A NEEDS ASSESSMENT SURVEY TO INVESTIGATE PRE-SERVICE TEACHERS' KNOWLEDGE, EXPERIENCES AND PERCEPTIONS ABOUT PREPARATION TO USING EDUCATIONAL TECHNOLOGIES

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ABSTRACT
This paper reports the results of a needs assessment survey that was conducted to find out pre-service teachers' background knowledge, experiences and perceptions about their preparation for technology integration at a university in the Middle East USA. A questionnaire with both closed and open-ended items was administered to a group of student teachers. Participants seemed neutral with regards to feelings of being adequately prepared to use technology in their teaching but perceived that they needed more training. Majority knew how to use office tools, webpage design, and presentation tools. However, they did not feel comfortable using spreadsheets, databases, concept mapping, hypermedia, WebQuest, simulation tools, and video editing. In addition, the overall results suggested that pre-service teachers still used technologies within the objectivist model of teaching and learning. Based on the findings, teacher education programs need to provide pre-service teachers with additional and alternative technology training programs. The characteristics of such programs were discussed to help pre-service teachers learn how to use technologies as instructional tools to enhance their teaching and students` learning.
Keywords: Pre-service teachers, Technology adoption, Needs assessment, Experience and Perceptions, Technology training.

INTRODUCTION

In today's rapidly changing world, information and communication technologies have become a part of every aspect of society and human's life at an exponential rate. This phenomenon has been of interest to educators, researchers, and policymakers in the field of education. Nowadays, technology integration to enhance student learning and to train students in accordance with the expectations of the current industry and workplace is one of the most desired missions of educational institutions. To fulfill this, schools have been spending a great deal of money, time and effort on getting the latest technological tools. However, no matter how much technology is brought into classrooms, it does not assure effective integration. Teachers need to be trained in both technical and pedagogical issues related to technology implementation. Consequently, the purpose of this research is to find out pre-service teachers' background knowledge, experiences and perceptions about their preparation for technology integration at a university in the Middle East USA. A needs assessment was conducted for the development of an instructional program for professional development of pre-service teachers during 2003-2005 academic years. The results of the needs assessment survey were reported in this paper.

RELATED LITERATURE

The earlier research studies in the area of pre-service teachers' technology adoption can be grouped into three main categories. The first group of work has focused on pre-service teachers' technology proficiency and experiences during their undergraduate education. Secondly, a number of studies have examined student teachers' attitudes toward technology use in teaching and learning, and their readiness to use technology. Lastly, research has dealt with possible barriers influencing pre-service teachers' learning about educational technologies.

Whetstone and Carr-Chellman (2001) found that pre-service teachers' learning experiences with computers included method courses, self-taught experiences, self-contained computer courses, family and friends teaching them about computers, and seminars given by academic centers. Of these, the first two were the most frequently reported modes for building technology skills. Their results revealed that pre-service teachers used word processing to type papers, e-mail to correspond with others, and used library information access system to conduct research. In addition, Iding, Crosby and Speitel (2002) found that pre-service teachers used computers mostly for their own personal use and large number of them were unaware of educational software facilitating demonstrations and simulations, portfolios, individual enrichment, remediation and student collaboration. As far as Internet applications are concerned, recent studies indicated that pre-service teachers were comfortable with utilizing electronic social communication tools including e-mail and instant messaging (Doering, Lewis,

Veletsianos & Nichols-Besel, 2008). However, a more recent study by Lei (2009) showed that pre-service teachers lacked the experience and expertise in using Web 2.0 technologies (e.g. wikis, blogs and podcasts) for classroom applications, publishing audio files and videos, and using classroom technologies such as interactive whiteboards, idea processors and assistive technologies. On the whole, research demonstrated that pre-service teachers were proficient with basic technologies such as word processing, e-mail, drill-and-practice applications, and presentation tools but were not familiar with more advanced tools including multimedia packages, problem-solving applications, electronic collaboration tools, spreadsheets, databases and simulations. (Brush, Glazewski & Hew 2008; Lei, 2009).

Despite increasing number of technologies and level of technology education provided by teacher education programs, effective and high-level integration of technology into learning and teaching processes is still minority (Cuban, 2001; Ertmer, 2005; Hew & Brush, 2007). One reason for this can be type of technology courses offered to pre-service teachers. Past research indicated that stand-alone courses solely focusing on technology literacy or awareness (e.g. knowledge about how to operate a specific tool or software) were not effective and sufficient. What is required is to offer well-designed and technology-enhanced methods courses emphasizing pedagogical strategies on how to use technology (Hasselbring et al., 2000). In this way, student teachers have the opportunity to observe an instructional model of technology use and understand what the role of technology should be in various teaching and learning contexts. Rizza (2000) concluded that increased exposure to technology activities during undergraduate years improved their competence and comfort levels with computers and reinforced basic computer skills such word processing and webpage construction. Similarly, Karchmer-Klein (2007) found that having student teachers watch and analyze experienced teachers` high-quality technology-supported instructions motivated them to use technology in their own future teachings.

Furthermore, Vannatta and Beyerbach (2000) found that technology integration into educational method courses increased pre-service teachers' technology proficiency. In a recent action research study, Keeler (2008) found that incorporating technology-rich instructional approaches into the social studies method course helped pre-service teachers become familiar with how to utilize technology in educational contexts and made them realize the usefulness and transferability of instructional technology techniques. Research also demonstrated that incorporating technology into method courses and training programs could transform views of technology and epistemological beliefs to constructivist orientations including active learning, problem solving, critical thinking and discovery (Howard, McGee, Schwartz & Purcell, 2000; Vannatta & Beyerbach, 2000).

Another reason for low level of technology integration could be related to pedagogical beliefs and attitudes toward educational technology. In fact, Ertmer (2005) pointed out that such beliefs teachers hold about technology were the ultimate determinant of their decision of whether to use technology in teaching. Teachers` early perceptions and intense experiences with technology can form beliefs with cognitive and affective functions. The ways teachers use technology is usually consistent with their beliefs about teaching and learning (Niederhauser & Stoddart, 2001). These beliefs become deeply personal and extremely resistant to change over time and greatly influence teachers' classroom practices (Ertmer, 2005). Vermillion, Young and Hannafin (2007) observed that pedagogical beliefs still remained as barriers after the removal of access and infrastructure shortcomings. Therefore, alternative approaches and different methods should be provided in order to change teachers' conceptions about and attitudes toward technology implementation.

Recent research studies highlighted the importance and need of integrating technology throughout the teacher education curriculum rather than solely teaching technology skills. For example, Allsopp, McHatton and Cranston-Gingras (2009) conducted a one-to-one laptop initiative and examined the effects of this attempt on pre-service teachers' belief systems. All faculty and student teachers in special education program used laptops and wireless technologies during classes and field experiences. The results indicated that perceptions of ability to integrate technology in teaching increased and attitudes toward technology implementation remained constantly high across the semesters. Herner-Patnode and Lee (2009) used web-based student portfolios for teacher preparation and witnessed positive changes in pre-service teacher's knowledge, skills and dispositions toward technology and teaching. Park and Ertmer (2008) examined the effect of using problem-based approach in an educational technology course on changing pre-service teachers' beliefs. The results showed that beliefs regarding technology use did not change but participants' intended teaching practices shifted from teacher-directed to student-centered learning.

Demographic and psychological characteristics have been shown to influence technology adoption. Watson (1997) demonstrated that low level of perceived competence in technology was related to gender and age as females expressed more negative feelings towards technology integration and reported lower computer self-efficacy than males did. However, recent studies show that mediating effects of gender on attitudes and

perceptions about technology have been disappearing since both man and woman has lately had the same amount of exposure and access to technologies (Wong & Hanafi, 2007). Furthermore, research showed that increased exposure to technology was strongly correlated with improved attitudes and self-efficacy (Rizza, 2000). In another study undertaken by Gunter, Gunter and Wiens (1998) to examine variables that may impact on attitudes towards technology, student teachers reported less anxiety and more positive attitudes after completing an educational technology course. Similarly, Albion (2001) found that completion of computing courses, personal ownership of computers, and the amount of time spent using computers were the factors explaining most of the variance in self-efficacy for computer use.

Numerous studies have focused on impeding factors or barriers to the technology preparation of pre-service teachers. Hew and Brush (2007) summarized common perceived barriers as the lack of access to technology, lack of time and lack of technology-supported pedagogical knowledge. Turkmen, Pedersen and McCarty (2007) investigated Turkish pre-service science teachers' beliefs about their preparation for using technology and found that participants were relatively unfamiliar with the advantages of instructional technologies and therefore did not maximize their use. Furthermore, pre-service teachers in a current study by Brush et al. (2008) described the lack of demonstration of effective technology integration techniques by faculty as a major barrier to their technology integration. Faculty modeling of technology use in teacher education is an effective way of preparing pre-service teachers as it reduces anxiety, promotes confidence and reinforces interest in technology (Benson, Farnsworth, Bahr, Lewis & Shaha, 2004; Ertmer, 2005). Brush and Saye (2009) cited lack of resources, experienced mentor-teachers and opportunities for pre-service teachers to implement technology available in field placements as major factors impacting the quality of providing authentic experiences through in-school modeling (e.g. field-based practicum activities, teaching internships and school experiences).

Other barriers to technology implementation that have been shown in the literature include lack of motivation (Whetstone & Carr-Chellman, 2001), feelings of discomfort, fear and anxiety about technology (Stone, 1998), lack of technological resources (Ertmer, Addison, Lane, Ross & Woods, 1999; Goktas, Yildirim & Yildirim, 2009), the absence of sufficient technical support (Bullock, 2004; Cuckle & Clarke, 2002), teachers' core values about teaching and learning (Cuban, 2001; Ertmer, 2005), lack of in-service training (Goktas et al., 2009), lack of time and basic knowledge/skills required for technology integration (Brush et al, 2003), and lack of administrative support (Schoep, 2004). Recent findings indicated that access to technologies in the USA was not a barrier anymore as a result of specific government programs and grants (Ertmer, 2005). Potential strategies to overcome these barriers given in the literature include establishing a shared vision and technology integration plan, fulfilling technical deficiencies, changing beliefs and attitudes, and offering professional development opportunities (Hew & Brush, 2007).

METHODOLOGY

Research Design, Settings, and Participants

For the purpose of this study, a quantitative-oriented "needs assessment" approach was used to determine the background information and needs of pre-service teachers in educational technology use and potential gaps in teacher preparation programs related to the issue of technology integration. The study took place at a major university in the Middle East USA. The sample included 26 students from the College of Education. Of these, 21 were female and 5 were male participants. The distribution of participants according to their major programs occurred as follows: Elementary Education (11), Mathematics Education (4), Secondary-English Education (4), Science Education (4), and Special Education (2). The demographic summary of the sample is given in Table 1.

Table 1: Demographic description of the sample.

Demographic Category	Frequency (f)	Percentage (%)
Gender		
Female	21	80.8
Male	5	19.2
Major		
Elementary Education	11	42.3
Mathematics Education	5	19.2
Science Education	4	15.4
Secondary-English Education	4	15.4
Special Education	2	7.7

Instrument and Data Collection

Based on the technology standards of the International Society for Technology in Education (ISTE) and available questionnaires in the literature (Metiri Group, 2001), an online survey was developed to gather data by

using a web-based questionnaire software program, "SurveyIt". The researchers contacted the advisors and instructors and asked them to inform their students about the questionnaire and how they could access the survey. Participants were able to access the questionnaire at anytime and anywhere with Internet connection. Upon accessing the survey site, participants were initially prompted to read consent information and indicate whether they were willing to participate in the study. Then, those who accepted to participate were directed to the survey page.

The questionnaire consisted of three parts. In the first part, participants were asked to provide demographic information (e.g. gender, major, etc.) and background information on their technology experience including how long they have been using technology to enhance their personal and academic productivity, whether they have received any training about the use of technology, and what prior experiences they have with integrating technology into teaching. This section also asked their opinions about the role of technology in teaching and learning and barriers to technology implementation. These questions were mostly open-ended; therefore, allowed participants to explicitly express what they thought about such issues.

Second part of the questionnaire were related to perceptions and beliefs about participants' knowledge and preparation to various aspects of using available technology for course planning, teaching, assessment, and communication. This section consisted of 11 statements and asked participants to indicate their level of agreement on each of statement by using a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Sample statements include "I am well prepared to use technology as a teaching tool", "I am able to use computers for engaging students in critical and higher order thinking", and "I have strategies for using computer technology to manage student assessment."

The final part of the survey was designed to assess participants' current level of knowledge and skills for using a variety of technological applications (e.g. word processing, databases, web searching tools, video editing, etc.). Participants were asked to rate their levels of comfort with each tool by using a 3-point Likert scale (1=low, 2=medium, 3=high).

Data Analysis

Data were entered into statistical analysis software SPSS 10 for quantitative analysis. Since the main purpose of this research was to understand pre-service teachers' technology adoption, descriptive statistics such as frequency, percentage, mean and standard deviation were calculated to summarize the data. Open-ended items were coded to identify key patterns and themes emerged from the responses. Where appropriate, verbatim quotations from participants' written comments were reported in order to complement and support the quantitative findings by providing contextual-based and more-detailed information. The results were tabulated in the order of mean scores from highest to lowest to identify the salient issues.

RESULTS

One purpose of the study was to find pre-service teachers technology experiences. Findings related to this issue were presented in Table 2 below. Half of the participants reported that they had been using computer for five years to eight years while 30% and 19% reported more than eight years and 1-4 years respectively. When they were asked whether they had received any training courses about the use of computer technology, 81% answered "yes" whereas the remaining answered "no." Participants listed their prior experiences with integrating computer technology into instruction in their course work or in their early field experiences. 35% reported word processing, 35% PowerPoint presentations, 27% Internet, 8% web design, 8% concept mapping, and 8% interactive games. A little more than one fifth reported no prior experiences. Below are representative comments on prior experience:

> I have had access to a computer since I was 6 or 7 when my family got a Macintosh. I have been using Microsoft Word and various art programs such as Print Shop Deluxe since grade school. I learned Publisher and Excel from my dad in junior high and high school. I learned Power Point my senior year in high school…I have been using the internet since junior high when my family got AOL, and I am very family with various search engines and ways to find information. I am also familiar with web page publishing. (Female, Elementary Education)
>
> I've created power point presentations, two web pages, and have participated in several online communities. I have worked with an underprivileged student one-on-one during a class period involving wireless laptops. I have created lesson plans that require computer technology. (Male, Science Education)

> Well, I've seen my teacher use a PowerPoint presentation to teach a lesson (3rd/4th grade). Also, I taught a lesson where the students used what is called Alpha Smarts which are specifically for word processing but they look like mini laptops, and the students composed their haikus onto these computer-like processor. I've also experienced my students working on interactive educational activities through the software or through the internet on the computers. (Female, Elementary Education)

Table 2: Findings related to technology experience.

Variable	Frequency (f)	Percentage (%)
Duration of computer use		
1-4 years	5	19.2
5-8 years	13	50.0
Over 8 years	8	30.8
Previous training taken about technology use?		
Yes	21	80.8
No	5	19.2
Prior experiences*		
Word processing	9	34.6
PowerPoint presentations	9	34.6
Internet	7	26.9
Web design	2	7.7
Concept mapping	2	7.7
Interactive games	2	7.7
None	6	23.1

* Participants could report more than one experience.

When participants were asked to indicate how computer technology should be used to improve teaching and learning, their responses included "to use the Internet as a research tool" (39%), "to present information" (31%), and "to provide time saving programs" (27%) (see Table 3). In addition, other responses were: "to use for communication" (15%), " to analyze data" (12%), "to create real world simulations" (12%), "to keep track of grades" (12%), and "to use it as a supplementary tool" (8%). They thought that the ways of technology use depended on several factors including access, class time, required skills in current workplace, and so on. The followings are the examples of written comments on this issue:

> It depends on accessibility. If student accessibility to computers are limited to a time slot in a computer lab once every two weeks, a teacher should utilize that time to teach the students as many basic navigational skills as possible, familiarizing them with programs like Excel and Word and of course, the Internet. However, if students have unlimited access to computers, the latest software upgrades, and teachers have a technical comprehension level beyond functional, computers should be used for developing web pages, creating power point presentations, so on. (Female, Secondary-English Education)

> I think there's a lot more to tackle in education than technology, but for people who have the means in their school systems; computers should be used mainly for research and for presenting reports…Also, if computers are available, writing assignments should be done in word-processing programs at the earliest possible age. (Male, Elementary Education)

> Students need instruction on the internet and the resources it can provide. Because this is a technology-based world, students should also be information of communication enhancement such as e-mail. It is also good for math and science when it comes to graphing and analyzing data. Lastly, it is helpful for presentations and publishing of writing works. (Female, Elementary Education)

In terms of obstacles to implement computer technology into teaching in their course work or in their early field experiences, 39% indicated "lack of knowledge", 31% indicated "lack of equipment", 12% indicated "platform differences (Mac vs. PC)", and 8% indicated "maintenance problems" and "Internet connection problems". Exemplary comments include:

> I am not completely comfortable using them for presentations and everyday instruction. I need to gain further knowledge and more experience on the subject of computer technology…Also, the compatibility between Macs and IBMs because schools seem to be using Macs while many college student teachers like IBMs. (Female, Special Education)

If the schools do not have computers, access to the internet, or these programs then it is pretty much impossible to implement these practices in my teaching. Many schools especially do not have a way to present a PowerPoint presentation to an entire class, if they even have computers to make a PowerPoint presentation. When I can teach using technology the students pick it up very quickly and really enjoy the activities, but having the access to the equipment is a huge obstacle. (Male, Mathematics Education)

Well sometimes, technology can be a hassle when you don't know what is wrong with the computer. Sometimes, computers act up and they just don't want to start or it tends to pop up errors everywhere. Therefore, as a teacher, one must always have a backup plan if any technology doesn't seem to work. Being prepared and ready is the key. (Female, Elementary Education)

Not knowing how to use computers and then there never was anyone to help me learn how to use computers. Always afraid it will never end up working properly and then being disappointed…Solving computer problems and not responding programs. (Female, Science Education)

Table 3: Opinions about the role of computers and barriers towards computer integration.

Variable	Frequency (f)	Percentage (%)
Role of computer use*		
To use the Internet as a research tool	10	38.5
To present information	8	30.8
To provide time saving programs	7	26.9
To use for communication	4	15.4
To analyze data	3	11.5
To create real world simulations	3	11.5
To keep track of grades	3	11.5
To use it as a supplementary tool	2	7.7
Barriers toward computer integration*		
Lack of knowledge	10	38.5
Lack of equipment	8	30.8
Platform differences (Mac vs. PC)	3	11.5
Maintenance problems	2	7.7
Internet connection problems	2	7.7

* Participants could report more than one experience.

The second part of the questionnaire asked participants to indicate their level of agreement or disagreement on a number of perceptional statements about knowledge and preparation to various aspects of using available technology for educational purposes. Table 4 presents mean scores and standard deviations for each statement. As far as strong aspects are concerned, participants believed that they were prepared (a) to regularly use computer technology to communicate and collaborate with peers in the field of education (M=3.77, SD=1.21), (b) to use computer technology to manage student assessment (M=3.58, SD=1.27), (c) to use computer programs as drill-practice and tutorial tools in their instruction (M=3.54, SD=1.10), and (d) to consider social, ethical and legal implications of computer use in their lessons (M=3.50, SD=1.10).

Moreover, participants disagreed with statements such as: “I have strategies for using computer technology to individualize instruction and meet the needs of diverse learners” (M=2.88, SD=1.21), “When planning how to use computer technologies for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies” (M=2.88, SD=1.18), and “I am able to use computers for engaging students in critical and higher order thinking” (M=2.80, SD=1.20).

Although they were neutral with regards to being well-prepared to use technology as a teaching tool (M=3.08, SD=1.26) and being comfortable with planning lessons and curriculum that involve technology use (M= 3.27, SD= 1.19), they perceived that they needed training to learn how to implement computers into instruction to enhance student learning (M=3.77, SD=1.21). In addition to this, participants found technology frustrating to use when they did not receive adequate support (M=3.62, SD=1.30).

Table 4: Perceptions about the knowledge and preparation for technology use.

Statement	M	SD
I need training to learn how to implement computer technologies into my instruction in order to enhance students learning.	3.77	1.21
I am prepared to regularly use technology to communicate and collaborate with peers in the field of education.	3.77	1.11
I find technology frustrating to use when I do not receive adequate support.	3.62	1.30
I have strategies for using computer technology to manage student assessment.	3.58	1.27
I am able to use computers as drill-practice and tutorial tools in my instruction.	3.54	1.10
As appropriate to my field, I am prepared to consider social, ethical and legal implications of computer technology use in my lessons.	3.50	1.10
I am comfortable with planning lessons and curriculum that involve student use of technology during instruction.	3.27	1.19
I am well prepared to use technology as a teaching tool.	3.08	1.26
I have strategies for using computer technology to individualize instruction and meet the needs of diverse learners.	2.88	1.21
When planning how to use computer technologies for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies.	2.88	1.18
I am able to use computers for engaging students in critical and higher order thinking.	2.80	1.20

Note. Participants rated these statements by using a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

One another purpose of this study was to determine how knowledgeable or skillful participants considered themselves on using a variety of technological applications. Table 5 below presents these applications along with mean scores of participants' ratings in descending order. They reported high level of comfort with word processing (M=2.92, SD=0.27), web searching (M=2.88, SD=0.33), Internet communication such as e-mail, forums and chat (M=2.81, SD=0.49), presentation software (M=2.73, SD=0.53), designing web pages (M=2.62, SD=0.69), and tutorials and drill-practice programs (M=2.50, SD=0.71). On the other hand, the applications that they feel less proficient include video editing software (M=1.23, SD=0.52), WebQuests (M=1.23, SD=0.43), simulation tools (M=1.50, SD=0.65), database tools (M=1.69, SD=0.74), and concept mapping tools (M=1.73, SD=0.83).

Table 5: Findings related to comfort level with technological applications.

Application	M	SD
Word processing	2.92	0.27
Web searching	2.88	0.33
Internet communication (e.g. e-mail, forums, chat)	2.81	0.49
Presentation software	2.73	0.53
Web designing	2.62	0.69
Drill-practice programs, tutorials	2.50	0.71
Spreadsheets	2.35	0.75
Hypermedia / Hypertext	2.00	0.85
Concept mapping tools	1.73	0.83
Database tools	1.69	0.74
Simulation tools	1.50	0.65
WebQuests	1.23	0.43
Video editing software	1.23	0.52

Note. Participants rated these items by using a 3-point Likert scale ranging from low (1) to high (5).

DISCUSSION AND CONCLUSION

This research contributes to the debate among educators in the field of teacher preparation that pre-service teachers are not adequately trained in achieving effective technology integration. In this study, participants were neutral about their readiness to use technology in their teaching. Nevertheless, majority of the participants indicated that they need more training to learn how to implement computer technologies in order to enhance their students' learning. They also indicated that technology was frustrating to use when adequate support was not received. Another indicator of such a need for more training was the lack of knowledge that was the most frequently explained impeding factor in pre-service teachers' implementation of computer technology into teaching in their course work or early field experience.

Having found that more training is needed, it is now important to identify the content and delivery method of the training. Perhaps, these factors are rarely considered when it comes to planning technology training because more attention is often given to increase either the number of technological equipments or the weekly hours of training already existed. This study revealed that pre-service teachers have approximately five years of computer use and basic computer skills such as word processing, presentation tools and the Internet are the most frequently reported prior experiences with computer technology in teaching and learning. It is reasonable to assume that pre-service teachers may have come to teacher education programs with adequate expertise in such skills. In addition, the results illustrated that they were less knowledgeable about more advanced and emerging technological tools such as video editing software, databases, WebQuests, concept mapping tools and simulations. Therefore, these applications along with wide variety of activities should be emphasized in the content of additional training programs or educational technology courses.

Moreover, pre-service teachers should be taught about the nature of technology and its alternative roles in educational contexts other than searching and presenting information and time saving applications. More emphasis should be put on the potential cognitive contributions of technology on teaching and learning. In this way, pre-service teachers could understand the pedagogical rationale underlying technology integration and develop more fruitful and high level technology-supported instructions. Teacher educators should model effective use of technology by incorporating it throughout the entire curriculum rather than exclusively offering stand-alone technology courses.

The study indicated that pre-service teachers still use technologies within the objectivist model of teaching and learning. Most of the participants indicated that they feel comfortable using computers as drill-practice and tutorial tools in their instruction; however, they were not able to use computers to engage their students in critical and higher order thinking. In addition to this, almost half of them referred to and based their selections on current research regarding the effectiveness of technologies when planning how to use computer technologies for instruction. Hence, they need to be trained about current pedagogical theory and practice particularly in constructivist models of technology infusion. One way of having teachers to teach with a constructivist model of technology use is to teach them in a similar model of technology use during their pre-service education.

On the whole, teacher education programs should provide pre-service teachers with learner-centered, collaborative, authentic and inquiry-based learning environments in order to help them understand how to use technologies as tools to enhance their teaching and students` learning. Such environments should be in the way to enable them to (a) generate technology-integrated instructional projects and strategies to address their questions, problems, and issues related to technology integration, (b) implement and evaluate their products to investigate in what kind of situations technology is really working effectively, and finally (c) share their experiences and findings with their peers. Even these trainings can be web-based and accessible at distance so that pre-service teachers can make use of these based on their own interests, pace, and time.

Although one limitation of the data is small size of the sample, the outcomes of the study are promising and demonstrate the situation in teacher education programs. It is suggested that similar future studies especially more detailed case studies can be replicated using a larger number of participants.

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