IMPROVING THE TECHNOLOGY INTEGRATION SKILLS OF PROSPECTIVE TEACHERS THROUGH PRACTICE: A CASE STUDY

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ABSTRACT
Rapid developments in invented technologies lead educational institutions to effectively integrate these technologies into the teaching-learning processes. However, both institutions and individuals face different obstacles because of these integration processes. By taking various precautions maybe overcome. Thus, this study was designed to explore to what extend the course "Instructional Technology & Material Development," from a non-thesis graduate teacher's preparation program, contributed to pre-service teachers' perceived computer competencies, attitudes toward computers and technology vision. The participants were 114 pre-service teachers with a degree from the faculty of arts and science. Both quantitative and qualitative measures were used to collect data in order to validate the findings. Participants were asked to fill out a computer attitude scale and a computer competency scale both at the beginning and end of the course, as well as an open-ended questionnaire at the end of the course. Besides, the researcher had observed all the participants during their weekly assignments. The results showed that pre-service teachers developed a positive attitude towards using computers in their future classrooms and enhanced their computer competencies. Furthermore, they became desirous and curious about technology and more willing to use technology in their future careers. Although one can find numerous similar articles in the literature that produced similar results, in Turkish context, this article has valuable information for those teaching in non-theses teaching programs.

Keywords: Pre-service teacher education, computer competencies, technology vision

INTRODUCTION

Educational systems are based on teacher and curriculum concepts. Effectiveness and efficiency of an educational system rely on these two inter-related concepts and the harmony between them. Any problems appearing in either of these concepts will decrease the quality of the educational system, as a result affecting the learners. For this reason, the quality of an educational system should be parallel to the quality of teachers trained. Moreover, the quality of a teacher will be in harmony with the curriculum focused knowledge, skills and the attitudes acquired by the preservice teachers.

Technological and computer competencies of teachers are important dimensions of this quality. Due to large investments of technology in many educational institutions, teachers are required to integrate technology into curriculum and classroom activities. For this reason, teacher education programs are reshaped and enhanced with the courses trying to infuse the use of various technologies. This enhancement includes the knowledge and skills necessary to use and integrate technology effectively. Besides, teachers' attitudes and beliefs toward technology usage should result in a positive one. Therefore, teachers should be designated in such a way that besides knowing how to use technologies effectively, they have to be empowered to use technologies to develop learners understanding and to support constructivism, cooperative learning and problem-based learning (Royer, 2002).

Technology Integration into Teacher Education Programs

Almost all education institutions across the world are rethinking and reorganizing the manner in which they are preparing pre-service and in-service teachers to use technology in order to enhance classroom instruction. Then again, higher education institutions are also seeking new strategies to support the process of technology integration, as they are the leaders and models of technology diffusion. Teacher education programs are intended not only to give occupational and branch of learning expertise but also the vision for integrating technology into the teaching-learning process. Consequently, "…schools, colleges, and departments of education have sought not only to provide courses on educational technology but also to infuse technology into the teacher education curriculum such that preservice teachers experience technology-rich instruction both as students and as teachers,"(Vannatta & Beyerbach, 2000, p. 132).

Higher education institutions are making great efforts to overcome the obstacles posed by information and communication technologies (ICT) and how to disseminate technology into classrooms. Many research studies have been carried out to find the correct pathways for effective integration, each pointing out different variables

affecting the integration process. Among these variables, the lack of role-modeling by professors, due to poor technology competencies of professors, is the one which plays an important role in the effectiveness of the teacher education process (Odabasi, 2000; Hadley, Eisenwine, Hakes & Hines, 2002). Effective integration requires the existence of the necessary hardware and software, effective usage of resources, adequate in-service training opportunities, well-prepared professors and innovative implementation strategies for faculties. Accordingly, the professors' technology-competency levels, perceptions on the use of technology and obstacles they face are the factors which should be investigated carefully in order to propose appropriate strategies for effective technology integration.

Factors Concerning the Technology Integration in Teacher Education Programs

A brief review of the literature indicates that pre-service teachers are not ready to integrate technology into teaching practice or learning processes (Bielefeldt, 2001; Willis & Montes, 2002; Doering, Hughes & Huffman, 2003; Wang, Ertmer & Newby, 2004). This pessimistic scenario may stem from several possible sources. Finley and Hartman (2004, p.328-329) discussed in their study, the issue of vision, skills and knowledge, plus departmental culture as barriers to the integration of technology into teachers' education courses. The researchers concluded that, "The faculty will experiment with technology integration if they feel it is consistent with their teaching style, if they feel they are knowledgeable and competently skilled, if they are supported and rewarded for doing so, and if they can see how it is pedagogically useful." Among many research studies have been carried out to diffuse the technology use or enhance existing levels, Adams (2004) proposed a field-based strategy for training in-service elementary teachers to use technology, where learning from one another was encouraged. Although the teachers' use of technology was limited before the study, research concludes that both the computer skills and technology integration ideas have increased (Adams, 2004, p. 510).

Subsequently, positive attitudes and perceptions towards computers are also important since it leads to increased computer competency (Wang, 2002; Carey, Chisholm & Irwin, 2002). Ertmer (2005), after reviewing the literature, determines that when teachers' uses of technology is considered, it is "…impossible to overestimate the influence of teachers' beliefs" (p. 36). Although many studies showed that pre-service teachers have positive attitudes toward technology and willing to use it, they are not given the opportunities to practice and teachers do not have access to good models of instruction (Breen, Lindsay, Jenkins & Smith, 2001; Iding, Crosby & Speitel, 2002). This fact is mostly due to professors' deficiency of technology usage and integration, since "Educators, the faculty, will play a critical role in the orientation of higher education students towards new learning environments" (Odabasi, 2000, p. 103). Otherwise, preservice teachers will lack the necessary skills to use and integrate technology into their future classrooms.

Another important point is that pre-service teachers should be provided with the opportunities to develop and implement technology-rich instructional activities in order to be able to integrate appropriate technologies into their future classrooms (Brush, Igoe, Brinkerhoff, Glazewski & et. al., 2001; Robyler, 2003). In pre-service teacher education, when prospective teachers experience and practice a variety of computer uses, the increase in the use of technology-enhanced learning practices in PK-12 is more likely to occur (Wheatly, 2003). Consequently, training for technology use should be provided as a component of the courses consistent with this aim as a course goal. Collier, Weinburgh and Rivera (2004) also recommended "…to design programs that provide pre-service teachers with multiple, real-world opportunities to learn and apply technology skills systematically and constructively in order to scaffold the mastery of more sophisticated technologies" (p. 466). Similarly, in their case studies of three urban elementary schools, Staples, Pugach and Himes (2005, p. 285), identified three scaffolds that appear to have a significant influence on technology integration as: "… alignment with the curriculum/mission, teacher leadership, and public/private roles for technology recognition" The researchers also stated the need that teachers should be provided with "…the opportunity to learn the technology well so that it can be used easily and transparently to support the curriculum" (p. 306). Rowley, Dysard and Arnold (2005) developed a technology infusion program for preparing tomorrow's teachers to use technology by providing online technology-enhanced learning topics which also provides practicing. They concluded that the program they developed "… holds promise as a vehicle for helping integrate technology-enhanced learning content across the preservice curriculum" (p. 122).

Hernandez-Ramos (2005) conducted a survey in order to reveal the technology use in K-12 schools. The researcher pointed out the broad context of technology integration process, and concluded that: as well as personality factors, the technological and contextual factors play crucial roles in technology integration decisions and applications. As Hernandez-Ramos pointed out, although barriers to technology integration might differ according to different context, there exist some common topics which all the researchers pointed out. Since without having necessary contribution it is difficult to use and infuse technology, technological and computer skills as required. Without faith, it will be hard to be creative, innovative and curious about technology, so

beliefs and attitudes toward new technologies and computers would also be a crucial step in the technology integration process. Does possessing the necessary skills and donation, having a positive attitude and willingness to learn be enough? Another crucial point is having the opportunity of practicing by the support of a model teacher. These three points are prerequisites for the technology integration process.

Teacher Training Programs in Turkey

Turkey is one of the countries, in which various teacher education programs have been put into application in the last 150 years (Üstüner, 2004; Akyüz, 2004). In the scope of The Council of Higher Education/World Bank Preservice Teacher Education Project, between 1994 and 1998, faculties of education were redesigned (The Council of Higher Education, 1998). The re-designing project aimed to overcome the shortage of available teachers, and together with the graduates of education faculties, the graduates of faculty of arts and sciences have also been employed as teachers. In order to provide the graduates of faculty of arts and sciences with a pedagogical formation, "Non-Thesis Master Program in Secondary Education" has been started. Within the program, courses in relation to pedagogical formation were re-organized, the number of courses and course hours were increased and the parallelism between subject matter areas and pedagogical formation was provided.

Within the framework of re-designing projects, one obligatory computer course has been placed in the curriculum of all teacher education programs (The Council of Higher Education, 1998a). Moreover, one more course "Instructional Technology and Material Development" has been integrated into the curriculum for all programs. This course has been added so that the graduates of those non-thesis master programs have been acquired with a technology in education vision (The Council of Higher Education, 1998; Üstüner, 2004).

The curriculum of "Instructional Technology and Material Development" for Non-Thesis Master Program in Secondary Education has been fulfilled with the following content; the properties of various instructional technologies, their position and use in teaching-learning process, development of instructional materials (worksheets, acetates, slides, videos, computer aided course materials and so on) and the evaluation of instructional materials (The Council of Higher Education, 1998b).

As a summary, preservice teachers are attending only one course aiming to help pre-service teachers be computer-literate on topics like word processing, spreadsheet applications, presentation software and Internet services. As a second and last course for gaining technology vision, they are also attending the course "Instructional Technology and Material Development". Thus, these two courses have thought to offer the preservice teachers the perspective of integrating technology into their subject matter area.

The underlying reason why pre-service teachers are attending the "Instructional Technology and Material Development" course is to contribute to the computer skills and technological perspectives to effectively use with and integrate technology into their classrooms. The purpose of this study is to explore to what extent pre-service teachers are competent in the necessary technology skills and to what extent they are capable of using of technology in their future classrooms.

Hence, this study tries to answer the following research questions:

1. What is the contribution of the course to the pre-service teachers' perceived computer competencies?
2. What is the effect of the course to the teachers' attitudes towards computers?
3. What is the relationship between pre-service teachers' perceived computer competencies and attitudes toward computers with academic attainment?
4. What is the contribution of the course activities to the pre-service teachers' observed computer competencies?
5. What are the overall perceptions of pre-service teachers about the course?
    a. What are the pre-service teachers' expectations about the course?
    b. How pre-service teachers have perceived the processes they experienced during the course?
    c. What do pre-service teachers think they have gained from the course?
    d. How pre-service teachers envision the use of technology within their future classrooms?

METHOD

Participants

The participants of this study were one hundred and fourteen graduate students from four sections enrolling to the "Instructional Technology and Material Preparation" course of a non-thesis teacher preparation program. All the students previously had a bachelor's degree in a content area in the faculty of arts and sciences and were seeking teaching licensure in this program. Of the students, a total of 89 students in three sections were graduates from the field of mathematics. The other section composed of 25 students' where 19 were graduates from the

field of biology and 6 were graduates from the field of chemistry. Of the 114 students, 77 were female and 37 were male. None of the students had previously taken a course in instructional technology, but all had taken a basic computer course in their undergraduate education. All of the students were instructed by the same faculty member, namely the researcher.

"Instructional Technology and Material Development" Course Design

One hundred and fourteen pre-service teachers from four different sections attended the course instructed by the same instructor. The main goal of the course was developing teachers' technological skills and their capacity to integrate technology into the curriculum. So, the course was structured in a way that gave the opportunity to practice immediately what they have learned in the computer laboratories. After delivering some introductory concepts in three weeks, the pre-service teachers started their computer laboratory applications. Meanwhile, students were asked to form groups of two or three and decide on a topic in their subject fields guiding their work through computer applications. This will compel each individual to prepare various teaching materials that used technology on selected topic, prior to exposure to theoretical content. Besides, pre-service teachers are required to perform activities like: send by e-mail the weekly assignments as attachments to the instructor, search content-related web sites and educational software. At the beginning of the semester, pre-service teachers were also required to develop lesson plans. By the end of the semester, this lesson plan would be revised and become a technology-rich lesson plan by integrating teaching materials developed throughout the semester. As the final project, students presented their lesson plans and materials to the class. Weekly schedules of the detailed course activities are given in Appendix A.

Research Design

Fifty six voluntary participants (43 female, 13 male) were given a "computer attitude scale" and "computer competency questionnaire" before they began the course and after they completed course. Both of the instruments were completed by the students via Internet. All the sections met three hours a week for fourteen weeks. All of the attending participants were observed for several skills by the researcher for nine weeks while practicing what they had learned. At the end of the course, all the participants filled out an open-ended questionnaire focused on (a) their expectations of the course at the beginning of the semester, (b) their perceptions about the process, (c) their perceptions about learning goals that they attained, and (d) their vision for using computers and technology in their future classrooms.

In order to analyze quantitative data, descriptive, reliability analysis, correlation analysis, homogeneity test and paired sampled t-test were used. On the other hand, qualitative data was analyzed using qualitative techniques (Miles & Huberman, 1994; Yıldırım & Şimşek, 1999). First, the data was grouped according to the answers given to the same questions. After analyzing the data inductively, repeating themes were noted. Finally, conclusions were drawn for achieving a generalization among the categories.

Instruments

Computer Attitude Scale

Originally developed by Lloyd and Gressard (1984), the "Computer Attitude Scale" (CAS) was translated into Turkish and analyzed by Berberoğlu and Çalıkoğlu (1992), (α=0.90). CAS items used a Likert scale of 1-4, in which 1 represented strong disagreement and 4 represented strong agreement. CAS, consisting of totally 40 items, has four sub-scales each having 10 items: 1) computer anxiety or fear of computers, 2) liking of computers, 3) confidence in ability to use or learn about computers, and 4) and usefulness (importance) of computers in life. Positively and negatively worded statements which present attitudes toward computers and the use of computers are included for each of the four sub-scales. For this study, reliability analysis of the scale was found as Cronbach alpha (α) 0.83.

Computer Competency Questionnaire

Computer Competency Questionnaire" was developed by the researcher in order to measure preservice teachers' computer proficiency and integration experiences in courses. This questionnaire consisted of 34 items, asking participants to report current proficiency using word processing programs (6 questions), internet related applications (11 questions), educational software (9 questions) and presentation software (8 questions). These items used a Likert scale of 1-4, in which 1 represented no proficiency and 4 presented high proficiency. For this study, reliability analysis of the questionnaire was found as Cronbach alpha (α) 0.97.

Student Observation Form

An observation form was used by the researcher, in order to keep weekly records of individual competencies. For this purpose, the researcher observed every student for a range of nine weeks while completing their projects

on different tasks. For this study, reliability analysis of the observation form was found as Cronbach alpha (α) 0.94.

Observation form consisted of following seven questions developed by the researcher and rated on a four scale (4=very good, 3=good, 2=inefficient and 1=not observed).

- Using software in parallel with/according to the course goals
- Using software without help from instructor
- Using software without help from peer
- Finalizing the activity in given time constraints
- Using all the facilities of the software effectively
- Similarity between the produced and expected product
- Appropriateness of the product to visual design principles

Open-Ended Questionnaire

For gathering data on the perceptions of preservice teachers, four open-ended questions were asked after the completion of the course. These questions addressed the expectations of preservice teachers about the course at the beginning of the semester, perceptions about the processes they experienced during the course, thoughts on what they gained from the course, and envisioned about the use of technology within their future classrooms.

RESULTS

Quantitative Findings

In order to gain a depth understanding about the collected data, various analyses were conducted before focusing on the main questions. First of all, gender differences were analyzed with respect to four dependent variables (pre and post-scores of CAS, pre and post scores of computer competency). Since the number of participants in gender groups was not close enough, a Mann-Whitney U Test was conducted. As the Table 1 shows, there are no significant differences on dependent variables with respect to gender.

Table 1. Gender differences for four dependent variables

Dependent variable*	U	*p*
CAS Pretest	260	.71
CAS Posttest	212.5	.19
Computer Competency Pretest	194	.10
Computer Competency Posttest	265.5	.79

* n= 56

Moreover, differences among sections were analyzed by Kruskal-Wallis Test. Since there were four sections, where three of them were graduates of mathematics field and one section consisted of students from different field areas, namely, biology and chemistry, five groups were formed in order to analyze group homogeneity. Results, as seen in Table 2, demonstrated that there are no significant differences on dependent variables with respect to sections and groups.

Table 2. Group and section differences for four dependent variables

Dependent variable *	X^2	*P*
CAS Pretest	5.71	.22
CAS Posttest	2.61	.63
Computer Competency Pretest	1.35	.85
Computer Competency Posttest	3.70	.45

* df = 4

Correlations among dependent variables were also performed. Results, as seen in Table 3, obtained only one significant correlation between pre and post scores of computer competency questionnaires ($p<.05$).

Table 3. Correlations among four dependent variables

Dependent Variable	1	2	3	4
1. CAS Pretest	--	.20	-.60	.00
2. CAS Posttest		--	.07	-.11
3. Computer Competency Pretest			--	.54*
4. Computer Competency Posttest				--

* $p<.05$.

Contribution of the course to the pre-service teachers' perceived computer competencies

Pre-service teachers' computer competencies were solicited via "Computer Competency Questionnaire" before and after the course. Paired Samples t-test results revealed a positive significant improvement from pretest scores (M=2.31, SD=.91) to posttest scores (M=3.70, SD=.79).

Effects of the course to the teachers' attitudes towards computers

Pre-service teachers' attitudes toward computers were elaborated via "Computer Attitude Scale" before and after the course. Paired Samples t-test results revealed a significant change from pretest scores (M=2.64, SD=.36) to posttest scores (M=2.53, SD=.16).

Relationship between pre-service teachers' perceived computer competencies and attitudes toward computers with academic achievement

Overall academic achievement level of pre-service teachers was calculated as 89.67 out of 100 (SD=6.11). Differences between pre and post scores of computer competency questionnaire and computer attitude scale were calculated and correlated with an overall academic achievement. The difference between pre and posttest scores of the computer competency questionnaire was found to be significantly correlated with academic achievement ($p<.05$). The reason for correlating data difference was to adjust the amount of improvement made by each individual.

Contribution of the course activities to the preservice teachers' observed computer competencies

Overall performances of pre-service teachers as observed by the researcher was calculated as 3.30 (SD=.24). Summary of weekly performances is shown in Table 4.

Table 4. Weekly observed performance of preservice teachers

Activity	n	*M*	*SD*
First week	57	2.75	.37
Second week	53	2.99	.58
Third week	53	3.72	.62
Fourth week	57	3.88	.38
Fifth week	42	3.12	.42
Sixth week	47	2.85	.36
Seventh week	42	3.26	.63
Eighth week	45	3.67	.47
Ninth week	57	3.42	.83

Qualitative Findings

The open-ended questionnaire, composed of four questions, was administered to preservice teachers in order to understand their perceptions about the course in detail. The questions addressed their expectations from the course at the beginning of the semester, their perceptions on the processes they experienced during the course, their perceptions about the level of improvement they achieved by the end of the course and finally their future plans about the use of technology. The results of the analysis were also presented in the same order.

Pre-service teachers' expectations about the course

Pre-service teachers' answers given to this question were converged under six categories. One of the expectations mentioned by the pre-service teachers was improving computer skills and learning an effective use of computers (21%). One of the preservice teachers expressed that "My prior expectation was to develop my limited skills about computer usage." Other pre-service teacher agreed that "I hoped to become a teacher who knows how to use computers and utilizes them in her future career".

Some pre-service teachers, who heard from their friends, had taken this course previously from other programs, noted that they were expecting to learn how to develop hand-made materials and to develop various materials (20%). One of the pre-service teachers pointed that "I did not think that this course would be such a technology-rich one". Another pre-service teacher established "Using computers for developing materials was not in my mind. I thought that we would produce more concrete and hand-made materials".

Although the entire group had taken an introductory computer course previously, 20% of the pre-service teachers expressed their fear, anxiety and worry about computers. One of the pre-service teachers framed that "I hoped to find the answers to such questions like, 'aren't computers things that are really such frightening? will it really

help?, if yes, how?, will I learn?". Another pre-service teacher acknowledged that "Before the course, I had been a little bit frightened and felt that it was difficult for me to learn using computers".

Some others sharing similar thoughts were mentioned that they just expected to gain theoretical knowledge like the use of media and innovations in technology (14%) from the course. There were also some pre-service teachers who desired to learn how to teach more effectively (12%).

Finally, 4% of pre-service teachers expressed their wish to learn the ways and methods of making students love the subject matter. One of the pre-service teachers expressed that "I thought that this course would add too much to my teaching profession, learn a lot to practice in my own future courses in order to make my students love mathematics".

Pre-service teachers' perceptions about the processes they experienced during the course

Pre-service teachers' answers given to this question were also converged under six categories. About half of the pre-service teachers pointed out that it was fun to participate in this course (41%). They also believed the course was so beneficial that all they learned was so permanent. Furthermore, they mentioned their willingness to attend the course. One of the pre-service teachers stated that "the course has provided me with a broad repertoire of teaching style". Another pre-service teacher added, "Unless you were afraid of computers and try to understand them, you may speak the same language. The course was informative, enjoyable and remedy where no second has wasted. Even in theoretical parts of the course, I feel that I interact with that knowledge. I did not realize how the entire course has finished. We acquired what we have learned by doing practice."

The pre-service teachers who mentioned that they improved their computer skills were about 20%. "Even though, I had used computer before, I was so amazed to see the possible instructional tasks that I could do with it" was claimed by one student. Another pre-service teacher uttered that "Especially the course project has added so much for me. With the help of this project, we had the opportunity to utilize what we have covered about visual design principles. I benefited from the course on computers in education".

The pre-service teachers concluded that they learned actively by doing (20%). One of the students acknowledged that, "I realized using computer is not a difficult task. It becomes simpler when a facilitator exists as working on the computer. We were demonstrated what is most suitable for our students and how to utilize from computers throughout our prospective teaching profession". Another student expressed his ideas by stating, "I improved myself in the laboratory sessions by activating my theoretical knowledge." Another student commented that, "I believed that the course provided me with permanent knowledge. Having an opportunity to make activities in the computer laboratory has increased my interest and skills."

Most of the pre-service teachers felt fear or anxiety at the beginning of the course, reported that they were not afraid of computers anymore, overcame their anxiety and liked the computers (15%). One of the pre-service teachers argued that "I was frightened at the beginning of the course and I felt that I was pushed due to my lack of knowledge about computer usage. In reality, it was hard for me to complete some of the tasks. Especially, I hated computers as I was preparing a concept map, yet I used them. As the course finished, creating materials became a fun task for me. I learned not to fear computers." Another pre-service teacher posited that "Even though I am not familiar with technology in general, computers in particular, throughout the course my attitude towards computers has evolved regarding computer use and various materials preparation."

The pre-service teachers realizing the importance of instructional material development and the use of technology in teaching-learning process was about 7%. One of the pre-service teachers pointed out that "the course sustained by functioning different teaching materials, and was free from a monotonous atmosphere". Another pre-service teacher stated that "I learned the benefits of instructional materials for students, where and how to use them, by doing, since we were also taught in a similar way".

The course instructor was perceived to be a positive facilitator (5%). One of the pre-service teachers wrote that "It was fun for us to learn on our own and the course turned out to be an enjoyable, self-guided and facilitated one with the help of the course instructor". Another pre-service teacher exclaimed that "The most memorable times in the course were the ones where I learned applicable and simplified knowledge. I achieved my goals straightforwardly with the in-time facilitation of the course instructor". Another pre-service teacher defined that "The most essential factor for me liking this course was the instructors' characteristics such as, being positive, encouraging comments and being patient of our questions." And finally, another stated that "the performance of the course instructor became a model for my future profession".

Pre-service teachers' thoughts on what they gain from the course

Pre-service teachers' answers given to this question were grouped under three categories. The ratio of the pre-service teachers who think that they learned how to use technology in education was 52%. One pre-service teacher claimed, "I recognized how the use of technology impacts learning", while another stated "this course gained me another dimension in my teaching background on effective teaching". Yet another pre-service teacher added: "We, as pre-service teachers, have to make use of technology in such a modernized era. Or else, we will be disadvantaged in this era".

The participants (44%) have commented that they learned distinct instructional materials and their importance in education. On that topic, one participant wrote that "I became aware that all my thoughts were wrong about the needless use of materials in teaching mathematics". Another participant also wrote, "Before the course, I did not know that computers could be used in mathematics courses, but I realized that prepared materials made our knowledge more stable and created a more interactive environment".

Ten percent of the pre-service teachers agreed that their computer skills have improved. On that issue, one preservice stated, "I learned to use different software", while another pre-service teacher commented that, "I learned how to use computers more effectively." "Throughout the course, I learned how to develop various instructional materials on computers."

Pre-service teachers' visions about the use of technology within their future classrooms

Pre-service teachers' answers given to this question were converged under two categories. The percentage of the pre-service teachers claiming that they will utilize technology in their future classrooms was 87%. One of the students stated that, "computers are the essential part of my professional life", where another noted that, "willingness to use technology in teaching has been formed, at the end of the course." One another student stated that, "a computer is a gift for us to increase the effectiveness of teaching."

Eleven percent of pre-service teachers asserted that they will continue increasing their knowledge and skills on computers in future. From that perspective, one student has noted that, "my aim is to improve myself. Since I acquired a computer at home, I am searching the net in all my spare time." Another student stated that "I am planning on how to integrate technology in mathematics courses. I know that my students will have a greater depth of knowledge than ours in technology, I am aware that I have to adapt myself to technological innovations." Waiting to own a computer, one pre-service teacher noted that, "My priorities have changed after this course. Now, I want to buy a computer, attend a computer course and improve my computer competencies." Another pre-service teacher also commented that, "Buying a computer will be a first step for me. After that, everything will follow upon the knowledge you furnished us with."

DISCUSSION AND CONCLUSION

The research findings from this study describe what pre-service teachers require to integrate technology, especially computers, into classroom activities. Only a small portion of the participants had negative attitudes towards computers and a lack of computer skills at the beginning of the semester. This negative attitude might stem from two reasons, a fear because of a lack of computer skills, and no prior knowledge about how to use technology in their subject fields. However, at the end of the course all of the participants had obtained positive attitudes and enhanced their computer skills. Since all of the pre-service teachers were willing to participate in the course and enhance their knowledge base, the gap among these pre-service teachers disappeared, and most of them successfully completed the entire assignments. Furthermore, pre-service teachers understood how to use technology in their pre, during and post class activities, since they had the opportunities to practice what they had learnt.

As the instructor observed, the mathematics group had more difficulties in altering content in a visual form than the biology-chemistry group preparing materials. This result might be caused by subject field, since mathematics is not as concrete as the other subjects. Moreover, the mathematics group were required to be more creative in order to fulfill the course goals, since the resources and examples of materials in mathematics were more limited in comparison to other subject fields.

Although, the findings of the study showed satisfaction for both pre-service teachers and the instructor, pre-service teachers declared their need for an advanced contribution for integrating technology into their future classrooms. This result revealed that just one goal for achieving the goal of effective teaching via using technology is not enough which is also mentioned in the literature by many researchers (Willis & Montes, 2002; Doering, Hughes & Huffman, 2003). Hence, teachers have to build a knowledge base on how to routinely

integrate technology into their classroom (Scheffler & Logan, 1999) and given more opportunities to apply instructional technology prior to their real-life experiences (Wilson, Notar & Yunker, 2003).

This study profoundly showed that the courses and the course content offered to pre-service teachers should constantly be revised to address current technology and its use in educational environment. These courses should be shaped in order to progress from computer competencies to instructional planning and technology integration. Accordingly, "the most important competencies for teachers appear to be the knowledge and skills to make computers a seamless part of the school curriculum" (Scheffler & Logan, 1999, p. 319).

In the process of a course-long intervention, prospective teachers not only increased their skills with computers and technology integration but also demonstrated incorporating changes in technology into their teaching and future plans. In other words, pre-service teachers experienced the power of technology to enhance traditional classroom instruction. Furthermore, this study underlined the need for pre-service teachers to effectively use and integrate technology into instructional processes.

Although the present study concluded with hopeful results, the real question that we have to answer is, "what kind of curriculum will allow pre-service teachers to gain sufficient technology vision?" It is obvious that increasing the number of courses aimed at teachers with the necessary skills and to provide instructional approaches to effectively integrate technology, will probably make a difference. If this increase includes model teachers of the same field, together with various skills to use technology to create constructivist and cooperative learning environments, this would be preferable (Royer, 2002). On the other hand, what if the change in the curriculum should not happen immediately? Then we have to answer the question, "how to use only one 'concrete' course to allow pre-service teachers gain enough technology vision?" Any technology integration process has many barriers to overcome. Trying to overcome these barriers in a very limited time should certainly end with changes in the learners' knowledge, skills, attitudes and vision. But the satisfactoriness of these changes will be an ongoing and never-ending discussion until no technological innovations are proposed. Hence, although one can find numerous similar articles in the literature that produced similar results, in Turkish context, this article has valuable information for those teaching in non-theses teaching programs.

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Appendix A: Content-Specific Technology Applications

WEEK	TOPIC	ACTIVITY
1	Introduction to Educational Technology	-
2	Instructional Technology and Communication	-
3	Introduction to Instructional Design	Searching and investigating lesson plans from Internet
4	Analysis and Planning phase of instructional design	Preparing lesson plans (word processor)
5	Organization of Knowledge-Concept Mapping	Preparing concept-maps (concept-mapping software)
6	Visual Design	Finalizing lesson plans and adding visual details (word processor)
7	Media and Materials	Midterm
8	Nonprojected visuals	Producing a poster (presentation software)
9	Projected visuals	Producing a presentation (presentation software)
10	Computers and Multimedia	Using and investigating multimedia educational software
11	Internet and Distance Education	Searching for content-related Internet sites and educational software on the web Creating a puzzle (http://www.discoveryshool.com)
12	Evaluation phase of instructional design	Producing work-sheets Finalizing technology-rich lesson plans
13	Presentation of the Projects	-
14	Presentation of the Projects	Final Exam