computers in their classrooms practices. Summarizing the results from the questionnaires and the interviews it is revealed that these factors can be divided in three categories: professional, organizational and attitudinal. The existence of these three categories of factors provides understanding and explains the frequency and the kind (various types) of computer use in classrooms.

6.3. Professional factors

The present study indicates that while teachers may be well able to use and even teach with computers on a personal or individual basis, they lack the knowledge and skills needed to incorporate computer technology on a classroom-wide basis. Along the same lines with the existing literature (e.g., Becker & Ravitz, 2001; Brush et al., 2003; Demetriadis et al., 2003; Dexter et al., 1999; Earle, 2002; Honey, 2001; Peck et al., 2003; Picciano, 2002; Wilson, 2003), teachers report a substantial lack of both pre and post service training and development courses, aimed at explaining how to integrate computers into instruction in any regularized fashion, as well as acquiring computer skills. Teacher educational background was found to be a significant predictor of classroom computer use, but only 22% of the teachers sampled possessed a Master's degree.

It is interesting, however, to find a significant link between teachers' level of professional behavior and the degree to which they use computers in their classes. Teachers who were more active, assumed more responsibility in their school, and maintain good relationships with their colleagues tended to use computers more frequently.

Somewhat surprisingly and inconsistent with previous studies (Becker & Ravitz, 2001; Becker & Reil, 2000; Carvin, 1999; Dexter et al., 1999; Earle, 2002; Ertmer, 1999; International Society for Technology in Education, 2002; Jonassen, 1999b) is that no link was found between computer usage and the tendency of teachers to support progressive instructional practices such as constructivist or student-centered learning. It may be that teachers conceptually distinguish the idea of computer integration in learning from the idea of constructivist learning. Of course, another explanation could be that the level of professional training (along with the lack of organizational support to be discussed below) is simply inadequate to allow computers to be used in constructivist ways.

6.4. Organizational factors

The organizational factors to computer usage appear to fall into three main categories; structural, normative, and resource-related. With regard to structural factors, it is clear from the interviews that teachers are severely impeded by a "tyranny of the curriculum," that is, a high volume of educational material to be covered and a demand by education officials that it be covered on a regularized nationwide basis. Like many educational systems around the world, Cyprus relies on a system of national standardized tests for determining educational opportunity and attainment. A tremendous "gravitational force" thus exists, which discourages Cypriot teachers from taking risks or loosening the reigns over classroom processes.

Another structural factor emerging from the interviews concerned the low level of support and assistance teachers reported receiving from local and district technology coordinators. Lacking regular support, teachers would be more likely to place less priority on computer instruction.

Of course, this lack of support also contributes to a normative factor against the use of computers in the classroom. In addition, teachers reported little in the way of professional or social networks, either formal or

informal, that supported classroom technological innovation. In short, the teacher responses suggest that professional culture and school climate are unsuited for promoting instructional change. Somewhat of a surprise, however, is the relatively low importance was placed by teachers on principal leadership as a factor in promoting classroom computer usage. This might suggest that principals are viewed more as managers than as instructional leaders and as having little relevance with regard to classroom instruction.

Finally, and perhaps most importantly, the teacher interviews reveal a marked lack of resources. In addition to the absence of human resources mentioned above (in the form of local and district support personnel), teachers cited having just one computer per classroom, a lack of other necessary equipment, a lack of prepared materials from district and ministry officials, as well as a lack of basic Greek language software. Teachers also reported that they were not granted the time necessary to prepare computer-oriented lessons. Adequate time was provided neither within the curriculum nor within the school year for teachers to grapple with the problem of how to effectively integrate computer technology into their teaching.

6.5. Attitudinal factors

Teacher attitudes toward the computer as a classroom tool was found to be a significant predictor of classroom use. Teachers expressing skepticism about the value of computers in the classroom tended to use them less frequently than other teachers. This is consistent with prior studies (Berg et al., 1998; Carvin, 1999; Demetriadis et al., 2003; Dexter et al., 1999), and may help explain why classroom computer usage remains limited even in ''technology rich'' schools (Zhu, 2003).

7. Conclusion

The current study evaluated computer technology integration in a centralized educational system. The results of the study allowed to determine the kind of computer technology integration. Firstly, it revealed that while teachers use computers rather extensively for their own purposes, they use them less frequently in their classes. When they do use them in their classes, it tends to be in a rather sporadic fashion, more as supporting than as educational tools. The emphasis is on skill-based applications that fit into traditional views of teaching and learning.

The examination of the personal, professional and organizational factors shed light to the existing situation in Cyprus elementary schools, since they explained the low frequency of computer use and the preference towards the traditional approaches. The factors discussed above that function as barriers, prohibited the full implementation of 'Evagoras' project and reveal up to a degree the problems that exist throughout the system regarding computer integration. It shows that too many aspects of the system either directly or indirectly related to computer technology integration are dysfunctional. One message seemed to emerge time and again from the teachers: to paraphrase, ''we simply don't know how to do this.'' If teachers believe that their traditional practice is reasonable, effective, and efficient, they are likely to resist implementing computer innovations. This would be particularly true when teachers lack the knowledge and resources needed for successful innovation.

Given the above, it can be said that the implementation of 'Evagoras' was partial, vague, and some of its goals were postponed. The centralized, curriculum-driven, content-oriented and bureaucratic nature of the Cypriot primary education system prohibits teachers from incorporating computer as a transformational tool in their classroom. The non-coercive character of 'Evagoras' and the lack of guidelines towards educators resulted in computer technology integration based on educators' personal experiences knowledge, skills and personality. Teachers, based on their own discretion made a decision regarding implementation – to use or not the computer in their classroom, and in terms of how to use it.

The results of the current study – computer uses and factors that influence computer integration – appeared to be similar to cases from other countries. More than a few studies covering different parts of the globe examined and evaluated IT (Information Technology) integration in numerous different educational settings (Cuban, 2000; Earle, 2002; Goddard, 2002; Kozma & Anderson, 2002; Pelgrum, 2001). Unfortunately, the majority of them report inadequate integration of new technologies in the educational scope (e.g. Cuban, 2001; Honey, 2001; Karagiorgi & Charalambous, 2004; Kazamias et al., 2005; Zhu, 2003). It appears that

the way that computers are integrated in classrooms and the barriers that inhibit successful integration are universal. Having in mind the previous, it is uncertain how the educational systems around the world should address such a situation? Certain questions arise, such as "how computers as tools could be effectively used in classrooms? Is there anything that can be done in order to enable teachers to develop more positive attitudes towards using computer technology in their teaching? What can be done in order to expand teachers and students' experiences with computer technology?"

The findings of the study, and consequently the questions and dilemmas raised, call for immediate and direct action for policymakers and educators since the goal is to improve the situation and successfully apply computer technology integration in schools. Since various educational systems appear to face similar problems, it is valuable to address those problems before moving on, taking into consideration the results of empirical research. Based on the results of the study as well as the knowledge gained from research so far, the author would like to highlight teachers' important role in the process of successfully integrating computers in education. By examining and understanding teachers' current experiences regarding computer integration, computer technology experience for both teachers and students is likely to get enhanced in terms of quality. We need to give more attention on the human aspect, in this case teachers than on the equipment, since it has been revealed once more that ignoring teachers' beliefs when implementing instructional change leads to disappointing results.

Based on the above, it is strongly suggested that *teachers' involvement* should be enhanced when innovations and changes are introduced. They should be more involved in the decision making process since any kind of changes in the educational settings are directly related to implementers, in this case the teachers. A negotiation process needs to be initialized among key stakeholders to close the gap that appears to exist and due to this gap several of problems ensue. As Noam Chomsky suggested in one of his speeches "... we have to ask the public opinion. There is a need to close the gap between the public opinion and the policies developed for it to implement". The same is applied regarding teachers and education policymakers.

In addition to the above, enhancement of pre and post teachers' professional development training should be achieved. Teachers once more appeared to be 'technophobic' since they are far from being computer literate and at the same time they have not been adequately informed and/or trained regarding computer integration in classroom. In order to optimize the use of computer use in the classrooms, teachers should realize the potential of computer technology integration to enhance the teaching and learning process. They need to be at a point to value the contribution of ICT in education as quite large in order to achieve successful computer technology integration. Consequently, professional development training should focus on enhancing not only teachers ICT skills but also knowledge on integrating computers in classrooms as well as eliminate to the best possible degree teachers' pedagogical concerns regarding computer technology contribution. Additionally, training could be also introduced at school level not at district or national level. School level training would directly address teachers' needs, in collaboration to their peers. They will have the opportunity to be more involved in their training by suggesting areas of weakness.

Finally, the author points out the importance of research. To be able to improve computer integration in classrooms we need to add a new approach to our research. It becomes essential to focus on observing teachers in classroom, instead of conducting only surveys and interviews. Researchers should feel the "classroom rhythm" when computers are used in the teaching and learning process. We need to get closer to the field to be able to effectively help and guide the teachers.

Even though computer technology is promising, is it on teachers to realize the potential provided by computer technology? We have to consider teachers' motivation as an extremely important factor in integrating computers in classrooms, since their role is unquestionable and increasingly important. Also, what is the role of the system? Why teachers should be the ones to "blame"? Should we shift the locus from the individual implementers to the broader system, and the context? The future of computer technology integration in classrooms is determined by our choices of today.

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