Asia Pacific Education Review
2008, Vol. 9, No.2, 168-179.

A Review of ICT Related Courses in Pre-service Teacher Education Programs

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This study investigated teacher educators', prospective teachers', and K-12 teachers' opinions about the effectiveness of ICT related courses and the ways to improve the courses in Turkey's pre-service teacher education programs. The researchers used both quantitative and qualitative research approaches within the data collection and analysis processes. The data were collected from 111 teacher educators, 1,330 prospective teachers, and 1,429 K-12 teachers through questionnaires; and from 6 teacher educators, 6 prospective teachers, and 6 K-12 teachers through interviews. Even though a majority of the participants felt that ICT related courses are effective, most participants recommended that these courses need to be redesigned to be more beneficial in practice.

Key words: pre-service teacher education, ICT related courses, technology integration, effectiveness of ICT related courses

Introduction

In the early days of educational computing, dating roughly from the launch of Sputnik in 1957 to the advent of personal computers, teacher education programs addressed professional development needs for technology through in-service training programs. In 1983, when the report, A Nation at Risk, recommended that students be required to take a high school computer course, it was still unusual for a pre-service program to offer ICT training for new teachers (ISTE, 1999).

According to Yildirim (2000), ever since the advent of information and communication technologies (ICT), teacher education programs have struggled with the question of "how to teach" in order to enhance human potential and improve teaching with available technologies. Likewise, teacher education programs have also struggled with the question of "how to prepare prospective teachers." It is crucial for teachers to have appropriate ICT training during their pre-service education if they are to meet their students' needs in an information society.

According to Brand (1998), "if students are going to be prepared for a technological society, they must be taught by confident and competent teachers. This can only be done by adequate training and development of teachers" (p. 13). Similarly, Adelsberger, Collis, and Pawlowski (2002), and Yildirim (2000) recommended that the best way to encourage teachers to use ICT in the classroom was to increase the level of competency. This can be achieved

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through appropriate training by providing ICT related courses that are designed according to the individual's competency level. By training prospective teachers to use ICT, it is expected that they will transfer the knowledge and the skills to their future classrooms (Brush, Igoe, Brinkerhoff, Glazewski, Ku, & Smith, 2001; Collis, 1996).

With the above mentioned consequences, many action plans were adopted at the national and international levels, and considerable investment was made for ICT in teacher education. Most teacher education programs have been redesigning their curricula in order for prospective teachers to become competent users of new technologies when they become teachers. ICT related courses such as computer literacy, fundamentals of ICT, and educational technology are turning out to be compulsory courses within the curriculum of teacher education programs in most countries (Yildirim, Kynigos, Potolea, Dumont, & Aufenanger, 2003).

However, as Betz and Mithchell (1996) have indicated, rather than integrating isolated ICT courses into teacher education curriculum, the "development of teaching methods courses which require students to incorporate technology-based methodologies in their respective teaching fields" (p. 182) should be facilitated and ICT related courses should be a model of real classrooms (Davenport, 1995). Similarly, Thompson, Bull, and Willis (2002) have identified three principles for ICT in teacher education. These are 1) ICT should be infused into the entire teacher education programs; 2) ICT should be introduced in context; and 3) students should experience innovative ICT-supported learning environments in their teacher education programs.

In Turkey, the Higher Education Council (HEC), responsible for the planning, coordination, and supervision of higher education, redesigned the curricula of teacher education programs to improve the quality, and to integrate ICT into these programs in 1998. ICT has been included in the new curricula, and 'Computer' and 'Instructional Technology and Material Development (ITMD)' courses became compulsory in both primary and secondary teacher education programs to fulfill the requirements for teaching credentials. The main goal of the 'Computer' course is to help prospective teachers become knowledgeable in the basic concepts of ICT, the role of ICT in society and education, and also have them gain competency in basic computer applications such as word processors, spreadsheets, databases, and presentation programs, and the Internet. The course consisted of four hours (two hours for conceptual/theoretical bases in the classroom and two hours for practice in the computer laboratory) a week for one semester during the second year of the program. The 'ITMD' course was designed to provide prospective teachers with the necessary knowledge and skills in a variety of instructional technologies in developing and evaluating technology based instructional materials. The goal of the course is "to underline major developments in the field of learning and teaching so as to understand the function of instructional technology in the learning process; emphasize learning theories that form bases in selecting instructional media and materials; highlight basic advantages and disadvantages of the main instructional media and materials; and provide the background, skills and practice needed to prepare and use a wide range of instructional media and materials" (HEC, 1998). The course consisted of five hours (three hours for conceptual/ theoretical bases in the classroom and two hours for instructional material development in the computer laboratory) a week for one semester during the third year of the program.

The related literature contains fewer large scale studies about evaluating the effectiveness of ICT related courses. According to Brush, Glazewski, Rutowski, Berg, Stromfors, Van-Nest, Stock, and Sutton (2003), prospective teachers were not satisfied with ICT integration courses and they needed more training and support for effective ICT integration into their future classrooms. Molebash's (2001) findings indicated that ICT related courses can play important roles in preparing prospective teachers to effectively integrate ICT into their teaching. He believed that constructivist philosophy and teaching practices of the instructor played a key role in the effectiveness of ICT related courses. In her study, Sahin (2003) found a parallel result that recommended a constructivist approach to enhance the effectiveness of the 'ITMD' course. Her findings showed that prospective teachers wanted to be active in the process of the 'ITMD' course. The participants thought individual material preparation and feedback given to the prepared material were very important. It can be implied from their studies that ICT related courses can be more effective if the courses are offered in a constructivist setting.

According to Tinmaz (2004), prospective teachers were

not strongly satisfied with their teacher education programs in terms of ICT related courses. However, the 'ITMD' course was found to be an impressive course in the teaching profession. Similarly, Toker (2004) studied the effectiveness of ICT related courses in Turkey. He pointed out that a majority of the first and second year prospective teachers believed that ICT related courses were effective in developing their competencies. However, more than half of the third and fourth year prospective teachers mentioned that ICT related courses were only partially effective in developing their competency. According to his study, the instructor was the main factor for the different perception levels of prospective teachers.

Even though the countries have taken some measures to integrate ICT in to teacher education curricula, the related literature contains fewer large scale studies on evaluating the effectiveness of ICT related courses from the perspectives of different stakeholders. In Turkey, the ICT integrated pre-service teacher education curriculum has been in use since 1998. However, the numbers of research studies that investigate the outcomes of this curriculum are very limited, and it is also not clear if this curriculum meets the required needs of ICT training for prospective teachers. Hence, the purpose of this study is to investigate the effectiveness of and the ways to improve ICT related courses in pre-service teacher education programs in Turkey in regard to teacher educators', prospective teachers', and K-12 teachers' perceptions. Rather than comparing the stakeholders' opinions, this study aimed to put forward the opinions of stakeholders themselves in relation to ICT related courses in teacher education programs. Those three stake holders are the ones that shape the actual impact of ICT in the whole education system. In other words, teacher educators are responsible for introducing ICT to prospective teachers in ICT related courses. On the other hand, prospective teachers gain much needed skills and develop attitudes toward ICT usage during those courses. Those skills and attitudes are the most important determents in their future ICT practices. Finally, K-12 teachers' use of ICT in their professional practice result from the training they received in their pre-service training. Therefore, it is of great importance to understand how those three stake holders view the effectiveness of ICT related courses from their own perspectives and to elicit their opinions on ways to improve the effectiveness of ICT related courses. In addition, this study aims to contribute to the related literature in the field. Consequently, this study addressed the following research questions:

1) How do teacher educators, prospective teachers, and K-12 teachers perceive the effectiveness of ICT related courses?

2) What are the perceptions of teacher educators, prospective teachers, and K-12 teachers on ways to improve the effectiveness of ICT related courses?

Method

In this study, descriptive research methods were used. In this process, the researchers used both quantitative and qualitative research approaches during both the data collection and analysis processes. The quantitative data were collected through three questionnaires and the qualitative data were collected through open-ended items in the questionnaires and semi-structured interviews with the participants.

Participants

The teacher educators, who teach ICT related courses in teacher education programs, were the first population group in this study. The second population group consisted of senior-level (4th year) prospective teachers who had completed the two ICT related courses before the spring semester of 2005. There were approximately 33,035 4th year prospective teachers in teacher education programs of Turkey (HEC, 2005). The last population group in this study consisted of K-12 teachers. According to the Ministry of National Education's (MoNE) statistics, there were 558,876 primary and secondary school teachers as of the year 2004.

Initially, the teacher educators, prospective teachers, and K-12 teachers were clustered into twelve statistical regions using NUTS (Nomenclature of units for territorial statistics) level 1 to be representative of the population. After this, 18 schools of teacher education (STE), at least one school from each region for the teacher educators and prospective teachers, and 92 K-12 schools in 35 provinces, from at least one province in each region for the K-12 teachers, were selected by the convenience sampling method. Finally, 223 teacher educators, 2,116 prospective

teachers, and 3,353 K-12 teachers were selected and questionnaires were sent to them in May 2005, requesting their participation. Follow-up questionnaires were sent in June and July 2005 to the ones who did not respond during the first query. Of these, 111 teacher educators, 1,330 prospective teachers, and 1,429 K-12 teachers responded to the questionnaires with a return rate of 49.8 percent, 62.9, and 42.6 percent, respectively.

In order to obtain in-depth data from the participants and to support the quantitative data, the researchers also gathered qualitative data through interviews. The interviews were conducted with 6 teacher educators from 3 STE, 6 prospective teachers from 2 STE, and 6 K-12 teachers from 4 K-12 schools in the capital city (Ankara) in July-August 2005. First, the provincial, K-12 schools, and STE were selected by the convenience sampling method. Then, 6 teacher educators, 6 prospective teachers, 6 K-12 teachers were chosen through a purposeful sampling approach using the criterion technique from these schools. For this purpose, the criteria used for the selection of teacher educators' group were as follows: 1) given ICT related courses; and 2) had at least three years of teaching experience in STE. The criterion used for the selection of prospective teachers' group was as follows: have taken the two ICT related courses before the spring semester of 2005. The criteria used for the selection of the K-12 teachers were as follows: 1) had at least two years of teaching experience in K-12 schools; and 2) had taken ICT related courses in their pre-service training. All participants were assigned pseudonyms to protect their identity.

Data Collection Instruments

In this study, the data were collected through three questionnaires and three interview guides. The questionnaire for prospective teachers was developed by Tinmaz (2004). Since the other questionnaires were addressed to different population groups in the study, they were developed by the researchers based on a review of related literature (Baron & Goldman, 1994; MirandaNet, 2000; Orhun, 2000; SEIRTEC, 1998; Topp, Mortensen, & Grandgenett, 1995; Tinmaz 2004) in 2004. In order to find out whether the courses are effective or not, a three-point scale was used in the questionnaires (1 for 'ineffective', 2 for 'neutral' and 3 for 'effective'. There were two specific reasons for using a three-point scale in this study: First, since data were collected from a large number of stake holders, (111 teacher educators, 1330 prospective teachers, and 1429 K-12 teachers) in order to increase the return rate of questionnaires, the number of points on the scale were set as three. As discussed in the literature, rather than simply relying upon the number of points on the scale, researchers should develop and use instruments which are a) easy to understand, b) discriminate well, c) easy to interpret, and d) have minimal response bias (Pearson NCS, 2006). Additionally, in the related literature, there is no clear consensus on the number of points in a questionnaire. As Chang cited in his study (1994), "...fewer scale points resulted in higher reliability than more scale points (e.g., three scale points had higher reliability than five scale points)" (p. 205). Second, data collected in this study were analyzed by means of descriptive measures including frequency, percentage, mean and standard deviation. Since inferential analyses were not considered in this study, three point scales did not yield any misanalysis or misinterpretation of data. Indeed, follow up interviews significantly contributed to the reliability of data in this study.

After the questionnaires and interview guides were developed, each instrument was checked by three graduate students and based on their comments, the instruments were modified. Then, the instruments were examined by four experts, and based on the feedback gathered from them, the instruments were revised again. They were then checked by a Turkish language expert for clarity of the language. After the revisions, the teacher educators' questionnaire was piloted with 64 teacher educators for a reliability check using an internal consistency method (Cronbach's Alpha coefficient, [Cronbach, 1990]), which was calculated as 0.87. For the K-12 teachers' questionnaire, a pilot test was conducted with 121 K-12 teachers, and the Cronbach's alpha coefficient was calculated as 0.81. The prospective teachers' questionnaire was calculated as 0.86 by Tinmaz (2004). At the end of the data collection process, each set of items was re-tested, which yielded reliability coefficients of 0.97 for teacher educators', 0.97 for K-12 teachers', and for 0.91 prospective teachers' questionnaires. All of these values are higher than the 0.80 criterion, which is regarded as internally reliable (Bryman & Cramer, 1997). The interview guides were also piloted with one teacher educator,

two prospective teachers, and two K-12 teachers to determine if the interview procedures were acceptable and if any additional interview questions were needed. The items in the final versions of each instrument were grouped around related major topics.

Data Analysis

In this study, quantitative data were analyzed through descriptive statistics such as means and standard deviations. The data were coded and prepared for analysis using the statistical analysis software SPSS 12.0.

For the qualitative data, audio recorded interview sessions were transcribed into text first. Then the data were analyzed through content analysis, which involved data reduction, data display, and conclusion drawing/verification phases (Miles & Huberman, 1994). Through reading and re-reading the transcripts, researchers of the study discussed the resulting interpretations. Data reduction activities included coding to represent, classify and organize the data under the pre-identified categories and themes. The researchers identified these themes based on each research question. Data display refers to organizing and compressing information based on the patterns and themes so that that it permits the drawing of conclusions. During this phase, data around themes was organized as labeled concepts into data display matrixes and structured summaries. Drawing conclusions and verification involves the researcher drawing meaning from the displayed data. This final phase included noting comparison-contrast, clustering, triangulation, and propositions. In order to attain interpretative validity, the original data and all of the interpretations were reviewed and conclusions drawn from this process were verified by the researchers of the study.

Findings

In teacher education programs of Turkey, there are two ICT related courses: 'Computer' and 'ITMD'. The findings of this study were presented under these two courses in regard to teacher educators', prospective teachers', and K-12 teachers' perceptions. The quantitative data were collected through questionnaires with 3-point scales (1 indicating 'ineffective' 2 indicating 'neutral', and 3 indicating 'effective'), and qualitative data were collected through open-ended questions in the questionnaires and interviews.

Perceived Effectiveness of 'Computer' Course

Teacher educators' perceptions. In regard to the effectiveness of the 'Computer' course, teacher educators showed a high degree of overall contentment (M= 2.60) indicating that the 'Computer' course in teacher education programs contributes to the ICT competencies of prospective teachers (see Table 1). According to open-ended responses and interview results, a majority of the teacher educators believed that the 'Computer' course was beneficial and effective for ICT integration into the learning process. They indicated that prospective teachers can learn how to use ICT in their fields from the course. One of the teacher educators (H) remarked that "*the prospective teachers had positive perceptions of ICT integration into*

Table 1
Perceived Effectiveness of Computer and ITMD Courses

	Computer Course			ITMD Course		
	N	*M*	*SD*	*N*	*M*	*SD*
Faculty Members	61	2.60	0.55	64	2.45	0.56
Prospective Teachers	1307	2.39	0.83	1287	2.58	0.71
*All K-12 Teachers	849	2.00	0.87	796	2.08	0.88
** K-12 Teachers Graduated from the New Program	159	2.34	0.82	157	2.45	0.79

*Note. * All K-12 teachers: had taken the ICT related courses in their undergraduate years but most of them took these courses prior to the new curriculum as elective courses or so.*
*** K-12 Teachers Graduated from the New Program: had taken ICT related courses in the redesigned curriculum.*

learning environments with this course. Thus, the course has vital importance for all prospective teachers in pre-service teacher education programs."

As presented in Table 2, in order to improve the effectiveness of the 'Computer' course, 32% of the teacher educators ranked the statement "the whole course should be offered in a computer laboratory based on the applications", as first. The teacher educators ranked the statement "the course content should be redesigned to acquire more benefit from ICT based on today's needs" as second (27%) in order to improve the effectiveness of the course.

A majority of the teacher educators commented on two key factors in order to make the course more effective. The first factor noted in an open-ended response, parallel to the questionnaire analysis was, *"rather than offering the course in a traditional classroom or an electronic classroom, the course should be offered in computer laboratories all the time."* A second key factor was, *"all examples and applications used in the course should be related to future teaching profession of the prospective teachers and to their subject area."* In line with the aforementioned two key factors, to make the course more effective, one of the interviewees (Z) recommended that:

> *"Computer course should be given in the first year, not in the second year so that, the prospective teachers can use ICT in their undergraduate courses in following years. As a result of this, the prospective teachers can be competent in integrating ICT into their teaching easily by the time of being a teacher."*

Prospective teachers' perceptions. As it is shown in Table 1, a majority of the prospective teachers agreed (M= 2.39) on the effectiveness of the 'Computer' course. According to the open-ended responses and interviews, parallel to the questionnaire analysis, almost all of the prospective teachers believed that the 'Computer' course was effective for ICT integration into the learning process. One of the interviewees (A) summarized this effectiveness by stating:

> *"I think it increased my teaching ability significantly. Before taking this course, I didn't know how to use*

Table 2
Teacher Educators' Perceptions of Ways to Improve the 'Computer' Course

	f	%
The whole of the course should be offered in a computer laboratory based on applications	13	32
The course content should be redesigned to acquire more benefits from ICT based on today's needs	11	27
Appropriate in-service training should be provided to the teacher educators who offer the course	10	24
More hardware and other equipment should be allocated to the course	7	17
TOTAL	41	100

Table 3
Prospective Teachers' Perceptions of the Effectiveness of ICT Related Courses

	N	*M*	*SD*
ICT related courses in my undergraduate years helped me to change my attitude toward ICT in a positive way	1316	2.54	0.74
I can integrate ICT into my future profession since I took ICT related courses in my undergraduate years	1285	2.39	0.76
I am a prospective teacher, trained in ICT, based on today's ICT needs	1319	2.30	0.79
I was trained how to use ICT in learning-teaching environments during my undergraduate years	1315	2.20	0.85
My instructors provided me with sufficient information about the social effects of ICT use in education	1316	2.08	0.86

computers (in everyday life). I learned how to use Word, Excel and PowerPoint in this course. Then, I learned a little bit how to run FrontPage programming software by myself."

Another participant noted this concern in his/her open-ended response as *"our capabilities of running computer programs were improved in the 'Computer' course. We learned about a variety of software well, because we had numerous projects and assignments. This was a preparation period for our future career."*

As shown in Table 3, prospective teachers were also asked some indirect questions about the effectiveness of the both courses. Even though the prospective teachers found the 'Computer' course as effective (in Table 1), when it came to ICT related courses, a majority of them were neutral on the items "I am a prospective teacher trained based on today's ICT needs" (M=2.30); "I was trained how to use ICT in learning-teaching environments during my undergraduate years" (M=2.20); and "My instructors provided me with sufficient information about the social effects of ICT use in education" (M=2.08).

On the other hand, some of the prospective teachers made important recommendations in order to make the course more effective. One prospective teacher (M) stated:

"We have learned many fundamentals of the field in this course. In my opinion, however, the conceptual/ theoretical part of the class should not be undertaken. I don't remember anything conceptual/ theoretical that was taught in the course. I think, to make it more effective, more attention should be paid to practice and the practice sessions should be arranged as one computer for per person".

K-12 teachers' perceptions. As presented in Table 1, there are two teachers groups as follows; (1) 'all K-12 teachers' and (2) 'K-12 teacher graduates from the new curriculum'. The first group had taken the ICT related courses in their undergraduate years but most of them took these courses prior to the new curriculum as elective courses. All K-12 teachers were at the 'neutral' level (M=2.00) of agreement on the effectiveness of 'Computer' course taken in their undergraduate education. However, when the graduates of the new curriculum (K-12 teachers who started STE after the curricula of teacher education programs were redesigned or later) were considered, the level of agreement on the effectiveness of the 'Computer' course in their undergraduate education was near to the 'agree' level (M=2.34). However, the interview results indicated that a majority of the interviewees believed that the 'Computer' course was effective in integration of ICT into the learning process. Graduates of the new curriculum were satisfied with their undergraduate 'Computer' course in regard to its effectiveness and its contribution to acquiring ICT competencies.

However, one of them (I) indicated having some negative perceptions about the course:

"...The computer classes were theoretical at the university that I graduated from. To be honest, the course was early in the morning and no attendance was required. Because the course was conducted in a classroom, attendance was even lower. We went to computer laboratories a few times, yet there were 3-4 students around each computer. However, because of it being a theoretical one, nobody was motivated by or interested in this course."

S/he (I) also believed that the exams in the course should be computer based:

"If these courses had involved any practical applications, they would be comprehended well. If the exams had been conducted in front of the computers, they might have been more effective; because, to get a good grade, you had to learn the content from somewhere even though you hadn't attended classes. However, it wasn't like that; exams were also theoretical and based on memorization."

The Perceived Effectiveness of 'ITMD' Course

Teacher educators' perceptions. As presented in Table 1, the findings of the questionnaire indicated that the teacher educators perceived 'ITMD' course as effective (M=2.45). The findings were corroborated by both open-ended responses and interview results. Teacher educators perceived 'ITMD' course as beneficial and effective for ICT integration into the learning process. In open-ended

Table 4
Teacher Educators' Perceptions of the Ways to Improve the 'ITMD' Course

	f	%
The course benefits (acquirement) should be implemented in the teaching method courses	26	34
More electronic classrooms and computer laboratories should be allocated to the course	20	26
Appropriate in-service training should be given to the teacher educators, who are offered the course	19	25
The course content should be redesigned to gain more benefit from ICT based on today's needs	12	15
TOTAL	77	100

responses, one of the teacher educators indicated, *"it is a very important course for students who had taken a 'Computer' course previously to learn how to use and integrate ICT into their future classes."*

To be able to improve the effectiveness of the course, 34% of the teacher educators ranked the statement "the course benefits (acquirement) should be implemented in the teaching method courses" as first (see Table 4). They ranked the statement "more electronic classrooms and computer laboratories should be allocated to the course" as their second choice (26%).

During the interview, one of the instructors (Z) offered, "*ITMD course should be given in the second year, after the 'Computer' course so that prospective teachers can use it in their future undergraduate courses.*" Another recommendation made in open-ended responses was that, *"problem / project based learning should be used in order to teach prospective teachers how to integrate ICT into their fields."* A third recommendation acknowledged by an instructor (V) was:

> *"Posters and 3-D materials dominate this course. During my experience, the majority of the posters were hand made. It should have been rather constructed on the previously taken 'Computer' course. In my opinion, class activities, assignments, and projects should utilize more computers and other technological devices. Students' subject matter content, in this course, should be integrated with the instructional and computer technologies. Besides this, it would be better if these courses were offered by the teaching staff from the field of instructional technology."*

The prospective teachers' perceptions. It is presented in Table 1 that prospective teachers agreed (M=2.58) on the effectiveness of 'ITMD' course, and felt well prepared for their professional life. The findings from the open-ended questions and interviews are in line with the questionnaire findings. Findings from the open-ended questions and interviews showed that prospective teachers perceived 'ITMD' course as effective in integration of ICT into pre-service teacher education programs. They believed that the course would be beneficial when they become teachers. One interviewee (G) stated:

> *"In this course, everyone developed creative materials on their subject areas and they would use these materials in their classes. We taught our topics by using computers. We gained experience about how to use technology in teaching."*

Similarly, another prospective teacher mentioned, "*the course demonstrates several aspects of teaching. It promotes creativity. It helps eliminate monotone classroom teaching by diversified teaching*". Some prospective teachers perceived the course as a slide design and web page development course. One of the prospective teachers (F) commented:

> *"In the content of the 'ITMD' course, we learned how to prepare PowerPoint slides and design our own website. As a student, I think it will be very useful for my teaching career and will help me to prepare great lesson contents. I think I will be able to improve myself more. If I apply this knowledge to my teaching, it will be very useful."*

In order to make the course more effective, some of the

prospective teachers made recommendations similar to the "Computer" course. Generally, they recommended that, it would be better if these courses were offered applications and projects related to their subjects. One prospective teacher remarked concerning this issue that "*using ICT is important, but the integration of ICT in our subjects and our future class is more important. For this, I need more examples and practices related to mathematics, which is my subject area.*"

The K-12 teachers' perceptions. As presented in Table 1, when all K-12 teachers' perceptions about the 'ITMD' course taken in their undergraduate education were examined, they were neutral (M=2.08) in regard to its effectiveness. However, when K-12 teachers graduated from the new curriculum were considered, they agreed (M=2.45) on the effectiveness of the 'ITMD' course in their undergraduate education. This finding is consistent with the findings of the interviews. Interview findings indicated that most of the K-12 teachers believed, that prospective teachers could learn how to integrate ICT into their fields through the 'ITMD' course.

For the 'ITMD' course, the K-12 teachers also thought that its effectiveness could be improved. One of the K-12 teachers remarked, *"The ITMD course should be given in project-based learning. Thus we can explore real-world problems and create solutions related to our fields."* The findings from the open-ended questions and the interviews showed that K-12 teachers do not like the conceptual / theoretical information in this course, rather they prefer practical applications. One of the interviewees of the K-12 teachers (E) stressed this situation:

> *"Because of the vast amount of the course curriculum being theoretical, I won't be able to comment positively. Practice should be emphasized. Besides practice, it is important to be taught in the way of how we are expected to teach. The knowledge needs to be remembered. The ways of how I utilize it while teaching aren't taught in this course. I think that the content of the course should be related to my future career. As a matter of fact, the instructors who teach the ICT related courses aren't from subject of instructional technology. I think it is important as well."*

Discussion and Conclusions

This study investigated the perceptions of teacher educators, prospective teachers, and K-12 teachers about the effectiveness of ICT related courses in Turkey's pre-service teacher education programs. The findings indicated that the two groups, teacher educators and prospective teachers, perceived ICT related courses as effective. Even though all K-12 teachers were neutral on the effectiveness of ICT related courses, the K-12 teachers who were the graduates of the new curriculum indicated a slight degree of satisfaction with the ICT related courses. Thus, the present research findings provide support to HEC's (1998) restructuring of the teacher education programs in terms of ICT integration.

The results of this study also indicated that a majority of the prospective teachers and the K-12 teachers perceived the 'ITMD' course to be more effective than the 'Computer' course. On the contrary, teacher educators believed the 'Computer' course was more effective than the 'ITMD' course to meet the required needs of prospective teachers in ICT training. This finding may be the result of preparing instructional materials in teachers' subject area.

Even though a majority of the participants felt that the ICT related courses are effective, all stakeholders recommended that the courses need to be restructured to be more effective. For the 'Computer' course, the teacher educators, during the interviews and in response to open-ended question, believed that all of the course hours should be offered in computer laboratories to enhance the course effectiveness, and all examples and applications used in the course should be related to future teaching profession. Similarly, prospective teachers indicated that conceptual/ theoretical elements of the course were unnecessary, and the course as a whole, together with the exams should be conducted hands on in computer laboratories, and computer facilities should be provided for each student in the laboratory. These findings supports the guidelines of Thompson, Bull, and Willis (2002) indicating that ICT should be infused into the entire teacher education programs, should be introduced in context, and should provide experience in innovative ICT-supported learning environments in their teacher education programs. Otherwise, the knowledge and the skills gained from this process remain isolated and unused.

For the 'ITMD' course, teacher educators also believed that the effectiveness of the course could be improved if the course content was practiced in the teaching method courses, and more electronic classrooms and computer laboratories were allocated to the course. As suggested by (Ertmer, 2003; Thompson, Bull, & Willis, 2002), teacher educators believed that problem and project-based learning needed to be integrated in to 'ITMD' courses to be more effective. The K-12 teachers made similar recommendations to improve the effectiveness of the 'ITMD' course. As stated by Betz and Mithchell (1996), rather than integrating isolated ICT courses into the teacher education curriculum, prospective teachers suggested ICT-based practices in their subject area.

In conclusion, the findings of this study supports the principles of Dell and Disdier' (1994) for effective ICT training. They stated that 1) ICT training needs to be integrated into the entire teacher education program so that effective ICT integration is modeled for pre-service teachers; 2) training should link ICT with the curriculum; 3) training should provide hands-on practice so that teachers become comfortable with it; and 4) training needs to be in-depth. These principles need to be considered in the ICT integration into teacher education programs.

Implications

Although the sample in this study was limited to 18 STE for teacher educators and prospective teachers, and 92 schools in 35 provinces for K-12 teachers in Turkey, and convenience sampling with representative methodologies were used for the whole participants, this study suggests several implications for practice. Even though including these courses in the curricula was the first curriculum based attempt at preparing Turkish prospective teachers to use ICT in the classroom, this effort should go beyond the mere training of teachers in basic computer skills. Isolated ICT courses in teacher education programs can help to develop ICT competency, but alone, they cannot help to increase the use of ICT in teaching. ICT related courses need to be redesigned to integrate ICT with the subject area teaching of the teachers.

'Computer' course can be provided to prospective teachers in their first year, and 'ITMD' course can be given in the second year after the 'Computer' course. In addition to these courses, a third ICT related course which includes integration of ICT into the field of studies (e.g., math, language) can be offered. Thus, the prospective teachers may use ICT throughout their undergraduate years. As a result of this, at the time of becoming a teacher, the prospective teachers could integrate ICT into their profession more easily and effectively.

Pre-service teacher education programs should provide ICT training for prospective teachers that satisfy their specific needs in the schools at which they work. Therefore, cooperation between STE and employers is needed when designing ICT training curriculum to meet teachers' specific technology needs.

ICT related courses need to be offered with appropriate technological facilities in appropriate numbers to provide practice for prospective teachers. Rather than being given as isolated content, conceptual/theoretical information should be embedded in practice so that prospective teachers can understand the reasons behind designing such materials and using such ICT. Teacher educators could be provided with training so that they can design their courses based on how prospective teachers can use the knowledge and skills they gained within their subject area and future classes. They can also support students' active participation in a learner-centered learning environment in their lectures. Problem- or project-based learning and case study methods and performance tests might be used to help prospective teachers integrate ICT into their fields.

All of the examples and applications in the ICT related courses are to be related to the future professional life of the prospective teachers and their subject. In these courses, cooperation with the K-12 schools may be supported. What students produce in those courses can be linked to K-12 schools, and the prospective teachers can have the opportunity to link theoretical knowledge with practice in authentic environments. This process may be supported in the school experience and teaching practice courses. Teaching staff of these courses may also be chosen from the field of instructional technology.

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Received June 20, 2007
Revision received December 4, 2007
Accepted January 19, 2008