Goktas, Y., Yildirim, S., & Yildirim, Z. (2009). Main Barriers and Possible Enablers of ICTs Integration into Pre-service Teacher Education Programs. *Educational Technology & Society*, *12* (1), 193–204.

Main Barriers and Possible Enablers of ICTs Integration into Pre-service Teacher Education Programs

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ABSTRACT

The purpose of this study is to investigate the main barriers and possible enablers for integrating information and communication technologies (ICTs) in Turkey's pre-service teacher education programs. The data were collected by means of questionnaires from 53 deans in schools of teacher education (STE), 111 teacher educators, and 1,330 prospective teachers, and additionally from interviews of six teacher educators and six prospective teachers. The findings indicate that the majority of the stakeholders believe that lack of in-service training, lack of appropriate software and materials, and lack of hardware are the main barriers for integrating ICTs in pre-service teacher education programs. There was also agreement on the possible enablers; "having technology plans" was the strategy most strongly agreed upon in that category. Based on these findings, we propose the use of several strategies that should enhance successful ICTs integration.

Keywords

ICT barriers, ICT obstacles, Technology integration problems, ICT enablers

Introduction

Increasing the quality of teaching and learning has been a seemingly important concern for education. Since the beginning of this century, education has faced a variety of social, cultural, economical, and technical challenges. As the study and practice of facilitating learning and improving performance (Januszewski & Molenda, 2008), the field of educational technology attempts to overcome challenges by developing new approaches and frameworks. In this context, information and communication technologies (ICTs) represent a new approach for enhancing the dissemination of information and helping to meet these challenges. ICTs comprise the use of at least a computer and the Internet as well as computer hardware and software, networks, and a host of devices that convert information (text, images, sounds, and motion) into general digital formats (Lever-Duffy, McDonald, & Mizell, 2003; USDE, 2000; ISTE, 1999).

A predetermined process is important for the integration of ICTs in the classroom, curriculum, school management, library, and any educational setting. Integration of ICTs enhances the quality of education by helping teachers to do their job and by helping students to learn more effectively. In these contexts, teachers' shifting role in the 21st century involves an essential mission, which is to be the frontier for applying technological innovations to the teaching and learning process. At this point, necessary skills and the level of future teachers' readiness are key factors in implementing new ICTs. Consequently, schools of teacher education play a crucial role in preparing future teachers to become proficient in the integration of ICTs into the curriculum. They need to help prospective teachers understand how ICTs can be used to teach content in rich and meaningful ways (ISTE, 1999; Keating & Evans, 2001; Roblyer & Edwards, 2000).

On the other hand, integration of ICTs into pre-service teacher education is critical to integrating ICTs in K–12 schools. Despite the huge investment of financial and human resources, pre-service teacher education programs do not currently provide prospective teachers with the necessary skills, competencies, and experiences to prepare them to use ICTs effectively in their future profession (Duran, 2000; Moursund & Bielefeldt, 1999; Bullock, 2004; Mehlinger & Powers, 2002). In light of the above-mentioned literature, it is obvious that integration of ICTs into pre-service teacher education is influenced by many barriers.

Bromme, Hesse, and Spada (2005) said of a barrier: "It comes from psychological research on problem solving and creativity. There it refers to the gap between an initial and end state. In other words, barriers are challenges which have to be overcome in order to attain a goal" (p. 1). The authors also stated that the localization of difficulties always depends on theoretically based assumptions concerning the nature of barriers. Working with ICTs is often difficult, simply because ICTs are new, and because individual and social routines have to be established in using them. Additionally, the use of ICTs is complicated because it involves not only the use of alternative tools for dealing with old, conventional problems but also expectations that these technologies will help in meeting new challenges.

A variety of action plans have been developed to effectively integrate ICTs in pre-service teacher education programs, but many barriers still exist in practice. To facilitate these plans, barriers need to be identified so that they may be overcome. ICTs integration in pre-service teacher education programs continues to be a challenge all around the world. To ease this struggle, Ertmer, Addison, Lane, Ross, and Woods (1999) noted that "when educators and researchers look for reasons why teachers are struggling to use ICTs effectively, it may be important to look at what they have (in terms of beliefs and practices) in addition to what they do not have (in terms of equipment)" (p. 68). Main barriers can be identified when incorporating ICTs in education. Toward this end, Ertmer (1999) classified barriers as falling into two primary categories: extrinsic (first order) and intrinsic (second order). Extrinsic barriers include lack of resources, inadequate training, insufficient technical support, and lack of time; intrinsic barriers include teachers'/instructors' beliefs, visions concerning technology integration, and views about teaching, learning, and knowledge (p. 51–52).

To better prepare prospective teachers and to overcome these barriers, enablers are required. Ertmer, Ottenbreit-Leftwich, and York (2006–2007) also classified enablers, like barriers, as either extrinsic or intrinsic. For instance, access to hardware, quality software, the Internet, and technical, administrative, and peer support might be viewed as extrinsic enablers, whereas personal beliefs, previous success with technology, and self-efficacy might be viewed as intrinsic enablers (p. 55).

Table 1. A summary list of the barriers affecting ICTs integration in pre-service teacher education programs

	Beggs (2000)	Brush, Glazewski, Kutowski, Berg, Stromfors, Van-Nest, Stock, & Sutton (2003)	Bullock (2004)	Mehlinger & Powers (2002)	Moursund & Bielefeldt (1999)	Mumtaz (2000)	Nantz & Lundgren (1998)	Schoep (2004)	SchoolNetAfrica (2004)	Williams, Wilson, Richardson, Tuson, & Coles (1998)
Lack of in-service training	√	–	–	√	–	–	–	√	–	–
Lack of appropriate software/materials	–	√	√	–	√	√	√	–	–	√
Lack of basic knowledge/skills for ICTs	–	√	–	√	√	√	–	√	√	√
Lack of hardware	√	√	√	√	√	√	–	√	√	√
Lack of knowledge/skills for ICT integration	–	√	–	√	√	√	–	√	√	√
Lack of technical support	–	√	√	√	–	–	√	√	–	–
Lack of appropriate course content and instructional programs	–	–	–	√	–	–	–	√	–	–
Lack of time	√	√	–	–	–	√	–	√	–	–
Lack of appropriate administrative support	–	–	–	–	√	–	√	√	√	–

Prior studies have identified numerous barriers and enablers that affect ICT integration in pre-service teacher education programs. Tables 1 and 2 provide summary lists of common barriers and enablers, respectively. There is currently a need, however, for further exploration of the main barriers and potential enablers that are important in the schools of teacher education (STE) in Turkey. Therefore, the purpose of this study is to reveal which main barriers are commonly encountered and which enablers are potentially the most useful for contemporary ICT integration in pre-service teacher education programs, specifically in Turkey. Consequently, this study addresses the following research questions:

1. What are the main barriers faced while integrating ICTs in pre-service teacher education programs according to deans, teacher educators, and prospective teachers?
2. What are the possible enablers for integrating ICTs in pre-service teacher education programs according to deans, teacher educators, and prospective teachers?

Table 2. A summary list of the enablers affecting ICT integration in pre-service teacher education programs

	Bullock (2004)	Collis & Jung (2003)	Fabry & Higgs (1997)	ISTE (2000)	Jung (2005)	Moursund & Bielefeldt (1999)	Picciano (2001)	Ronnkvist, Dexter, & Anderson (2000)	Strudler & Wetzel (1999)	UNESCO (2002)
Having technology plans	–	√	–	√	√	√	√	–	√	√
Offering in-service training	√	√	–	√	√	√	–	–	√	√
Allocation of more budget	√	√	√	√	–	√	–	–	–	√
Allocation of specific units and personnel for peer support	√	–	–	√	–	–	–	√	√	√
Supporting teacher educators (i.e., incentive payment)	–	√	–	√	√	√	√	–	√	√
Decreasing course load of teacher educators	–	–	–	–	√	–	–	√	–	–
Designing appropriate course content and instructional programs	–	√	–	√	–	–	–	–	–	√

Method

Overview

In this study, the researchers used both quantitative and qualitative research approaches in the data collection and analysis processes. Two questionnaires were used for the quantitative data collection from the deans and teacher educators. Open-ended questions from the questionnaires and interviews were used for the qualitative data collection from the deans, teacher educators, and prospective teachers. By using different sources and approaches, the researchers intended to strengthen the validity of the results.

Participants

There are 63 public and private STE that train teachers for primary and secondary education in Turkey (as of Spring 2005). The deans of these schools constitute the first population in our research. This entire group was surveyed in March and April 2005. Follow-up questionnaires were sent in May and June 2005 to those deans who did not respond to the first query. In total, 51 deans responded to the deans' questionnaire, yielding a return rate of 81 percent.

The teacher educators who teach ICT-related courses in STE were the second population in this study. The final group consisted of senior-level (4^{th} year) prospective teachers who had taken ICT-related courses before the spring semester of 2005. There are approximately 33,035 senior-level prospective teachers in STE in Turkey (HEC, 2005).

Initially, the teacher educators and prospective teachers were clustered into 12 statistical regions using NUTS (Nomenclature of units for territorial statistics) level 1, so as to be representative of the population. After that, 18 STE (including at least one school from each region) were selected by the convenience sampling method. Thus, 223 teacher educators and 2,116 prospective teachers were selected from these schools in May 2005 and invited to participate in the study by completing the questionnaire. Follow-up questionnaires were sent in June and July 2005 to those who did not respond to the first query. Overall, 111 teacher educators and 1,330 prospective teachers responded to the questionnaire, yielding return rates of 49.8 percent and 62.9 percent,

respectively.
The researchers also collected in-depth data via interviews, which were used to support the quantitative data. The interviews of certain participants were done by selecting six teacher educators from three STE and six prospective teachers from two STE in the capital city (Ankara) of Turkey. First, the capital city and STE were selected by the convenience sampling method. Then, six teacher educators and six prospective teachers were chosen by means of a purposeful sampling approach using the criterion technique. The criteria used for the selection of the teacher educators' group were as follows: 1) instructs ICT-related courses; and 2) has at least three years of teaching experience in STE. The criterion used for the selection of the prospective teachers' group was that the candidate must have taken ICT-related courses before the spring semester of 2005. All of the participants in this study have been assigned pseudonyms (e.g., A, B, C) to protect their identities.

Data collection instruments

The data were collected by means of five different instruments: three questionnaires and two interview guides. The prospective teachers' questionnaire was developed by Tinmaz (2004). The deans' and teacher educators' questionnaires and both interview guides were developed specifically for this study in 2004, following a review of similar instruments in the literature (Baron & Goldman, 1994; Queitzsch, 1997; Roblyer, 1994; SEIRTEC, 1998; Smith, 2002; Topp, Mortensen, & Grandgenett, 1995; Vagle & College, 1995). Generally, items in all of them were grouped around four major topics: 1) demographic and institutional information, 2) main barriers, 3) possible enablers, and 4) comments/proposals. The prospective teachers' questionnaire consisted of demographics and open-ended responses. However, excluding demographics and open-ended items, two questionnaires consisted of nine barrier and seven enabler items formatted as Likert-type statements to which participants responded with a rating of 1−5 (5 indicating Strongly Agree, 4 indicating Agree, 3 indicating Neutral, 2 indicating Disagree, and 1 indicating Strongly Disagree).

To determine the content validity of the instruments, we used peer and expert juries as well as a language expert. For this purpose, after the questionnaires and interview guides were developed, each instrument was examined first by three PhD candidates and then by four experts. After revisions were made, the teacher educators' questionnaire was piloted for reliability with a group of 64 teacher educators; an internal consistency method was used, which yielded a reliability coefficient of 0.87 (Cronbach's Alpha coefficient; see Cronbach, 1990). For the prospective teachers' questionnaire, the pilot test reliability coefficient was 0.86 (provided by Tinmaz, 2004). A pilot test could not be conducted for the deans' questionnaire because of the group's characteristics. At the end of the data collection process, each set of items was re-tested, yielding reliability coefficients of 0.91, 0.97, and 0.91 for the deans', teacher educators', and prospective teachers' questionnaires, respectively. All of these values are higher than the 0.80 criterion, which is regarded as internally reliable (Bryman & Cramer, 1997).

The interview guides were piloted with the help of two prospective teachers and one teacher educator to determine if the interview procedures were acceptable and if any additional interview questions were needed to answer the research questions. Before the final version was completed, the whole instrument was checked by a Turkish language expert for clarity of language.

Data analysis

The quantitative responses were analyzed by using descriptive and inferential statistics. For these, the data were coded and prepared for analysis using the statistical analysis software SPSS 12.0. Both the means and the standard deviations of the questionnaire items were calculated. The inferential analysis was used to investigate the significant differences among mean scores of "teacher educators" and "deans." For this reason, one-sample *t* tests were used.

The qualitative responses were analyzed by means of content analysis. Data reduction, data display, and conclusion drawing/verification phases were employed in this process (Miles & Huberman, 1994). This analysis began after the recorded interview sessions were transcribed into text. The interview participants first reviewed the accuracy of the details in the transcriptions of each interview. Data reduction activities included coding to represent, classify, and organize the data under the pre-identified categories and themes. Themes in the data were then identified, and the open-ended data from the questionnaires were coded and organized according to these themes. Data display refers to

organizing and compressing information based on patterns and themes to permit conclusion drawing. During this phase, data based on themes was labeled and organized into data display matrixes and structured summaries. Conclusion drawing and verification require the researcher to draw meaning from the displayed data. This final phase included noting comparing and contrasting, clustering, triangulation, and propositions. A synthesis of all the data gathered was reviewed and discussed by the researchers.

Results

The data were collected from: 1) deans, by means of five-point Likert-type scale questions and open-ended responses; 2) teacher educators, by means of five-point Likert-type scale questions, open-ended responses, and interviews; and 3) prospective teachers, by means of open-ended responses and interviews.

Analyses of the entire body of responses from all of the participants revealed a variety of main barriers and possible enablers. The researchers first identified and then categorized these responses. The results were grouped under the categories of main barriers and possible enablers, and then into two sub-themes under each category: quantitative and qualitative.

Main barriers

Quantitative results

The mean scores and standard deviations of the barriers perceived by the deans and the teacher educators are presented in Table 3. The findings indicate that a majority of the deans and teacher educators believe that "lack of in-service training," "lack of appropriate software and materials," and "lack of hardware" are all main barriers for integrating ICTs in pre-service teacher education programs. On the other hand, the following items fell below the mean, and a majority of the deans and teacher educators were neutral in their responses to the following items: "lack of appropriate course content and instructional programs," "lack of time," and "lack of appropriate administrative support."

Table 3 also indicates the results of differences between two groups. One-sample *t* tests were conducted on the barrier items to evaluate whether the mean scores of the teacher educators were significantly different from the mean scores of the deans. From the statistical analysis, only two items significantly differed ($p < 0.05$): "lack of appropriate administrative support" and the overall barrier score, where the mean scores of teacher educators (2.94 and 3.79) were higher than the mean scores of deans (2.53 and 3.46). Although, these are significantly different scores, they must be interpreted carefully, since the number of teacher educators is double the number of deans.

Table 3. Main barriers encountered while integrating ICTs in STE

Barriers	Deans			Teacher educators			Sig.
	N	M	SD	N	M	SD	
Lack of in-service training	50	4.08	0.75	105	3.95	0.95	0.247
Lack of appropriate software/materials	49	3.81	0.93	107	4.06	0.85	0.114
Lack of basic knowledge/skills for ICTs	49	3.79	1.06	105	3.94	1.01	0.053
Lack of hardware	50	3.72	1.24	106	4.14	0.99	0.628
Lack of basic knowledge/skills for ICT integration	49	3.67	1.12	105	3.95	0.97	0.139
Lack of technical support	50	3.60	1.03	105	3.99	1.03	0.288
Lack of appropriate course content and instructional programs	50	3.38	0.97	107	3.41	1.08	0.865
Lack of time	50	2.60	1.16	105	2.95	1.17	0.081
Lack of appropriate administrative support	49	2.53	1.10	105	2.94	0.99	0.043*
Overall		**3.46**			**3.79**		**0.036***

(levels of significance: $p < 0.05$ level: *)
Qualitative results

According to the open-ended responses and interviews, and in agreement with the questionnaire responses, almost all of the participants believed that the items which were identified in the questionnaires, excepting "lack of appropriate administrative support," were main barriers. In addition to the aforementioned barriers, the qualitative findings also revealed the followings as main barriers:

- crowded classrooms
- inadequate number of ICT-related courses
- lack of computers and other presentation equipment in classrooms
- lack of computer laboratories for use in free time
- lack of technology plans
- lack of motivation of the teacher educators concerning the use of ICTs in their classes
- lack of motivation of the prospective teachers concerning the use of ICTs in their courses and their future classes
- lack of good role models for prospective teachers
- lack of successful institutional models for STE.

One of the deans stated the following, concerning all of the barriers:

> Teacher educators do not integrate ICTs into their classrooms due to disinterestedness which is caused by their insufficient ability and knowledge in the field. Another problem is overwhelming course load on teacher educators (that causes less time for research and personal development). Lack of time makes teacher educators stay away from ICTs, and they cannot fulfill their personal developments in this field.

One of the prospective teachers (A) said:

> One month ago, I prepared my homework in CD format, but I could not show it to my teacher in class, because we don't have any computers in the classroom. I want to present my homework through a computer by using flash animations and some pictures. Unfortunately, we have to prepare it by traditional methods. I think at least one computer should be placed in each classroom.

One of the prospective teachers (B) additionally noted a general need for computers, out of class:

> We do not have any computer laboratories to use after the lesson. Sometimes, I have to go home to check my e-mail. Every time, there is lesson in the computer laboratory or it is closed. We could not use it after the lessons.

B also said the following in regard to teacher educators' attitudes: "they [teacher educators] don't have any positive attitude towards computers. If they had, they might be able to learn it. They cannot become a good model for the use of technology."

On the other hand, the most important problem for one of the teacher educators was students' attitudes. The teacher educator (C) indicated that:

> We need to change the attitude of students in order to benefit from ICTs-related courses. They have negative attitudes and complain: "What will I do with it?" "Where will I use it?" "Why will I use it?" We should change these attitudes. This is the most important problem for me.

Possible enablers

Quantitative results

The means and standard deviations of possible enablers reported by the deans and teacher educators are provided in Table 4. There is strong agreement among the stakeholders; overall, they ranked "having technology plans" highest. The other leading enablers are "allocating more budget," "allocating specific units and personnel for peer support," and "offering in-service training." On the other hand, "decreasing course load of the teacher educators" and "designing appropriate course content and instructional programs" items received the lowest mean scores as enablers Table 4 also indicates the results of the differences between two groups. One-sample *t* tests were conducted

on the enablers' items to evaluate whether the mean scores of "teacher educators" are significantly different from the mean scores of "deans." Based on our analysis, none of the items significantly differed on mean scores ($p = 0.05$).

Table 4. Possible enablers for ICT integration in STE

Enablers	Deans			Teacher educators			Sig.
	N	M	SD	N	M	SD	
Having technology plans	50	4.42	0.76	105	4.54	0.64	0.324
Offering in-service training	50	4.34	0.69	109	4.44	0.62	0.189
Allocating more budget	50	4.34	0.94	105	4.50	0.62	0.263
Allocating specific units and personnel for peer support	50	4.24	0.85	105	4.53	0.62	0.095
Supporting teacher educators (i.e., incentive payment)	50	4.24	1.02	105	4.49	0.65	0.064
Decreasing the course load of the teacher educators	50	4.14	0.96	105	4.10	0.96	0.864
Designing appropriate course content and instructional programs	49	4.08	0.78	104	4.17	0.89	0.853
Overall		**4.25**			**4.39**		**0.132**

(levels of significance: $p < 0.05$ level: *)

Qualitative results

There is also a strong agreement between the open-ended responses and the participants' interview results concerning possible enablers. A majority of the participants agreed on the items in the questionnaires, with the exception of "supporting teacher educators." In addition to the aforementioned enablers, the qualitative findings revealed followings as possible enablers:

- having at least one computer in every classroom
- having at least one free laboratory in every STE
- supporting courses with an appropriate web page
- offering more ICT-related courses
- enhancing the motivation of the teacher educators and prospective teachers in regard to using ICTs in their classes
- designing ICT-related courses based on applicable activities
- being role models, as teacher educators, for prospective teachers by demonstrating how to use ICTs effectively in teaching.

One of the deans said the following about the enablers:

> More teacher educators and technical support personnel need to be recruited at an adequate level. The current teaching staff must take in-service training under experts in the field. More competent STE should lead the less competent ones and transfer their experiences.

One prospective teacher said the following concerning the enablers: "Instructors should be provided with in-service training for the integration of ICTs." On the other hand, another interviewee suggested a proficiency exam on ICTs for the teacher educators. If a teacher educator takes this exam, then s/he should be motivated (i.e., by financial incentives).

In addition to the themes stated in the questionnaire, one teacher educator suggested that the prospective teachers' motivation should be enhanced. He offered further suggestions for new ICT-related courses for the STE. According to him, two ICT-related courses were not meeting the needs. Also one of the teacher educators (C) commented:

> ICT-related courses should be integrated into school-experience courses. I think this model would enhance the efficiency of the integration. Using ICTs is important, but the integration of ICTs in your class is more important. Also, we have to offer our students a new ICT-related course which has to include both ICTs and a field of study (e.g., math, language, chemistry) after the method courses.

Discussion

Generally, there was agreement among the results of deans, teacher educators, and prospective teachers' concerning the main barriers and possible enablers to successful ICT integration in pre-service teacher education programs. According to Willis (2001), enablers are local, not universal; however, the findings of this study show that not only the enablers but also the barriers are similar to those identified in the literature, as summarized in Table 1 and Table 2. This study also indicates contradictory results compared to the literature on barriers (USDE, 2000) in that "lack of appropriate course content and instructional programs," "lack of time," and "lack of appropriate administrative support" were below the mean, and a majority of the participants identified these statements as not representing main barriers.

It is important to recognize that a number of factors have been identified which encourage and enable all of the stakeholders to integrate ICTs in pre-service teacher education programs. The findings revealed that the following strategies could provide a generic approach towards enhancing this ICT integration: technology plans, in-service training, strong infrastructures, technical support, and role models.

Technology plans

The questionnaire results of the deans and teacher educators showed that a technology plan could be one of the possible enablers. The strategy "having technology plans" ranked as the most commonly agreed-upon item by both groups. The effective integration of ICTs in STE is possible if future goals and strategies are set and implemented in a planned manner. According to Bates (2000), ICT infrastructure needs to be guided by the administrative, financial, and teaching needs of the STE, which in turn are reflected in the technology plan that should integrate the vision and strategic direction of the institution. In this sense, the first possible enabler is to develop a technology plan for the STE. Every STE can prepare a technology plan, and they can employ a technology support task force for both technical and instructional purposes. Existing plans, policies, and strategies additionally need to be updated, developed, and spread to all stakeholders. This idea was also supported by Anderson, Varnhagen, and Campbell (1998); Fabry and Higgs (1997); Moursund and Bielefeldt (1999); Rogers (2000); and UNESCO (2002).

In-service training

According to the participants, teacher educators need leadership and require training in methods for integrating ICTs in their classrooms. Thus, the present research results are parallel to the literature (Rogers, 2000) and lend support to the strategy of appropriate in-service training for teacher educators. Almost all of the participants noted "lack of in-service training" as a main barrier.

Instructional technology centers can be founded in universities to lead the departments to use ICT tools effectively and integrate them into an educational environment, as well as to offer in-service training. Moreover, these centers can organize and decide which ICT resources will be purchased and how available resources could be used most efficiently. These centers can also serve to offer peer support to the teacher educators, and can further offer to the public the use of existing ICT resources.

Strong infrastructures

The findings of previous research (Anderson, Varnhagen, & Campbell, 1998; Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Ertmer, 1999; Schoep, 2004; Vaughan, 2002) and the findings of this study suggest that providing access to ICTs is not enough. ICT resources and infrastructures in STE are limited. STE should invest in larger budgets for purchasing new hardware and software, and for updating and upgrading them. Therefore, funding for new ICT resources should be increased in order to provide adequate ICT equipment and resources.

Rather than limiting ICTs to certain centers (laboratories) and courses (ICT-related courses), ICTs can be spread to the whole physical environment of an STE such as canteens, corridors, and particularly classrooms and courses from the introductory to the school-experience level. This would create a more authentic environment and involve students

in more practice. Moreover, laboratories can be kept open for the use of students not only during lesson hours but also after lessons by employing student assistants.

With the aim of increasing quantity of instructional software and materials, cooperation between the STE and related companies can be useful in providing software. For instance, portals that function as reusable learning objects can be formed. Projects or objects can be developed and uploaded to those portals to provide a discussion environment (Klinger, 2006). In this process, graduate students of Instructional Technology departments may provide necessary support, as they can work as professional instructional technologists. K–12 teachers can be participants in these portals as well. This can enhance the cooperation among all participating institutions to better ensure successful ICTs integration.

Technical support

In this study, specific units and personnel were advocated for technical support to teaching staff as a cost-effective method. Universities and/or STE can allocate specific units or personnel to provide technical support, to assist with the public's use of ICT tools and materials in instruction, and to help reduce the instructor workload. The aforementioned instructional technology centers can also offer technical support. This finding was supported by Ronnkvist, Dexter, and Anderson (2000); Rogers (2000); and Sandholtz (2004).

For ICT issues, necessary policies can be constructed by cooperating with other institutions (e.g., employers, universities, STE) in order to supply personnel such as technicians. They can provide timely training and arrange peer collaboration. Peer support and technical support might be chosen as in-service training methods.

Role models

The findings in the literature parallel this study's results in terms of the advocated need for good role models. Prospective teachers should observe appropriate models throughout their undergraduate process (Bullock, 2004; Hornung & Bronack, 2000; Kariuki, Franklin, & Duran, 2001; O'Bannon, Matthew, & Thomas, 1998; SITE, 2002; Yildirim, 2000; Whetstone & Carr-Chellman, 2001).

It is important that teacher educators act as role models for prospective teachers by using ICTs. They can demonstrate their competency and willingness to use ICTs in teaching and should use ICTs in their classrooms. Other than basic ICT applications (MS Office), they need to be aware of other appropriate software (e.g., tutorials and simulations) and use these programs to enrich their courses in an ICT-integration process.

Conclusion

Even though the sample in this study was limited to 18 STE for teacher educators and prospective teachers and convenience sampling with representative methodologies was used for both groups, this study does provide a good picture of the views of deans, teacher educators, and prospective teachers pertaining to the main barriers and possible enablers for ICT integration in their schools. To create an environment of effective ICT integration, pre-service teacher education programs must focus on eliminating barriers. Based on the findings and discussions presented here, the several recommendations are offered for practitioners. Future research is needed to verify the effectiveness of the following recommendations and to identify other important ones:

1. Technology plans for implementing ICTs in STE should be prepared and implemented.
2. Specific units and personnel should be allocated for peer support and organization, as well as to assist in the public's use of ICT tools and materials for ICT-enhanced instruction.
3. The teacher educators who integrate ICTs in their courses should be supported (i.e., through incentive payments).
4. The course load of teacher educators should be decreased.
5. Teacher educators should act as role models for prospective teachers by using ICTs in their courses.
6. In-service training in ICTs for teacher educators should be improved in both quantity and quality.
7. Every classroom should have at least one computer with Internet access and an LCD projector.

8. Every STE should have at least one laboratory available to students.
9. Course content should be redesigned to acquire more benefit from ICTs.
10. Courses could be supported by a course delivery system (e.g., LMS, course support web page).
11. More ICT-related courses for prospective teachers should be offered.
12. Every ICT-related course should be based on practice-oriented.
13. ICT-related courses should be integrated in teaching practice courses.
14. A new ICT-related course, which must include both ICTs and a field of study (e.g., math, language, chemistry), should be integrated in the curriculum after the method courses.
15. Teacher educators and prospective teachers should be aware of the benefits of ICTs.

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