FACTORS AFFECTING TEACHERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGY

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Research studies in the past decade have shown that computer technology is an effective means for widening educational opportunities, but most teachers neither use technology as an instructional delivery system nor integrate technology into their curriculum. Studies reveal a number of factors influencing teachers' decisions to use ICT in the classroom: non-manipulative and manipulative school and teacher factors. These factors are interrelated. The success of the implementation of ICT is not dependent on the availability or absence of one individual factor, but is determined through a dynamic process involving a set of interrelated factors. It is suggested that ongoing professional development must be provided for teachers to model the new pedagogies and tools for learning with the aim of enhancing the teaching-learning process. However, it is important for teacher trainers and policy makers to understand the factors affecting effectiveness and cost-effectiveness of different approaches to ICT use in teacher training so training strategies can be appropriately explored to make such changes viable to all.

Key Words: information and communication technologies, teacher, training program

INTRODUCTION

Technology involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. In other words, technology can change or alter how people access, gather, analyze, present, transmit, and simulate information (See, 1994). The impact of technology is one of the most critical issues in education (Webber, 2003). The use of information and communication technology (ICT) creates a powerful learning environment and it transforms the learning and teaching process in which students deal with knowledge in an active, self directed and constructive way (Volman & Van

Eck, 2001). ICT is not just regarded as a tool, which can be added to or used as a replacement of existing teaching methods. ICT is seen as an important instrument to support new ways of teaching and learning. It should be used to develop student's skills for cooperation, communication, problem solving and lifelong learning (Plomp et al., 1996; Voogt, 2003).

Integrating technology into curricula with the intent of positively influencing teaching and learning has been in a state of evolution over the past 20 years (Dias & Atkinson, 2001; Dockstader, 1999). Driven primarily by hardware and software evolution, accessibility to computers in educational settings, and popular instructional technology trends, technology integration has covered the continuum from instruction on programming skills, self-directed drill and practice, interactive learning software, online training, testing, instructional delivery augmentation, and Internet-based accessibility to information, communication, and publication (Dias & Atkinson, 2001). According to Flanagan and Jacobsen (2003), technology integration is meant to be cross-curricular rather than become a separate course or topic in itself. Technology should be used as a tool to support the educational objectives such as skills for searching and assessing information, cooperation, communication and problem solving which are important for the preparation of children for the knowledge society (Drent & Meelissen 2007). In fact, innovative use of ICT can facilitate student centered learning (Drent, 2005). Hence, every classroom teacher should use learning technologies to enhance their student learning in every subject because it can engage the thinking, decision making, problem solving and reasoning behaviors of students (Grabe & Grabe, 2001). These are cognitive behaviors that children need to learn in an information age.

Despite successful efforts to acquire computer hardware and to raise the student to computer ratio to 5:1 (World Almanac, 2002), there has been less success identifying, which computer skills should be taught in school and how computers can be used for teaching and learning (Dooling, 2000). Thus, current attention has turned to what is actually happening in the classroom with computer technology. Although ICT may facilitate independent self-paced learning, the potential of ICT may not be optimized if there is no shift in the learning and teaching paradigm (Bangkok, 2004). In fact, teachers play an important role in the teaching/learning paradigm shift. They must understand the potential role of technology in education. Also, they should become effective agents to be able to make use of technology in the classroom.

This paper reviews factors that influence teachers' decisions to use ICT in the classroom and highlights models for integrating technology into teacher training programs. In fact, understanding the pedagogical, psychological and cognitive barriers to the successful use of information technology is a vital precondition for improving the utilization of computers and other technological aids in the educational process (Benzie, 1995). Also, the detection of these barriers provides information that is helpful in supplementing existing in-service training programs. So, this paper is aimed at educators and policymakers who would like to learn from the research and experiences of others. It is hoped that the knowledge gained from this paper would be useful to these people in making wise decision in relation to their technology investment.

Factors Affecting Teachers' Use of ICT

As a classroom tool, the computer has captured the attention of the education community. This versatile instrument can store, manipulate, and retrieve information, and it has the capability not only of engaging students in instructional activities to increase their learning, but of helping them to solve complex problems to enhance their cognitive skills (Jonassen & Reeves, 1996). Generally, three objectives are distinguished for the use of ICT in education (Plomp, Ten Brummelhuis, & Rapmund, 1996): the use of ICT as object of study, the use of ICT as aspect of a discipline or profession; and the use of ICT as medium for teaching and learning. The use of ICT in education as object refers to learning about ICT, which enables students to use ICT in their daily life. The use of ICT as aspect refers to the development of ICT skills for professional or vocational purposes. The use of ICT as medium focuses on the use of ICT for the enhancement of the teaching and learning process (Drent, Meelissen, 2007). It is a fact that teachers are at the center of curriculum change and they control the teaching and learning process. Therefore, they must be able to prepare young people for the knowledge society in which the competency to use ICT to acquire and process information is very important (Plomp et al., 1996).

In general, the research literature on the implementation of ICT shows that it involves a large number of influencing factors (e.g., Mumtaz, 2000). We can make a distinction between non-manipulative and manipulative school and teacher factors by reviewing several studies on factors that influence teachers' decisions to use ICT. Non-manipulative factors are factors that can not be influenced directly by the school, such as age, teaching experience, computer experience of the teacher or governmental policy and the availability of external

support for schools (Ten Brummelhuis, 1995). On the other hand, manipulative factors refer to the attitudes of teachers towards teaching and ICT, ICT knowledge and skills of teachers, commitment of the school towards the implementation process and availability of ICT support (Ten Brummelhuis, 1995). This paper reviews studies on the use of ICT by teachers and identify relevant factors that included and categorized in the framework of Ten Brummelhuis.

Non-manipulative school and Teacher Factors

Teachers' Characteristics

Teachers' characteristics (e.g. individual's educational level, age, gender, educational experience, experience with the computer for educational purposes and financial position) can influence the adoption of an innovation (Rogers, 1995, Schiller, 2003). The report by the National Center for Education Statistics (2000) indicated that teachers with fewer years of experience were more likely to use computers in their classes than teachers with more years of experience. More specifically, teachers with three years or less teaching experience reported using computers 48% of the time; teachers with 4-9 years, 45% of the time; those with 10-19 years, 47% of the time, while teachers with 20 years or more reportedly used computers only 33% of the time. This may be due, in part, to the fact that new teachers have been exposed to computers during their training and therefore, have more experience using this tool. Then, one of the factors that determine the extent to which teachers use computers in their classes may be the number of years they have been teaching.

Moreover, Venkatesh and Morris (2000) investigated about age and gender differences in the overlooked context of individual adoption and sustained usage of technology in the workplace using the Theory of Planned Behavior (TPB). They studied on user reactions and technology usage behavior over a 5-month period among 355 workers being introduced to a new software technology application. The results showed that the decisions of men and younger worker were more strongly influenced by their attitude toward using the new technology. In contrast, women and older worker were more strongly influenced by subjective norm and perceived behavioral control. Then, these groups of people adopt very different decision processes in evaluating new technologies. On the other hand, Albirini (2006) found that age was not a significant factor in relation to teachers' attitudes towards ICT. However, it was revealed in the current study that age correlated negatively with the Jordanian EFL teachers' attitudes towards ICT in Jordan ($r = -.13$, $p <.01$). This result

demonstrated that as the age of the teachers decreased, their attitudes towards ICT increased. This finding confirms the results of Roberts, Hutchinson and Little's study (2003) that the probability that teachers would use ICT in the classroom was limited by the reality that teachers who were educated 20 years ago were trained by people who themselves were trained before the arrival of computers in schools.

In addition, Bauer and Kenton (2005) carried out a study about technology integration in the schools. They used a qualitative study to examine the classroom practice of 30 "tech-savvy" teachers who used computer technology in their instruction. They found that the teachers were highly educated and skilled with technology, were innovative and adept at over coming obstacles, but that they did not integrate technology on a consistent basis as both a teaching and learning tool. They stated two reasons regarding these findings: students did not have enough time at computers, and teachers needed extra planning time for technology lessons. Other concerns were out-dated hardware, lack of appropriate software, technical difficulties, and student skill levels.

Furthermore, there are other personal characteristics that may influence how teachers use computer applications in their classrooms. The teacher's own learning style is certainly one such factor. For example, if a teacher is a creative thinker who likes the idea of constructing knowledge, is a life-long learner, a social learner, and a decision maker, he may be more likely to use computers in more integrative and transformational ways that are useful and valuable to students instead of ways that promote and support traditional classroom practices (Bielaczyc & Collins, 1999; Carvin, 1999). Therefore, personal characteristics of teachers are an important influence on how easily they take up an innovation. Support for this is provided by a classic American study of the diffusion of innovations. Rogers (1995) found that innovators are divided into five categories, depending on the stage at which they take up an innovation. The initial innovators typically form the first 2-3 % to take up an innovation, while early adopters make up the next 13-14%. These two groups together might be called the earlier adopters. This is important when looking for ways to encourage further take-up, because Rogers identifies a tendency for there to be distinctive differences in the personality characteristics of earlier and later adopters. As he summarizes it, earlier adopters differ from later ones in tending to show greater empathy, less dogmatism, a greater ability to deal with abstractions, greater rationality, a more favorable attitude towards change, a better ability to cope with uncertainty and risk, a more favorable attitude toward science, less fatalism and higher aspirations. This characterization implies a

distinctly unfavorable perception of later adopters. However a positive description of later adopters is not hard to provide. Compared to earlier adopters, later adopters could equally well be described as more realistic, steadier in their judgments, with a concrete grip on problems, having a dislike for fads, being less willing to take unnecessary chances, having a preference for being guided by experience and with a more realistic appreciation of possibilities than earlier adopters.

Parent and Community Support

One way in which schools can move to student-centered use of ICT is through links with the wider community. Such links enable the development of a more authentic and contextualized approach to learning supported by ICT tools (Demetriadis et al., 2003). Thus, human responsibilities, roles and priorities within the community must be rearranged. For example, assessment methodologies should be redesigned to allow all interested community members to play an appropriate role.

In this respect, Granger and his colleagues (2002) studied on four schools to identify factors contributing in successful implementation of ICT by teachers. Based on their findings, they concluded that successful implementation required not only computers but commitment and community, with the last two being closely interlinked. Also, they added that the schools worked continually with questions of equity, privilege, language, and community support. Each aimed to develop a philosophy of pedagogy informed by the unique characteristics of their specific communities.

In addition, Kington et al. (2002) carried out a study on innovative practice using ICT in schools. They showed how a school used the introduction of laptops to build up a 'connected learning community' in an area of lack of social and economic context. Kington and her colleagues categorized the main elements of the model developed by the school. They are as follows:

•The creation of an "open access" school where dialogue about learning between parents and teachers and children was encouraged;

•The provision of laptops at school and home: for pedagogical and personal purposes; to develop pupils' ICT skill and competence; and to support the adoption of new teaching approaches which motivate students and parents and which give students a sense of success;

•The arranging of e-Mentors in industry for students with little family history of formal employment;

•Access to skill development in ICT for parents through adult education courses on site;

•A network of support for students and parents learning about ICT together;

•The provision of a crèche to support parental access to learning;

•The celebration of the learning of adults and children through assemblies.

Therefore, instead of taking innovative ICT-based learning to the students, the students are taken to the innovative learning. Teachers should be aware of the influence of home on school success. When parents are encouraged to participate in and contribute to change management activities within a school's ICT master plan, change occurs more quickly (Bangkok, 2004). Morale was generally high in these schools, while teachers, students, and parents were excited about the level of innovation in the school and quite anxious to share their experiences with others. Hence, parent and community support can influence the implementation of ICT in education. Thus, school leader must explore business partnerships to support technology initiatives. To involve parents in the decision-making process, school leader must host ICT information or education events for community. Therefore, ICT facilitates linkages among schools, homes and communities, enabling teachers, peers, parents and members of the community to play a greater role in the students' learning experiences. These experiences include engaging in authentic problem solving, working with researchers and honing their entrepreneurial skills. The bonds between schools and homes and communities are also strengthened through increased interaction and communication.

Manipulative School and Teacher Factors

Availability of Vision and Plan about the Contribution of ICT to Education

Teachers need to know exactly how ICT is used as a teaching and learning tool. Many researchers have pointed out that a school's ICT vision is essential to effective ICT integration (Anderson & Dexter, 2000). Bennett (1996, p. 60) stressed the importance of a "well-defined mission that describes technology's place in education". In line with this idea, Ertmer (1999) wrote, "A vision gives us a place to start, a goal to reach for, as well as a guidepost along the way" (p. 54). Also, Means and Olson (1997) recommend that teachers and schools must develop a vision before they make substantial investments in hardware and software. In other words, users of technology must have a fundamental belief in the value of innovation or the innovation is doomed to failure. Teachers must have opportunities to study, observe, reflect, and discuss their practice,

including their use of ICT, in order to develop a sound pedagogy that incorporates technology (Kearsley & Lynch, 1992). Hence, the vision should not be created by a single person or through a top-down process starting from the MOE. It is crucial to involve those who have a stake in the outcomes, including teachers, parents, students, and the community, and allow them to assist in the creation of the vision by contributing their knowledge, skills, and positive attitudes. Therefore, a clear vision of ICT integration in schools that is shared by all members of the school community promotes effective use of ICT in the classroom.

Once the vision has been successfully created and accepted, the next step is to articulate an ICT integration plan, spelling out how the teachers are expected to integrate technology in their lessons (Strudler & Wetzel, 1999). In fact, an ICT master plan that is formulated according to a school's vision and its socio-cultural setting assures effective integration of ICT (Bangkok, 2004). Gulbahar (2005) conducted a study to illustrate how technology planning process was carried out in a private K-12 school in Turkey. Data were collected from 105 teachers, 25 administrative staff, and 376 students. Findings of this study indicated that educational institutions must develop a technology plan in order to use technology in an effective and efficient manner for teaching, learning and administrative purposes. Also, some issues that should be considered include staff and student development in ICT-related skills, curriculum and assessment, ICT facilities and resources and support teams (both technical, administrative and pedagogical). Therefore, an ICT integration plan provides a detailed blueprint of the steps and methods needed to translate the school ICT vision into reality. Developing ICT integration plans is no doubt a complex and time-consuming task, but they are usually well worth the time required to put them together.

Level of and Accessibility to the ICT Infrastructure

Using up-to-date hardware and software resources is a key feature to diffusion of technology (Gulbahar, 2005). In recent years, most of the schools are equipped with different kinds of technological infrastructure and electronic resources available. For instance one Australian school has reported that this school has provided personal notebook computers and their own web spaces, email access and workspace for all staff, and students from Year 5 onwards. Video conferencing is available and the school has established its own intranet, placing all its resources on-line. These are accessible via radio connections from school and home. In this college the use of radio is seen as an innovation that

has completely changed the nature of teaching and learning (Richardson, 2000). Also, Richardson (2000) reported that many teachers integrated technology into their teaching and learning process in this school. This awareness appeared when they saw the potential of on-line lessons and the possibility of creating shared, net-based teaching materials. Therefore, hardware, software and network infrastructure must be available to integrate ICT in education. Appropriate resourcing and flexible, forward-looking planning, linked closely to what teachers actually want and need at any given stage, will be essential.

Furthermore, Albirini (2006) carried out a study examining the factors relating to the teachers' attitudes toward information and communication technologies. A questionnaire was designed to collect evidence from high school English teachers about their perceptions of computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics (including computer training background). The sample consisted of 63 male and 251 female teachers. The results showed that a relatively high percentage of the respondents (57%) had computers at home while only 33.4% of the respondents had access to computers at school. This percentage gives a clear indication of the insufficiency of computers at Syrian schools, particularly for teacher use. Thus, Albirini's findings substantiated this globally felt barrier that computer access has often been one of the most important obstacles to technology adoption and integration worldwide (Pelgrum, 2001). On the other hand, Mumtaz (2000) stated that many scholars proposed that the lack of funds to obtain the necessary hardware and software is one of the reasons teachers do not use technology in their classes. Also, a report on teachers' use of technology by the National Center for Education Statistics (September, 2000) indicates a correlation between availability of computers and computer use. In general, teachers who had computers in their classes were more likely to use them in instruction than teachers who did not; more than 50% of teachers who had computers in their schools used them for research and activities related to lesson preparation. A total of 78% of teachers surveyed cited limited access to computers as a barrier to effectively using computers in their classes. Of this total, 38% thought "not enough computers" was a "great barrier" to using technology in their classes. Therefore, efficient and effective use of technology depends on the availability of hardware and software and the equity of access to resources by teachers, students an administrative staff.

Availability of Time, to Experiment, Reflect and Interact

According to Mumtaz (2000), lack of time is a factor that hinders technology integration in schools. This barrier becomes manifest in two ways: (a) release time and (b) scheduled time (Mumtaz, 2000). Results of a study conducted by the National Center for Education Statistics (2000) with in-service teachers revealed that 82% of the participants thought that lack of release time was the most significant factor that prevented them for using computers in their classes as well as prepare materials for use with their classes. Teachers felt that, with their regularly scheduled classes, they did not have enough opportunities to practice using computers in their classes. Also, lack of time scheduled on the timetable to use computers with students is a factor mentioned by teachers as a barrier to using computers in their classes. Approximately 80% of the teachers surveyed in the aforementioned study thought there was not enough time scheduled for students to use computers. Even though some of the teachers had a genuine need to use computers with their students, there was no available time to do it. Hence, the lack of time required to successfully integrate technology into the curriculum is a recurring issue.

Available Support to Computer-Using Teacher in the Workplace

The National Council for the Accreditation of Teacher Education (NCATE) (1997) reported the lack of technical support as one of the major barriers that resulted in computers being underutilized in the classes. Teachers did not want to use computers because they were not sure where to turn for help when something went wrong while using computers. Butler and Sellbom (2002) carried out a study on barriers to adopting technology for teaching and learning. Regarding to the role of technical support staff, they recommended that schools should work to convince technology staff that reliability is very important, especially concerning technology in classrooms; encourage the purchase of highly reliable technologies; improve systems for checking and maintaining classroom technologies; create new approaches (including staff training) to assure that extremely rapid responses are made to breakdowns; new classroom technology setups should be tested by faculty before they are installed; classrooms should be as similar as possible; differences in the technologies in each classroom should be well documented ; help faculty learn by encouraging faculty discussions about teaching, learning and technology; identify faculty who have used and evaluated the impact of technologies on learning and organize a workshop, conference, or set of papers to make this information more widely available to faculty; encourage faculty to assess and evaluate the

impact of technologies on learning; identify attitudes and behaviors that are seen as poor or inadequate support and work with technology staff to reduce these; rapid response system must be in place that can deal with a wide range of problems. Therefore, lack of technical support is very stressful for the teacher, which may affect the teacher's willingness in the adoption of ICT (Tong & Trinidad, 2005).

On the other hand, appointing an ICT coordinator or head of the ICT department in each school helps to assure administrative and pedagogical support for the teachers. This appointment should not be confused with that of a technology assistant. The ICT coordinator or head of department should advise teachers on ICT solutions to their teaching or learning problems, help teachers to acquire ICT resources, and conduct training needs assessment of teachers' ICT-related capacities and advise them on their professional development (Bangkok, 2004). Regarding to the in importance of technical coordinator in school, the National Center for Educational Statistics (2000) reported that about 68% of the teachers surveyed believed that lack of support regarding ways of using technology in the class hindered technology use. The survey also found that teachers in schools with no technical coordinator were more likely to cite lack of technical support as a barrier to their use of technology than teachers in schools with a technical coordinator. Also, sixty-four percent of the teachers surveyed identified lack of technical support or advice as a barrier to using technology in their classes. Hence, lack of on-site support is one of the reasons that teachers do not use technology in their classes.

In addition, Bosley and Moon (2003) review the literature on the use of Information and Communication Technology within an educational context. They mentioned a case study research in the UK that identified a number of factors that enable teachers to successfully engage in innovative practice. These were: support at senior management level for implementing new practices and addressing financial implications where appropriate; involvement of several members of staff; fostering culture within schools of collaboration and mutual support; and lastly willingness to take risks. The role of school leadership is clearly central in meeting several of these preconditions. In fact, teachers need both technical and administrative support when they decide to use technology in their classes. Although infrastructure is important, leadership is an important element in establishing technology as a part of school culture (Anderson and Dexter, 2000). Fullan (1992) believes that the role of the leader is crucial to the successful implementation of educational innovations. Similarly, Baylor and Ritchie (2002, p. 412) describe leadership as a critical predictor of ICT

integration, since it focuses on promoting the use of ICT at a strategic and action level: 'school principals who wish to nurture a technology culture need to join in rather than sitting by the side'. Then, if leaders are cognizant of the benefits to be gained from using technology in the teaching, learning process, technology use in school is more likely. To promote ICT integration in schools, school leaders should adopt strategies that make ICT a part of the daily routine or tasks of the teachers. These strategies may include using e-mail as the mode of communication among staff, accessing the Intranet to download forms and using a word-processor to complete lesson plans for submission (Bangkok, 2004). Therefore, school leaders should be a role model and should make ICT a tool in his everyday life.

School Culture

Social system is an important parameter in the innovation diffusion process (Rogers, 1995). Martinez (1999) found that one of the major challenges facing developing countries is to make technology an essential part of the culture of the people. According to Hodas (1993), the diffusion of technologies may be inhibited by the micro culture of a certain institution or organization. Hence, acceptance of a new technology in a society depends on how well the proposed innovation fits the existing culture. Therefore, there must be a match between organizational culture and new technology into an organization.

Within the school organization, school culture is an important consideration in terms of ICT integration (Tearle, 2003). School culture can be defined as the basic assumptions, norms and values, and cultural artifacts that are shared by school members (Maslowski, 2001, pp. 8–9). These meanings and perceptions indirectly affect attitudes and behavior in the organization of schools (Devos et al., 2007). Hence, if the technology is not received well by teachers, there must be a mismatch of values between the culture of schools and the technology (Albirini, 2006). Thus, teachers who have positive perceptions about the cultural relevance of computer technology will apply ICT in education.

Computer Attributes

According to past research, Rogers (1995) stated that characteristic of an innovation as perceived by individual in a social system affect on the rate of adoption. Also, he identified five innovation attributes that may contribute to the adoption or acceptance of an innovation: relative advantage, compatibility, complexity, observability, and trialibility. The relationship between an innovation's attributes and adoption has been examined in a number of

diffusion studies. For example, Albirini (2006) found that the computer attributes were significantly correlated to teachers' attitudes towards computer. Albirini's study accentuated the importance of computer attributes in the process of computer adoption in developing countries. Also, Dillon and Morris (1996) stated that "innovations that offer advantages, compatibility with existing practices and beliefs, low complexity, potential triablity, and observability will have a more widespread and rapid rate of diffusion" (p. 6). Therefore, if teachers perceive ICT as a beneficial tool, compatible with their current activities, easy to use and have observable outcomes, they will demonstrate positive attitudes towards ICT.

Level and Quality of Training for Teachers and School Principals

Professional development of teachers sits at the heart of any successful technology and education program. Baylor and Ritchie (2002) carried out a quantitative study that looked at the factors facilitating teacher skill, teacher morale, and perceived student learning in technology-using classrooms. They found that professional development has a significant influence on how well ICT is embraced in the classroom. Also, they added that teachers' training programmes often focus more on basic literacy skills and less on the integrated use of ICT in teaching. Despite the numerous plans to use technology in schools, however, teachers have received little training in this area in their teacher education programs (Varsidas & McIsaac, 2001). According to Schaffer and Richardson (2004), when technology is introduced into teacher education programs, the emphasis is often on teaching about technology instead of teaching with technology. Hence, inadequate preparation to use technology is one of the reasons that teachers do not systematically use computers in their classes. Teachers need to be given opportunities to practice using technology during their teacher training programs so that they can see ways in which technology can be used to augment their classroom activities (Rosenthal, 1999). Teachers are more likely to integrate ICT in their courses, when professional training in the use of ICT provides them time to practice with the technology and to learn, share and collaborate with colleagues.

On the other hand, training school students to serve as technology experts may aid the integration of computers into the classroom setting (Hruskocy et al, 2000). Hruskocy et al (2000) carried out a study on training students to become technology experts for teachers and peers. Based on this study, ten teachers of grades one through five sent their students to the training sessions. The strengths and limitations of the programmes were evaluated through reflection

papers prepared by each member of the university team. The strengths of the programmes showed that teachers became more frequent users of technology, expressed a greater desire to learn along with their students. Teachers became more curious about their students' expanding computer skills and enthusiasm and lost their reluctance to ask questions. In the end, teachers began to use their students' expertise to increase their own computer skills. Also, students' skills were transferred to the classroom, and teachers became more motivated to learn to use technology and to incorporate technology in classroom activities. The limitations of the training session mainly centered on the limited time in sessions to practice. Hruskocy and his colleagues concluded that not only teachers' expertise and dedication are necessary for technology integration but also students' enthusiasm and talent prompt the process.

Attitude towards Computer

Drent and Meelissen (2007) conducted a study about factors which stimulate or limit the innovative use of ICT by teacher educators in the Netherlands. The study used questionnaires for 210 teachers and interviews for 4 of those teachers who had responded. Their findings showed that several factors such as a student–oriented pedagogical approach, a positive ICT attitude, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher. Also, comparison between these factors in predicting computer use identified that attitude toward computer contributed more in explaining ICT use by teachers.

In addition, educational theorists and researchers have realized that an important factor in the implementation of computers is users' acceptance, which is in turn influenced by their attitudes towards these media (Koohang, 1989). Teachers' attitudes have been found to be major predictors of the use of new technologies in instructional settings (Almusalam, 2001). The successful use of technology in the classroom depends to a large extent on the teachers' attitudes toward these tools (Lawton & Gerschner, 1982). In fact, it has been suggested that attitudes towards computers affect teachers' use of computers in the classroom and the likelihood of their benefiting from training (Kluever, Lam, Hoffman, Green & Swearinges, 1994). Positive attitudes often encourage less technologically capable teachers to learn the skills necessary for the implementation of technology-based activities in the classroom. Harrison and Rainer (1992) found that participants with negative computer attitudes were less skilled in computer use and were therefore less likely to accept and adapt to technology than those with positive attitudes. They concluded that changing individuals' negative

attitudes is essential for increasing their computer skills. Therefore, if teachers want to successfully use technology in their classes, they need to possess positive attitude to use technology. Such attitude is developed when teachers are sufficiently comfortable with technology and are knowledgeable on its use.

Computer Competence

According to Pelgrum (2001), the success of educational innovations depends largely on the skills and knowledge of teachers. Also, he found that teachers' lack of knowledge and skills was the second most inhibiting obstacle to the use of computers in schools. Similarly, in the United States, Knezek and Christensen (2000) hypothesized that high levels of (attitude), skill and knowledge (proficiency), and tools (level of access) would produce higher levels of technology integration that will reflect on student achievements positively. Their model postulated that educators with higher levels of skill, knowledge, and tools would exhibit higher levels of technology integration in the classroom. Moreover, Berner (2003) studied the relationship between computer use in the classroom and seven independent variables: perceived relevance; desire to learn; emotional reaction to technology; beliefs about computer competence; beliefs about technology; administrative support; and peer support. He found that the faculty's belief in their computer competence was the greatest predictor of their use of computers in the classroom. Therefore, teachers should develop their competence based on the educational goals they want to accomplish with the help of ICT.

In addition to the factors mentioned above, there are other factors that influence teachers' decision to use ICT. They are collegiality among computer using teachers, self image, student- oriented educational philosophy of the teacher, positive views about the impact ICT has on teachers' work, perceived changes, student-oriented pedagogical approach, personal entrepreneurship, professional engagement, self confidence, and willingness to change.

However, the research literature on factors influence the implementation of ICT in education has a relatively long history and is international in nature (Becta, 2003). If one is aware of these factors 'teacher level factor' and 'school level factor' steps can be taken to gain success in technology integration process. Most of the articles reviewed focus either upon the individual teacher or upon the school as a whole as the unit of analysis. However other issues emerge about the innovation tasks facing both if they are viewed together. The study by Ertmer and her colleagues (1999) offers one useful framework for making this connection. They identified three levels of teachers' computer use, varying in their relationship to the existing curricula. These involve using ICT as: (1) a

supplement to the curriculum, (2) a reinforcement or enrichment of the curriculum, or (3) a facilitator for an emerging curriculum. However, these three categories help us to distinguish the positions of whole schools as well as individual teachers. This enables us to speculate about what the implications might be of various kinds of match and mismatch between a schools' position and that of an individual teacher within it. The position is different again in schools where both teacher and school favor using ICT to promote an emerging curriculum. Many of the sources, such as Evans (2002) and Richardson (2000) show such schools as learning organizations that are continually looking for ways of improving teaching and learning. These schools train their teachers to use technology as a tool, and to transform their classrooms into interactive, inquisitive learning environments. Therefore, teachers need support, examples of good practice, and leadership from their school principal to receive the necessary time for professional development , in order to truly transform teaching and learning in the classroom.

Effective Training Program

The teacher has an important role to play in the teaching/learning paradigm shift, with ICT facilitating the development of a higher level of cognitive skills in evaluating arguments, analyzing problems and applying what is learnt. Although teachers play an important role in the learning environment, they are often not consulted regarding changes to teaching learning procedures (Bangkok, 2004). In fact, the teachers' needs under changing conditions have to be continuously assessed and activities to satisfy these have to be developed. So, professional development is necessary for teachers to enable them to effectively use technology to improve student learning. Staff development should be collaboratively created, based on faculty input and school needs. It must prepare teachers to use technology effectively in their teaching.

According to Spillane (1999), teachers who have a strong engagement towards their own professional development are more motivated to undertake activities, which lead to a better understanding of the goals of an innovation. Similarly, Fullan (1992) pointed out that teachers who are actively involved in their own professional development are more able to implement changes in their teaching. Hence, having a recognition system for innovative and effective use of ICT integration in schools will motivate teachers to use ICT in teaching. For example, formal certification of in-service professional development that leads to diplomas or degrees could provide an incentive for teachers to upgrade and update their skills in and knowledge of ICT integration.

In line with this idea, Fullan (1992) suggested that training should not be one-shot workshops, but rather ongoing experiences so that learners can be kept up-to-date with ever-changing technologies. Teachers need follow-up training sessions to ensure that they keep abreast with current technologies. Hence, teacher training is crucial and these programmes must adequately prepare teachers with skills necessary to integrate technology in their classes. Moreover, they must learn to work smarter and have a vision to implement ICT in their classes. Having vision requires strategic planning, risk-taking and decision-making, imagination and commitment. In addition, teachers need to have a clear understanding of what to change as well as how to change (Bennis, 1990). Therefore, they need to become lifelong learners and develop their skills and abilities to overcome their fear of being the captain and focus on leading the ship. In other words the teachers must work to become transformational leaders. The following section reviews some literature on teacher training to identify models or strategies that are effective for preparing teachers to integrate technology.

Models for Integrating Technology into Teacher Training Programs

Schmidt (1998) stated that two approaches have been primarily used in teacher education programs which are "offering an instructional technology course" or "integrating technology throughout all courses". In the first approach, a complete instructional technology course is offered to teachers as one of the courses in their program of study. According to Parker (1997), this approach is not effective because technology classes are usually focused on teaching students about using technology at the expense of exposing them to practical ways of applying it in their classroom practices (Parker, 1997). Similarly, findings from the ISTE survey commissioned by the Milken Exchange family Foundation (1999) show that implementing a single instructional technology course in teacher preparation programs is not usually very effective. In fact, teachers need to understand what computers can do, what learners can do with computers and ways of using them in their classes (Brownell, 1997). Hence, in order for technology to be effectively incorporated into teacher preparation programs, teachers should complete a well-planned sequence of courses and experiences that will help them understand and apply technology in education (ISTE, 2000). In other words, technology must be infused into their instructional practices and that college faculty use technology in their courses as a learning and teaching tool.

Kortecamp and Croninger (1996) proposed a model that was successfully implemented in a teacher education program at New England University (UNE). This model consisted of five interrelated components which were familiarization with hardware and software, partnering with mentors, developing personal projects, becoming mentors, keeping current. At the first phase of this model, teachers became familiar with hardware and software and then aggressive professional development was introduced to equip them with the knowledge and skills necessary to use the technology. At the second phase, partnering with mentors, teachers were motivated to collaborate with other faculty members who had experience using technology. The main reason for doing this was so teachers get exposed to ways of using technology in their professional activity as well as to provide ongoing support for faculty who were less familiar with technology. In the third stage, teachers were involved in designing projects that help their students to use technology in meaningful ways. For example, teachers designed projects to model technology use in their teaching activities, and to facilitate, place students in technology-rich field practices. At the final stage, becoming mentor and keeping current, teachers became mentors and guide their students in using technology. Technologies are constantly being developed to decrease the educator's workload and increase student learning, motivation, and knowledge of tools and skills necessary to become lifelong learners in the age of technology. Therefore, keeping abreast with new technologies is critical if technology is to be effectively used in teaching.

Another model was proposed by McKenzie and his colleagues in 1996. They called it the "systematic design model". This model was applied at West George College to facilitate staff development. The model consisted of three distinct stages: planning, implementation phase, evaluation. This model seems to provide a good explanation of the teachers' training program because it was designed based on a written technology plan. This plan identified what should be taught, how it should be taught, and which technology should be used in teachers' training program. Also, a technology planning team was responsible to determine the school's current level of technology use, and to conduct both informal and formal needs assessments in order to identify priorities for professional development activities. In this way, they could get information to establish professional development goals for using technology to promote engaged learning.

Another important feature of the McKenziel's model is evaluation. In fact, effective professional development uses evaluation to ensure that each activity

meets the needs of the participants and provides them with new learning experiences. According to Guskey (1998), evaluation consists of three types: preformative evaluation, formative evaluation, and summative evaluation. Preformative evaluation assesses educators' needs during the planning process. During this phase, intended goals are clarified and strategies for gathering data about reaching them are set (Guskey, 1998). Evaluation continues with formative evaluation, which is conducted during the professional development activity. Formative evaluation provides feedback and determines changes that can be made during the activity to make it more valuable to participating educators. Finally, the evaluation process concludes with summative evaluation, which is conducted after the activity. Summative evaluation allows participants to judge the overall merit or worth of the activity and gives decision makers the information they need to plan for the future (Guskey, 1998). It would seem that systematic design model can be applied as a basis for conceptualizing and developing a technology training program.

On the other hand, Efaw (2005) conducted an experimental study about effective strategies in teacher's development programme among the United States military academy at West Point. He implemented three phase to accomplish faculty development most effectively. The three phases were learning, practice and feedback, and continued development. The first phase encompassed training in available technology, classroom modeling of the technology, learning how to encourage student participation, and initial feedback from experienced instructors. The second phase of the program involved setting aside time in the new instructors' schedules for designing and practicing lessons; mentoring by experienced faculty; videotaping practice sessions; encouraging reflection among the new instructors; and providing feedback on their efforts. The final phase included the formal summer developmental workshop and several activities and programs regarding technology integration. These programs were implemented to ensure continued development and integration of technology in the classroom and teaching repertoire. Cradler and Cradler's (1995) finding supported this approach that although one-time workshops help instructors incorporate and integrate technology; it takes a long-term program for true effectiveness. Therefore, continued development, training, and mentorship are essential for an effective teacher's development program.

Generally, the review of literature in teacher training program shows that lack of professional development for technology use is one of the most serious obstacles to fully integrating technology into the curriculum. But traditional sit-and-get training sessions or one-time-only workshops have not been effective in

making teachers comfortable with using technology or adept at integrating it into their lesson plans. Instead, a well-planned, ongoing professional development programme that is tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support is essential if teachers are to use technology appropriately to promote learning for all students in the classroom.

CONCLUSION

The proliferation of technologies has complicated the teaching-learning process and finding the best ways of integrating technology into classroom practices is one of the challenges the 21st century teachers face. Effectively integrating ICT into learning systems is much more complicated than providing computers and securing a connection to the Internet. In fact, the integration of ICT is associated with a shift from instructivist to constructivist philosophies of teaching and learning (Barker, 1999). So, technology integration takes time; time to learn about the innovation, time to be adequately prepared to use it. In this respect, principals play an important role and apply different strategies such as change agent, lifelong learner, principal supporter, and resource provider to implement ICT in schools (Han, 2002). Thus, they should be able to identify and articulate a vision, provide an appropriate model, provide individualized support, provide intellectual stimulation, foster acceptance of group goals, and achieve high performance expectations (Leithwood, 1994). They should have knowledge, skills and positive attitudes toward the implementation ICT in schools. In this way, they can create changes in their schools by focusing on action and by converting their teachers to be leaders who will eventually become agents of change. Therefore, teachers can play a role as a leader when they are committed to a cause and are self managing (Bennis & Nanus, 1985).

An examination of past research studies and reports on ICT implementation in schools show that there are two main factors that affect teachers' uptake of ICT. These are manipulative and non-manipulative school and teacher factors. Research on the implementation of ICT in schools has also shown that these school and teacher factors are interrelated. The success of the implementation of ICT is not dependent of the availability or absence of one individual factor, but is determined through a dynamic process involving a set of interrelated factors (Ten Brummelhuis, 1995). Moreover, no single solution exists to address the immense challenges of ICT integration because different perspectives of integrating ICT can be chosen (Becker, 2001; Niederhauser & Stoddart, 2001).

According to Fullan (1991), the process of change implementation is planned along three stages, namely adoption, implementation and institutionalization. In this respect, Ten Brummelhuis (1995) stated that variables identified by the theories of educational change do not have equal impact during all stages of the innovation process of computer use in education. Hence, researchers must identify influencing factors at different stages of development. Based on this information, barriers to the successful use of ICT can be identified. An awareness of any barrier that teachers face could lead to the development of solutions for overcoming these barriers, develop useful training programs, and encourage the use of ICT.

It is a fact that teacher training programmes play an important role to provide the necessary leadership in training pre-service and in-service teachers to deal with the current demands of society and economy. They should model the new pedagogies and tools for learning with the aim of enhancing the teaching-learning process. Moreover, teacher education institutions and programmes must help teachers to understand how the new technologies can best be used in the context of the culture, needs, and economic conditions of their country. Hence, building the capacity of teachers in the utilization of ICT for education requires long-term continuous development of the lead trainers, sharing of knowledge among teachers, partnerships and collaboration among educators and organizations, and support from principals and administrators. These factors must be available in order to create changes in the classroom. Therefore, both teachers and trainers require ongoing support and opportunities to experiment with new skills and strategies over time.

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