PRESERVICE TEACHERS' COMPETENCIES, BELIEFS AND INTEGRATION LEVELS IN ICT

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ABSTRACT

This study examined preservice teachers' computer skills and beliefs regarding online educational facilities, and explored the effects of courses at the faculty of education on preservice teachers' competencies and attitudes toward computers and their ICT integration levels in the ICT integration taxonomy which was created by the researchers. The study used data from 344 3rd and above year preservice teachers at a faculty of education in Ankara. Of 207 students were female whereas 127 were male; 10 failed to respond to the gender question. The study indicated that preservice teachers had minimum degree of knowledge and skills with respect to ICT; they had positive beliefs about online educational facilities; the courses related to ICT usage offered by the faculty of education had impact on the preservice teachers' knowledge in and attitude toward ICT; and pre-service teachers carried the characteristics of each level of the taxonomy to a similar extent.

INTRODUCTION

Information and communication technologies (ICT) have broad impacts on almost all aspects of society. Because of the advance in ICT in the 21st century, it is clear that all jobs require the use of computer anyway. As stated by Ross, McGraw and Burdette (2001), "information technologies have changed the ways we work, learn and live transforming teachers teach and students learn" (p.3). ICT offer various advantageous and features for teaching and learning environment. They facilitate learning for children who have different learning styles and abilities, make learning more effective and provide a broader international context for approaching problems as well as being more sensitive response to local needs (UNESCO, 2005). In order to benefit from the features they provide, the schools and governments make considerable investments in technology for its integration into education.

Despite of the progression in the use of technologies in schools, the successful technology integration is a complex process. The literature indicted that one of the biggest barrier to teachers using technology in their classroom is missing or inadequate teacher training (Schoepp, 2004; Ertmer, 1999; Yildirim & Kiraz, 1999). The most preservice and in-service teachers do not feel adequately prepared to use technology in their classrooms (Wetzel, 1993; Brush, 1998). How to prepare preservice teachers to deal with technology integration into their classrooms appears as a challenging question. In this aspect, the faculties of education have a crucial mission to prepare service teachers for information age. As Yildirim (2000) advocated, "teachers teach as they have been taught" (p.480). The faculties of education take a pivotal role to improve preservice teachers' competencies in computer skills, beliefs in ICT, and ICT integration levels.

Having the preservice teachers reach a reasonable level of competence in computer skills can be seen as the first step to prepare them to integrate ICT into their classrooms. The higher level of competency in computer skills teachers have, the more likely they use the computers in their classrooms (Yildirim, 2000). Teachers' knowledge about technology is a prominent factor that influences their perception of ICT integration. As Jones (2003) advocated, "every teacher is expected to be capable of competently and efficiently using the ICT and other learning technologies currently available in schools" (p.67). From this point of view, teacher education institutions need to take a number of capabilities into considerations to train and graduate beginning teachers who have the necessary knowledge, skills and understanding to make effective use of ICT in their teaching practices (DEST, 2002). As a result, assessing the preservice teachers' competencies in computer skills can be seen an initial attempt to explore their potential to integrate ICT into their classroom in their future profession.

WWW provides a number of possibilities for the use of ICT. A traditional course enhanced with a web component motivates the students as well as the instructor (MacEntee & Lewis, 2004). However, teachers' belief can be thought as a key indicator for whether they integrate online features into their lessons or not. In his literature review, Pajares (1992) concluded that teachers' beliefs have an impact on their perceptions and judgments, which, in turn, affect their behavior in the classroom. Bandura (2000) declared that "unless people believe that they can produce desired effects and forestall undesired ones by their actions; they have little incentive to act" (p. 120). Moreover, according to Fishbein's (1963) expectancy-value

model, individuals' attitude is based on their beliefs and the evaluation aspects of those beliefs (Fishbein & Middlestadt, 1995). Therefore, it can be inferred that preservice teachers' beliefs in online facilities in education play a pivotal role in their attitude toward online facilities and their integration processes of online facilities into their classroom, in turn, that of ICT.

The courses offered by preservice teacher education programs play important role to prepare preservice teachers with the capacity of successful integration of ICT. Teacher education programs should teach both how to use hardware and software and how to incorporate computers into their teaching strategies and activities (Abbott & Faris, 2000). Moreover, the preservice teacher education programs have impact on preservice teachers' knowledge and skills in use of ICT as well as their attitude toward the use of ICT (Albion, 1999; Willis & Raines, 2001; Chin & Hortin, 1993-94). As a result, the impact of courses can be seen on teachers' knowledge level in and attitudes toward computers which are important factors for ICT integration.

In addition to having competency in computer skills, it is another important consideration for teachers to know "how to use" ICT with the goal of enhancing learning. Krueger et al. (2000) stated, "the levels of understanding related to the application of technology to learning settings is curial to successful integration into the curriculum" (pp. 47). Therefore, it can be said that it is particularly important to explore the preservice teachers' ICT integration level as to reveal their ICT integration potential in their future profession.

Based on the assumptions indicated above, this study aims to assess preservice teachers' competencies in computer skills and beliefs in online educational facilities, and to explore of courses at the faculty of education on preservice teachers' competencies and attitudes toward computers and their ICT integration levels in the ICT integration taxonomy which was adopted by the researchers.

ICT Integration Taxonomy

Constructing taxonomy can be a way to understand the technology integration level of the preservice teachers and can help us to understand the needs of them.

Table 1: Definition of the levels for ICT integration taxonomy

Level1: Novice	Having the minimum degree of knowledge and skills with respect to ICT
Level2: Awareness	Being aware of the ICT in classroom context and their applications for learning and teaching although they do not use ICT for their learning purposes
Level3: Integration	Integrating ICT into learning for fostering educational purposes (mechanical integration and routine integration)
Level4: Expert	Creating new technology applications that are appropriate for new concepts encountered
Level5: Leader	Becoming a key indicator of ICT usage

The levels in the Table1 were constituted with the help of relevant previous studies, including "Instructional Transformation Model" proposed by Welliver (1990, as cited in

Macrow, Wright & Brew, 2004), "Innovation- Decision Process" proposed by Rogers (1995), "Levels of Technology Implementation (LoTi)" developed by Moersch (1995), "Learning to Use Technology" submitted by Russell (1996), and "Adoption Rubric for Computer Technology Integration" developed by Gladhart (2001),

We defined the first level of taxonomy as 'novice' whereas this level is identified by Russel as 'awareness' an by Gladhart as 'entry' in the literature. The reason for doing so is that, preservice teachers were already taken a special course related with computer literacy. This kind of users had the minimum degree of knowledge and skills with respect to ICT. Therefore, it was assumed that preservice teachers were the potential users of ICT, but they might be novice users. For this reason, this level was identified as novice users of ICT.

The second level was defined in the light of LoTi and Russeell's fist stage. This level also covered the first level of "Instructional Transformation Model" (familiarisation). However, for the taxonomy awareness was more professional like awareness of the usage of ICT for the educational purposes. In this level, preservice teacher were aware of the educational applications of ICT but had not implemented them yet.

The third level of the taxonomy shares the common characteristics of the fourth level of LoTi. In LoTi, this level was defined as 'integration' and consists of two sub-levels in it, mechanical and routine like in our taxonomy. The aim of the division in this level is to examine the differences between preservice teachers in terms of the application of ICT in class setting. In addition, this level has similarities with Rogers's fourth level of the Innovation Decision Process (implementation).

In fourth level of the taxonomy, it is expected that preservice teacher is able to use computer-based applications with success and create new applications in ICT which is appropriate for new conditions. In addition, this level had similarities with Russell's fifth level (adaptive to other contexts), LoTi's fifth level (expansion) and Welliver's fourth level (reorientation).

The last level for the taxonomy was defined as 'leader'. While constructing this level, the sixth level of Russell and LoTi's sixth level of the taxonomies were taken as reference point. The aim of this level was to reveal the preservice teachers' potential in terms of being key indicators on ICT.

METHOD

Subjects

This study examined 3rd and above year preservice teachers attending at a faculty of education. This study focused on students who are enrolled in four different departments (Computer Education and Instructional Technology, Elementary Education, Foreign Language Education, and Secondary Science and Mathematics Education) in a faculty of education in Ankara. The main reason for selecting 3rd and above year preservice teachers was that they had already attended such courses as 'Computer Literacy' and 'Instructional Technology and Materials Preparation' which are offered to prepare preservice teacher for technology enriched classrooms. The study used data from 344 students who voluntarily participated, 43% of whole population (n=792). Of 207 students were female whereas 127 were male; 10 failed to respond to the gender question. Their age ranged from 20 to 28, with a mean of

22.56 (S.D. = 1.35). In this sample of 344 students, 71.5% reported owning a personal computer; 76 % of students owning a personal computer have an internet connection. Of 37.8% the participants reported using computers more than 24 hours in a week while 29.1% of them reported the using internet more than 24 hours in a week. Finally, 61.5%, 32.4% and 6.1% of the participants perceived themselves as intermediate, advanced and beginner computer users, respectively.

Instruments

The study utilized four surveys to assess preservice teachers' competencies in the computer skills, preservice teachers' beliefs in the importance of online possibilities in education, the effect of courses at the faculty of education on preservice teachers' competencies and attitudes toward computers, and the level at which preservice teachers perceived themselves as comfortable with integration of ICT. The surveys' items were developed by the researchers. The content validity of the instruments ensured with expert opinion.

Computer Competency Survey. The survey assessing competencies in the computer skills has nine sub-categories of computer applications commonly used. Preservice teachers were asked to rate their competency in the following areas: (1) operation systems, (2) word processing, (3) spreadsheet, (4) presentation software, (5) database software, (6) educational software, (7), Web design software, (8) Web browsing, and (9) e-mail. The scale rated nine items on a 4-point Likert-type scale, with 1 equaling *never using*, and 4 equaling *using well*. This survey also assessed the requirements of the 1st level of the ICT integration taxonomy. The reliability of this survey was calculated as .84, which could be considered as high.

Belief in Online Educational Features Survey. The survey assessing beliefs in the importance of online features in education attempted to explore the importance attached by preservice teachers to accessing syllabus, lecture notes, video files used in the lecture, problems about lecture subject, discussion topics, presentation files used in the lectures, exercises, resources and announcements in an online way in blended learning environment. The scale had nine items on a Likert-type scale of 1 to 4 where 1 represented *non-important* and 4 represented *very important*. The reliability of this survey was calculated as .78, which could be regarded as almost high.

Impact of Courses Survey. The survey aiming to investigate effect of courses at the faculty of education on preservice teachers' competencies and attitudes toward computers had seven items on a Likert-type scale of 1 to 5, with 1 being "I absolutely do not agree" and 5 being *"I absolutely agree"*. The reliability of this survey was calculated as .87, which was considered as a fairly consistent measure.

ICT Integration Survey. The survey including questions to determine the level at which preservice teachers perceived themselves as comfortable with integration ICT had twenty items on a Likert-type scale of 1 to 5, where 1 represented *"I absolutely do not agree"* and 5 represented "I absolutely agree". This survey constituted the statements regarding the requirements of the 2nd, 3rd, 4th and 5th levels of the ICT integration taxonomy. The reliability of this survey was calculated as .84, which denoted a satisfactory reliability.

Procedure

The data were collected in the following manner. All surveys were conducted in one session by the researchers. All data from the subjects were collected in many sessions. Prior to the administration of the surveys, a brief overview of the main goal of the research was explained and students were asked to participate in the study.

FINDINGS

Table 2: Descriptive statistics regarding preservice teachers' competencies in computer skills

Preservice teachers' competencies in computer skills

Computer Skill	Mean	Std. Deviation	N
1. Operating systems	3.07	.78	344
2. Word processing	3.46	.65	344
3. Spreadsheet	2.73	.92	344
4. Presentation software	3.58	.58	344
5. Database software	1.84	1.01	344
6. Educational software	2.11	1.12	344
7. Web design software	2.60	.94	344
8. Web browsing	3.18	1.14	344
9. E-mail	3.80	0.48	344

As shown in Table 2, preservice teachers rated themselves most competent with e-mail usage and least competent with database software. The total possible score for competency was 36 and a few respondents (6.7%) were quite competent in nearly all areas of computer use. The results also showed that preservice teachers had minimum degree of knowledge and skills with respect to ICT, meaning they fulfilled the requirements of the first level of the ICT integration taxonomy.

One-way ANOVA was employed to examine whether the mean differences of the competencies among departments were significant. The result showed that the department the preservice teachers studied had a significant effect, $F(3,340) = 38.48$, $p = .000$, indicating there were differences among the departments on competencies in computer skills. Following to ANOVA, the Tukey HSD test was conducted to make comparison between the competency means of preservice teachers in the different departments. The results indicated that only preservice teachers in the department of Computer Education and Instructional Technology were significantly more competent in computer skills. A great deal of respondents who scored 30 or above studied in the department of computer education and instructional technology.

Preservice teachers' beliefs in online features in education

As Table 3 indicates, the preservice teachers in this study thought that access to almost all online features in education addressed in the study were very important. They perceived access to lecture notes and presentation files to be the most important and access to discussion topics to be the least important. The results of

one-way ANAVO examining whether the mean differences of the beliefs among departments were significant showed that the department the preservice teachers studied at was not a significant factor ($F(3, 340) = 1.08$, $p = .358$). Finally, there was no meaningful relationship between their competencies in computer skills and their beliefs in online features in education ($r^2 = .002$, adjusted $r^2 = -.001$).

Table 3: Descriptive statistics regarding preservice teachers' beliefs in online features in education

Online features	Mean	Std. Deviation	N
1. Syllabus	3.45	.76	344
2. Lecture notes	3.71	.56	344
3. Video files used	3.43	.80	344
4. Problems related to course topics	3.61	.66	344
5. Discussion topics	3.23	.88	344
6. Presentation files used	3.70	.56	344
7. Exercises related to course topics	3.52	.72	344
8. Resources	3.54	.67	344
9. Announcements	3.67	.63	344

The effect of courses at the faculty of education on preservice teachers' competencies and attitudes toward the use of computers

The preservice teachers reported that the courses related to computer technologies contributed to their competencies in computer skills ($M = 3.96$, $SD = .95$) as well as their knowledge about the use of computers ($M = 4.04$, $SD = .90$). Moreover, they agreed that the efficient use of computer technologies in the teaching credential courses showed them how to use computers in their future profession ($M = 3.74$, $SD = 1.07$).

The preservice teachers agreed that the courses related to computer technologies significantly contributed to their attitude toward the use of technology in education ($M = 3.90$, $SD = 0.99$). Moreover, they agreed that the efficient use of computer technologies in the teaching credential courses helped them to improve their attitudes toward the use of technologies in their professional life ($M = 3.85$, $SD = 1.00$).

Lastly, the preservice teachers agreed that all preservice teachers had to have adequate skills and knowledge on how to use computers in education ($M = 3.46$, $SD = 1.17$), and reported that they desired to have more information about the use of computers for educational purposes ($M = 4.15$, $SD = .95$).

Preservice teachers' integration levels of ICT

As Table 4 indicates, the mean for preservice teachers at the faculty of education for awareness ICT integration level - being aware of using ICT in education ($M = 4.05$, $SD=.59$), revealed that they agreed to being aware of the use of ICT in classroom context and their applications for learning and teaching despite no use of ICT for their learning purposes. Integration level had two sub-levels, mechanical integration and routine integration. While the mean for mechanical integration sublevel -

beginning to use ICT, was 3.12 ($SD = .73$), the mean for routine integration sublevel - using ICT regularly, was 4.12 ($SD = .65$). There was a significant difference between two sub-levels, $t = 16.92$, $p = .000$, indicating the preservice teachers were significantly stronger at the routine integration sub-level than at the mechanical integration sub-level. The mean for expert ICT integration level - innovative use of ICT, was 3.92 ($SD = .71$), meaning that the preservice teachers agreed they could create new technology applications appropriate for new concepts. Finally, the mean for leader ICT integration level - masterly using ICT in education ($M = 3.81$, $SD = .70$) indicated that this group of pre-service teachers can be labeled as a key indicator in terms of ICT usage.

Table 4: Descriptive statistics regarding preservice teachers' integration levels of ICT

T / C: T integration levels / The name of the department *	Awareness		Integration: Mechanical Integration		Integration: Routine Integration		Expert		Leader	
	M	SD	M	SD	M	SD	M	SD	M	SD
CEIT	4.07	.61	3.10	.63	4.12	.69	4.00	.69	3.82	.67
ELE	4.03	.54	3.12	.73	4.15	.65	3.97	.64	3.89	.64
FLE	4.07	.58	3.18	.80	4.12	.63	3.80	.83	3.75	.78
SSME	3.75	.77	3.01	.78	3.95	.68	3.75	.67	3.56	.74
OVERALL	4.05	.59	3.12	.73	4.12	.65	3.92	.71	3.81	.70

* CEIT = Computer Education and Instructional Technology
ELE = Elementary Education
FLE = Foreign Language Education
SSME = Secondary Science and Mathematics Education

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CONCLUSION AND DISCUSSION

Technology integration into the classroom settings is a distressed process, which is affected by many parameters or factors like infrastructure problems, inadequate education given to the teachers and the resistance to adopt technology, as such. Our main thought is that preparing preservice teacher for successful technology integration is one possible means to eliminate obstacles related to inadequate education.

The results of this study indicated that the preservice teachers were relatively less competent with the use of database, web design, educational software and spreadsheet than other computer applications. However, the use of these computer applications in education may facilitate teachers' tasks related to teaching and management in the class settings as well as enhance learning. Database software, hypertext and spreadsheets can be used as cognitive tools in the classrooms (Jonassen, 2000). This kind of usage requires teachers to have the reasonable competency with these tools so that the teachers can explore the potential of these tools to improve the students' problem solving and critical thinking skills. Indeed, database and spreadsheet applications help teachers to complete tasks such as management of the information about the students, reporting grades and organization of the classroom resources. In addition, the use of educational software in the classroom may enhance learning through providing various different kinds of teaching and learning activities. The results also showed that students in the department of Computer Education and Instructional Technology were the most competent with the computer skills whereas there were not any significant differences between students in the other departments in terms of the competency in computer skills. This result is expectable because one of the objectives of the department of Computer Education and Instructional Technology is to prepare teachers who has high competency in computer skills and integration of ICT into classroom.

Teachers have a potential to be the key indicator of the innovation in the integration process. According to Wetzel (2002) for composing successful technology integration, it is necessary that teacher's beliefs and values shifted. Teachers' values and beliefs are the critical components in integration process since a positive shift on their beliefs on technology usage might effect the implementation of ICT directly. The results of this study indicated that preservice teachers viewed the use of online facilities in education as important. These positive beliefs the preservice teachers had may have an impact on the usage of online facilities in their future teacher professions.

From the results of this study, it is clear that preservice teachers thought that the courses related with computer literacy and its implications in education have a positive impact on their future profession. In addition, the preservice teachers specified that they desire to know more about ICT and its possible applications in education. Therefore, in the light of this information, it might be possible to give the demanded training on ICT and prepare them to their future profession adequately. In this perspective, the nature of the ICT courses, a stand-alone educational technology course or the integration of technology throughout the teacher preparation experience, is important consideration for teacher education programs. Moreover, because of the rapid developments in the technology the demand of

students from teacher has been increasing. In order to meet these needs, the future teachers need to be well prepared with the necessary skills related with ICT. For accomplishing this, it can be a way to cooperate with the instructional technology departments. In order to bring in the necessary skills to the preservice teachers additional educations can be given to them.

Therefore, for constituting an effective integration it is necessary to educate the preservice teachers adequately to be well- prepared about the technology integration into subject matter teaching. In this process, faculties of education have a critical role in terms of preparing the future teachers. This study concluded that the preservice teachers carried the characteristics of each level of the taxonomy to the similar extent. It can be inferred that as the obstacles preventing from successful integration of ICT into classroom were eliminated, the preservice teachers would have reasonable potential to integrate technology into subject matter teaching more effectively. Despite of having reasonable capacity to integrate of ICT into the classroom, the preservice teachers' performance at each level may be improved.

Further researches can be conducted about how preservice teachers can integrate ICT into their classrooms in real life settings and examine if there is a relationship between existing levels of them and their applications in class. In addition, how does the usage of online facilities in education change preservice teachers' beliefs and what the factors affect the preservice teachers' levels of technology integration taxonomy can be investigate. Lastly, the contributing factors related to the structure and content of the teacher education programs which may affect pre-service teachers' technology integration levels can be investigated.

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