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### **Influencing Factors and Integration of ICT into Teaching Practices of Pre-service and Starting Teachers**

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## Influencing Factors and Integration of ICT into Teaching Practices of Pre-service and Starting Teachers

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### Abstract

Teachers need to be competent in integrating ICT into education to support teaching and learning process. This study aims to investigate both the pre-service and starting teachers' perceptions for ICT-related variables—perceived ICT competence, perceived competence in ICT integration, attitudes towards ICT, anxiety around ICT usage, external barriers to ICT integration, ICT-related courses, pedagogical knowledge, and prior experience concerning the use of ICT— with regard to their integration of ICT into teaching practice to explore to what extent they integrate ICT into education. Quantitative data were collected from 200 pre-service teachers from the subject areas of Turkish language, social sciences, elementary mathematics and science in their fourth year of training programmes and 105 starting teachers who have been teaching not more than for three years in the mentioned subjects. T-test and multiple regression analysis were used to analyse the data. It was found out that perceived competence in ICT integration, computer anxiety, perceived ICT competence and pedagogical knowledge variables significantly predicted the teachers' integration of ICT into teaching practices. The results showed that their integration of ICT was limited to basic level and demonstrative purposes and they underused simulated tasks for experience, discovery and experiment. Implications and suggestions were put forward for the teacher training and professional development trainings to enable teachers to use ICT more competently and confidently in education.

**Key words:** Pre-service teachers; Starting teachers; ICT integration; ICT competence

### Introduction

Teachers have encountered new challenges owing to the expanding possibilities of the use of ICT in every respect of the school context in the 21<sup>st</sup> century (Albion et al., 2015). One of the challenges they face is to use their knowledge of pedagogy, content and technology to teach content and skills with a student centered approach (Nelson, Christopher & Mims, 2009). These challenges are not just limited to teachers alone. Teacher education institutions have also confronted the challenge to improve in-service teacher education and prepare pre-service teachers to successfully integrate ICT into teaching and learning process (Sang et al., 2010). According to Agyei and Voogt (2011), these institutions need to teach the pedagogical issues in relation to technology to pre-service teachers to enhance their ICT competence and increase their experience to integrate technology in their future classes. Teacher education institutions play a significant role in pre-service teachers' acquisition of ICT competence for their prospective teaching practices in K-12 setting through ICT. For that reason, it is important to integrate technology into every aspect of a teacher preparation program (Franklin, 2007).

As argued by Kaufman (2014) that the reinforcement of learning and using technology for educational purposes in K-12 settings firstly takes place in the teacher education classrooms. "It is of great importance to examine how teacher programs influence preservice teachers to use technology in their future classrooms" (Tondeur et. al., 2012: p.135). To evaluate the role of the programs in enabling pre-service teachers to use technology in their teaching practices, the 4<sup>th</sup> year pre-service teachers and starting teachers who have been teaching not more than three years have been selected owing to the fact that they are more experienced in the integration of ICT as an educational tool thanks to their training with the ICT-related courses in teacher education programs. As a result of their ICT training, they are assumed to have developed a notion for the role of ICT in their teaching practices. The teacher groups' perceptions with regard to their integration of ICT into their courses will make it possible to reveal to what extent the teacher training programs are effective to influence their use of technologies in education.

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## Theoretical Background

“Educational change depends on what teachers do and think - it is as simple and as complex as that” (Fullan, 2007:129). This indicates that teachers are the main determiners to what extent they will apply educational changes in their teaching practices. In this regard, the related literature (e.g., Ertmer, 1999; Jung, 2005; Mumtaz, 2000; Sang et al., 2011; Somekh, 2008; Pamuk & Peker, 2009; Vanderlinde et al., 2015), ICT-related courses and pedagogical courses in the teacher-training programme (HEC, 2006), theories, models and conceptual frameworks aiming to understand teachers’ intention or actual use of ICT in teaching practices (e.g., Agyei & Voogt, 2011; Davis, 1989; Drent & Meelissen, 2008; Ajzen, 1991; Venkatesh et al., 2003) were reviewed to account for the factors influencing teachers’ use of technology in their teaching practices. As a result of the review, the researchers presented the proposed research model of ICT integration in Figure 1.

The variables in the model can be categorized as teacher characteristics (e.g., gender, perceived ICT competence, perceived competence in ICT integration, attitudes towards technology, computer anxiety and prior experience), training related variables (e.g., subject, university, pedagogical knowledge and ICT-related courses) and institutional variables (e.g., external barriers to ICT use). The research model is hypothesized to account for the variables influencing teachers’ integration of ICT into education in the Turkish context.

The following main variables are included in the conceptual model. Subject refers to the subject areas teachers study in the teacher training program and teach in lower secondary school. University displays the place where teachers study in the teacher training program and where they graduate from. Perceived ICT competence includes teachers’ use of basic ICT skills (e.g., using search engines to look for information on the Internet, using presentation programs, using the Internet to communicate, using a word processing program, etc.) in education. Perceived competence in ICT competence refers to teachers’ integration of ICT skills (e.g., using simulated tasks to discover, experience and experiment, selecting and evaluating educational software, creating lesson plans through ICT, having the knowledge and skills necessary for ICT integration, etc.) in teaching practices. Attitudes towards technology refer to teachers’ attitude towards the general use of ICT in education. Computer anxiety indicates teachers’ perceived anxiety with regard to the specific use of ICT in teaching practices. External barriers to ICT use specify the barriers being extrinsic to teachers (e.g., lack of access to computers and software, insufficient time to plan instructions etc.). ICT-related courses refer to Computer I and II, and Instructional Technology and Material Development (ITMD) courses taught to pre-service teachers in teacher education programs. Pedagogical knowledge indicates the pedagogical courses in teacher education programs in relation to ICT integration. Prior experience concerning ICT displays ICT courses provided at secondary level. Integration of ICT into teaching practices refers to how often they integrate ICT into their teaching practices.

Ertmer et al. (2012) revealed that teacher beliefs and attitudes towards technology, in addition to their current levels of knowledge and skills remain barriers for the use of technology in education. Furthermore, Aydin, Gürol and Vanderlinde (2016) report as a result of their literature review that “there is a link between teachers’ use of ICT in their classes and their ICT training and ICT competencies” (p. 3). In this regard, the variables incorporating teacher characteristics, institutional and training related variables in the proposed research model of this study is assumed to shed light on the teacher groups’ influencing factors in relation to their use of technology for educational purposes.

New teachers should enter classroom with knowledge and skills to design and conduct the lessons in which the use of technology is emphasized to support curricular goals (Mouza et al., 2014). These new teachers’ adoption of technology is heavily determined with the quantity and quality of their technology experience involved in the teacher training programs (Agyei & Voogt, 2011; Tondeur et al., 2012). Therefore, studying both the pre-service and starting teachers’ factors influencing their actual use of ICT in teaching practices can form a basis where strategies or policies in relation to their ICT training in the teacher training program can be identified and developed to make teachers competent users of technology in class activities.

To evaluate to what extent the teacher training programs are effective to prepare pre-service teachers to integrate ICT into education, this study dealt with identifying and comparing the pre-service and starting teachers’ perceptions for gender, subject, university, perceived ICT competence, perceived competence in ICT integration, attitudes towards ICT, anxiety around ICT usage, external barriers to ICT integration, ICT-related courses, pedagogical knowledge, and prior experience concerning the use of ICT with regard to their integration of ICT into teaching practices. In this way, the teacher groups’ perceptions in relation to the issue of the integration of ICT will give a chance to researchers to evaluate the program from the perspective of the teacher groups.

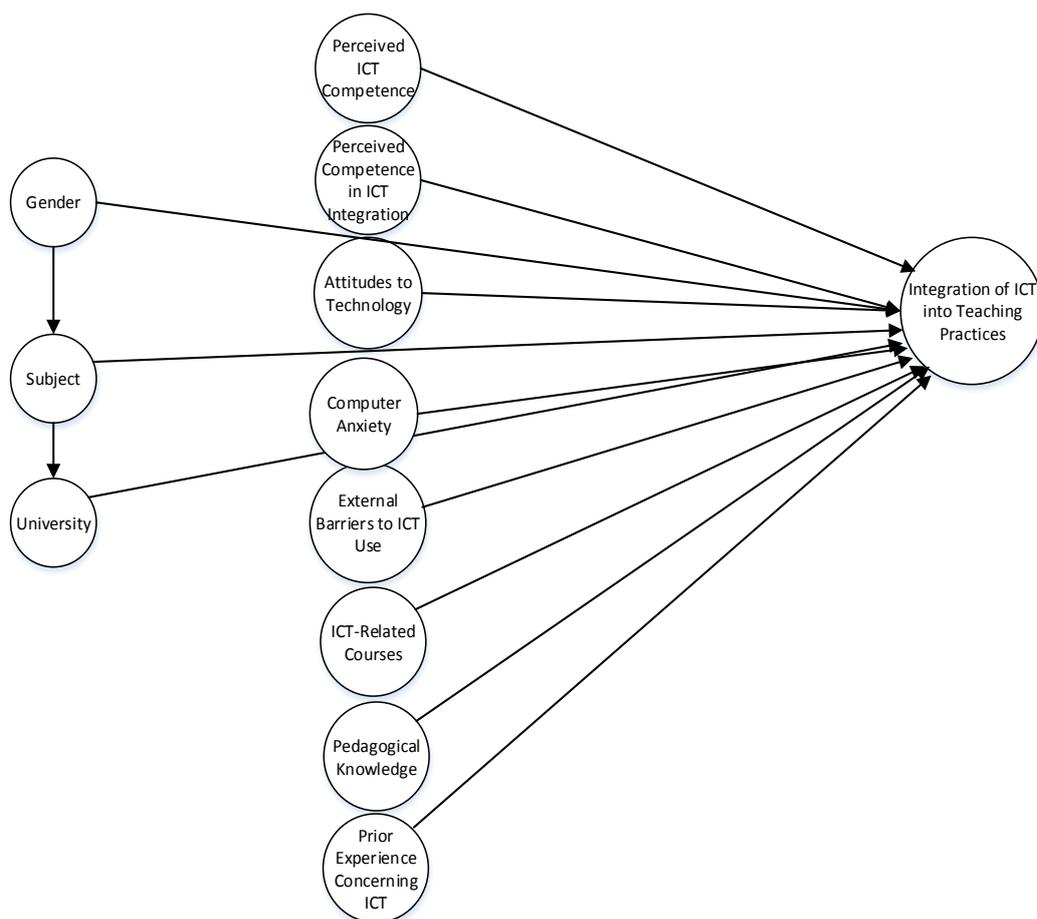


Figure 1. The study's conceptual model of ICT integration

## Objectives and Research Questions

### *Objectives of the Study*

This study has three objectives. The first objective is to investigate the teacher groups' (both pre-service and starting teachers) perceptions with regard to the independent variables to find out whether there are significant differences among the variables between the two groups. The second objective is to compare the teacher groups regarding their integration of ICT into teaching practices to reveal to what extent they differ in using technology for educational purposes. And the third objective is to compare the teacher groups' predicting variables regarding their integration of ICT into their teaching practices to identify whether there are significant differences among the predicting variables for the both teacher groups.

In this study, a quantitative method was applied to investigate the pre-service and starting teachers' perceptions concerning their integration of ICT into teaching practices. In this context, t-test was used to make comparisons between the teacher groups regarding the independent and dependent variables. Besides, multiple regression analysis was conducted to reveal to what extent the independent variables predict the teacher groups' integration of ICT into teaching practices.

### *Research Questions*

This study focuses on the following research questions:

RQ1: Are there significant differences between the pre-service and starting teachers with regard to perceived ICT competence, perceived competence in ICT integration in education, attitudes towards ICT, computer

anxiety and external barriers to the use of ICT, perceptions concerning ICT-related courses, pedagogical knowledge, and prior experience concerning ICT training?

RQ2: Are there significant differences between the pre-service and starting teachers in relation to their integration of ICT into their teaching practices?

RQ3: Are there significant differences between the pre-service and starting teachers regarding the predicting variables for their integration of ICT into their teaching practices?

## Methods

### The Survey Instruments

In this study, the instruments aiming at investigating the variables predicting Turkish pre-service teachers' integration of ICT into teaching practices in the study by Aslan and Zhu (2016) were used. The instruments consist of two parts, namely "teachers' ICT competence" (TIC) and the "integration survey" (IS).

The instrument included 49 items and four scales, namely "perceived ICT competence", "perceived competence in ICT integration in education", "attitudes towards ICT" and "anxiety concerning ICT usage in teaching practices" are involved in the first part (TIC), whereas 40 items and five scales, namely "barriers related to the teacher-training programs, human and physical conditions", "perceptions concerning ICT-related courses in the teacher-training programs", "pedagogical knowledge in the teacher-training program, in terms of integration of ICT into education", "prior experience concerning ICT training" and "integration of ICT into teaching practices" are included in the second part (IS). The following five-point Likert-point measurements have been used for the different scales: (1) None, (2) Low, (3) Confident, (4) High and (5) Very High were used in the scales for "perceived ICT competence" and "perceived competence in ICT integration in education", in TIC. The Likert-point scaling used in the other scales in TIC and IS, except in the scale for "integration of ICT into teaching practices" the following responses were used: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree. For the last scale, a 5-point Likert-point scaling—varying from (1) The Least, to (5) The Most—was used to determine how often teachers use ICT in their teaching practices.

The fit index values for the TIC competence scale were as follows:  $\chi^2=425$ ; AGFI=.90; NFI=.95; CFI=.96; and RMSEA=.039. The internal consistency reliability for TIC varied from .85 to .91, while for IS it ranged from .86 to .97.

### Participants

A stratified two-stage probability sampling design was used in the study. Firstly, three Turkish state universities were chosen with the highest and the lowest numbers of pre-service teachers. The population size was determined based on the Student Selection and Placement Centre's 2012 quota (ÖSYM, 2012). In the context with the criteria, Aksaray, Gazi, Marmara, Dokuz Eylül, Niğde and Fırat universities were chosen. Secondly, Turkish teaching, social sciences teaching, elementary mathematics teaching and science teaching programs were selected to represent social science and science teachers.

TIC and IS were applied to the pre-service teachers during the 2014 Spring Semester. 599 pre-service teachers' responses were analysed. Of these pre-service teachers, 200 pre-service teachers were randomly selected to make group comparison between the pre-service and starting teachers. 105 starting teachers answered the survey instruments during the 2014 Spring and Autumn Semesters. The demographic information of the participants is displayed in Table 1.

### Data analysis

Multiple regression analysis was applied to identify to what extent the independent variables predict the teacher groups' integration of ICT into teaching practices. Before multiple regression analysis was conducted, the variance inflation factor (VIF) and tolerance values had been calculated to determine whether there was multicollinearity among the variables. Any VIF of 10 or more and tolerance values of .10 or less (equivalent to a VIF of 10) indicated serious problems of multicollinearity concerning independent variables (Cohen et al., 2003:

423-424). It was seen that the VIF values varied from 1.00 to 2.18, and the tolerance values ranged from .45 to .99 for the starting teachers. On the other hand, the VIF values varied from 1.08 to 1.53, and while the tolerance values ranged from .65 to .92 for the pre-service teachers. According to these results, multiple regression analysis was decided to be implemented.

Table 1. Demographic characteristics of the participants (n=305)

	Starting teachers (n=105)	N		Pre-service teachers (n=200)	
		N	%	N	%
<b>Age</b>	18–23	21	20	166	83
	24–30	68	64.8	33	16.5
	31–40	16	15.2	1	.5
<b>Gender</b>	Female	43	41	129	64.5
	Male	62	59	71	35.5
<b>University</b>	Aksaray Uni.	2	1.9	25	12.5
	Dokuz Eylül Uni.	11	10.5	46	23
	Fırat Uni.	42	40	33	16.5
	Gazi Uni.	29	9.5	21	10.5
	Marmara Uni.	11	10.5	51	25.5
	Niğde Uni.	10	13	24	12
<b>Subject Area</b>	Elementary Math.	113	18.9	34	17
	Science	214	35.7	75	37.5
	Social Sciences	121	20.2	48	24
	Turkish	151	25.2	43	21.5
<b>Working period</b>	1 year	31	29.5	-	-
	2 year	27	25.7	-	-
	3 year	47	44.8	-	-

## Results

### *Descriptive Results of Key Variables on ICT Integration of the Teacher Groups (RQ1)*

The mean scores and standard deviation for TIC are displayed in Table 2. Based on the data in Table 2, it appeared that the pre-service teachers were more competent than the starting teachers in relation to perceived ICT competence ( $M_{\text{pre-service}}=4.14$ ;  $M_{\text{starting}}=3.82$ ). There was a significant difference in favor of the pre-service teachers with regard to perceived ICT competence ( $t(164.42)=3.87$ ,  $p<.05$ ). The pre-service teachers seemed to be more competent than the starting teachers in integrating ICT into their teaching practices as well ( $M_{\text{pre-service}}=3.03$ ;  $M_{\text{starting}}=2.85$ ). There was a significant difference in favor of the pre-service teachers with regard to perceived competence in integrating ICT into lesson ( $t(303)=2.06$ ,  $p<.05$ ). The teacher groups' attitudes towards ICT were positive ( $M_{\text{pre-service}}=3.94$ ;  $M_{\text{starting}}=3.82$ ) and it did not have a significant difference among them concerning this variable ( $t(303)=1.70$ ,  $p<.05$ ). It was understood that the pre-service teachers were more anxious than the starting teachers for ICT usages in their teaching practices ( $M_{\text{pre-service}}=2.89$ ;  $M_{\text{starting}}=2.54$ ). There was a significant difference in favor of the pre-service teachers regarding anxiety for ICT usages in education ( $t(303)=3.48$ ,  $p<.05$ ).

The mean scores and standard deviation for IS are presented in Table 2. The pre-service teachers seemed to face more external barriers than the starting teachers with regard to ICT integration ( $M_{\text{pre-service}}=3.92$ ;  $M_{\text{starting}}=3.59$ ). There was a significant difference in favor of the pre-service teachers regarding the barriers to ICT integration ( $t(303)=4.11$ ,  $p<.05$ ). It was seen that the teacher groups' perceptions with regard to the effectiveness of the ICT-related courses were moderately effective ( $M_{\text{pre-service}}=3.41$ ;  $M_{\text{starting}}=3.53$ ) and it did not have a significant difference among the teacher groups concerning this variable ( $t(303)=-1.05$ ,  $p<.05$ ). It was understood that the teachers groups' perceptions for the effectiveness of the pedagogical courses ( $M_{\text{pre-service}}=3.45$ ;  $M_{\text{starting}}=3.53$ ) and prior experience concerning ICT training at secondary education level ( $M_{\text{pre-service}}=3.37$ ;  $M_{\text{starting}}=3.37$ ) were moderately effective at developing their ICT competence. There were not significant differences among the teacher groups with regard to the effectiveness of the pedagogical courses ( $t(303)=1.05$ ,  $p<.05$ ) and prior

experience concerning ICT training at secondary education level ( $t(303)=-.01, p<.05$ ). It was seen that the pre-service teachers used ICT more frequently than the starting teachers ( $M_{\text{pre-service}}=3.46; M_{\text{starting}}=3.10$ ) and there was a significant difference among the teacher groups in favor of the pre-service teachers in terms of integration of ICT into teaching practices ( $t(303)=4.40, p<.05$ ).

Table 2. Descriptive statistics for TIC and IS

Subscale	Items (n)	Pre-service teacher (n=200)		Starting teacher (n=105)		df	t	p
		M	SD	M	SD			
Perceived ICT competences	8	4.14	.54	3.82	.74	164.42	3.87	.00*
Perceived competence in integrating ICT into lessons	13	3.03	.73	2.85	.74	303	2.06	.04*
Attitudes towards ICT	21	3.94	.48	3.82	.64	303	1.70	.08
Anxiety concerning ICT usages in teaching practices	7	2.89	.79	2.54	.89	303	3.48	.00*
Barriers related to the teacher-training programs, human and physical conditions	10	3.92	.63	3.59	.67	303	4.11	.00*
Prior experience concerning ICT training	3	3.37	1.49	3.37	1.44	303	-.01	.98
Perceptions concerning ICT-related courses	3	3.41	1.01	3.53	.90	303	-	.29
Pedagogical knowledge	12	3.45	.92	3.33	.98	303	1.05	.29
Integration of ICT into teaching practice	12	3.46	.66	3.10	.72	303	4.40	.00*

\* $p<.05$ 

#### *Integration of ICT into the Teaching Practices of the Pre-service and Starting Teachers (RQ2)*

Based on the data in Table 3, both pre-service and starting teachers mostly used search engines (e.g., Google, Yahoo, etc.) to look for information on the Internet in their teaching practices ( $M_{\text{pre-service}}=4.40; M_{\text{starting}}=4.26$ ) and it did not have a significant difference among the teachers regarding the use of the search engines in education ( $t(165.40)=1.17, p<.05$ ). It was understood that the teachers commonly evaluated information on the Internet in terms of social, legal and ethical issues ( $M_{\text{pre-service}}=3.81; M_{\text{starting}}=3.67$ ) and there was not a significant difference among them concerning this competence ( $t(303)=1.24, p<.05$ ). They commonly created instructional materials (e.g., handouts, tests, etc.) using ICT in their teaching practices as well ( $M_{\text{pre-service}}=3.72; M_{\text{starting}}=3.72$ ) and a significant difference did not occur among the teachers with regard to this competence ( $t(206.35)=-0.35, p<.05$ ). They moderately created lesson plans using ICT in their teaching practices ( $M_{\text{pre-service}}=3.13; M_{\text{starting}}=3.27$ ) and a significant difference did not appear among them regarding this competence ( $t(303)=-1.17, p<.05$ ). On the other hand, it was understood that the pre-service teachers used OHP ( $M_{\text{pre-service}}=2.60; M_{\text{starting}}=2.20$ ), data-show projectors ( $M_{\text{pre-service}}=3.83; M_{\text{starting}}=3.10$ ) and presentation programs ( $M_{\text{pre-service}}=4.15; M_{\text{starting}}=3.20$ ) more frequently than the starting teachers to present subject matters in their teaching practices. As a result, a significant difference occurred in favor of the pre-service teachers concerning the usage of OHP ( $t(233.28)=2.64, p<.05$ ), data-show projectors ( $t(173.90)=5.33, p<.05$ ), and presentation programs ( $t(152.89)=7.38, p<.05$ ). Likewise, the pre-service teachers used ICT to prepare visual effects ( $M_{\text{pre-service}}=3.75; M_{\text{starting}}=3.24$ ) and sound effects ( $M_{\text{pre-service}}=3.29; M_{\text{starting}}=2.89$ ) more often than the starting teachers to enhance learning concepts. So, a significant difference occurred in favor of the pre-service teachers regarding the competences to prepare visual ( $t(303)=4.16, p<.05$ ) and sounds ( $t(303)=2.89, p<.05$ ) effects to enhance learning concepts through ICT. It was also understood that the pre-service teachers used simulation for experiment ( $M_{\text{pre-service}}=2.93; M_{\text{starting}}=2.50$ ), discovery ( $M_{\text{pre-service}}=2.92; M_{\text{starting}}=2.53$ ) and experience ( $M_{\text{pre-service}}=3.00; M_{\text{starting}}=2.57$ ) more frequently than the starting teachers in teaching practices. Based on these results, there was significant differences among the teachers in favor the pre-service teachers concerning the related competences such as the usage of simulations for experiment ( $t(303)=2.81, p<.05$ ), discovery ( $t(303)=2.61, p<.05$ ) and experience ( $t(303)=2.88, p<.05$ ).

Table 3. Participants' use of ICT in teaching practices

Competences	Pre-service teacher (n=200)		Starting teacher (n=105)		df	t	p
	M	SD	M	SD			
Using search engines (e.g., Google, Yahoo, etc.) to look for information on the Internet	4.40	.75	4.26	1.02	165.40	1.17	.24
Evaluating information on the Internet in terms of social, legal and ethical issues	3.81	.89	3.67	.97	303	1.24	.21
Creating instructional materials (e.g., handouts, tests, etc.) using ICT	3.72	.91	3.72	.94	206.35	-.03	.97
Creating lesson plans using ICT	3.13	1.06	3.27	.96	303	-1.17	.24
Using an OHP to present subject matter	2.60	1.36	2.20	1.22	233.28	2.64	.00*
Using data-show projectors to present subject matter	3.83	.95	3.10	1.20	173.90	5.33	.00*
Using presentation programs (e.g., PowerPoint, etc.) to present subjects	4.15	.79	3.20	1.19	152.89	7.38	.00*
Preparing visual effects to enhance learning concepts through ICT	3.75	.94	3.24	1.09	303	4.16	.00*
Preparing sound effects to enhance learning concepts through ICT	3.29	1.11	2.89	1.13	303	2.96	.00*
Using simulated tasks for experiment	2.93	1.30	2.50	1.15	303	2.81	.00*
Using simulated tasks for discovery	2.92	1.24	2.53	1.20	303	2.61	.00*
Using simulated tasks for experience	3.00	1.27	2.57	1.14	303	2.88	.00*

\*p&lt;.05

*The Relationship between the Predicting Variables and Integration of ICT into Teaching Practices with regard to the Pre-service and Starting Teachers (RQ3)*

Multiple regression was conducted to test to what extent the independent variables predict the pre-service and starting teachers' integration of ICT into their teaching practices. The results are displayed in Table 4. The variables accounted for 52% of the dependent variable in the pre-service and starting teachers' case. "Perceived competence in ICT integration" ( $\beta=.64$ ), "computer anxiety" ( $\beta=.16$ ), "perceived ICT competence" ( $\beta=.13$ ) and "gender" ( $\beta=.12$ ) variables were seen to significantly predict the pre-service teachers' integration of ICT into teaching practices. Unlike the pre-service teachers' predicting variables, the "perceived competence in ICT integration" ( $\beta=.43$ ) and pedagogical knowledge ( $\beta=.29$ ) variables significantly predicted the starting teachers' integration of ICT into teaching practices. The "perceived competence in ICT integration" was the only variable which had a predictive value for the dependent variable among the teacher groups.

Table 4. Depending variables concerning "integration of ICT into teaching practices"

	Pre-service teacher (n=200)			Starting teacher (n=105)		
	$\beta$	t	p	$\beta$	t	p
Gender	.12	2.30	.02*	-.58	-.77	.43
Subject	.02	3.72	.71	.03	.42	.67
University	-.01	-.31	.75	.08	1.17	.24
Perceived ICT competence	.13	2.11	.03*	.16	1.58	.11
Perceived competence in ICT integration	.64	10.78	.00*	.43	4.81	.00*
Attitudes towards technology	-.00	-.11	.91	.08	.75	.45
Computer anxiety	.16	2.93	.00*	-.06	-.76	.44
External barriers to ICT use	-.05	-.92	.35	.07	.93	.35
ICT-related courses	.10	1.82	.06	-.09	-.96	.33
Pedagogical knowledge	.05	.98	.32	.29	3.06	.00*
Prior experience concerning ICT	-.041	-.75	.45	.04	.49	.62
R <sup>2</sup> "integration of ICT into teaching practices"		.52			.52	

\*p&lt;.05

## Discussion

A quantitative method was used to identify the pre-service and starting teachers' perceptions with regard to their integration of ICT into their teaching practices. Understanding only pre-service teachers' perceptions for their use of ICT in education would be insufficient to assess to what extent the teacher training programs could prepare them to use technology in their prospective teaching practices in lower secondary schools. So, it was thought that the starting teachers' perceptions for their use of technology in classrooms would play a complementary role in the assessments of the teacher training programs. In this context, the teacher groups' main differences and commonalities in relation to their perceptions for their use of ICT in education were investigated. The findings were discussed in the following three aspects taking into account the research questions.

### Key Variables of the Teacher Groups for ICT Integration

The study showed that the pre-service teachers were more competent than the starting teachers in using basic ICT skills (e.g., presentation skills, word processors, etc.). Although the pre-service teachers were also more competent in using integrated ICT skills (e.g., using simulated tasks to discover, experiment and experience, etc.), the teacher groups were not necessarily competent in using integrated ICT skills. It seemed that the teacher groups were not equipped with the necessary ICT competence to integrate ICT into education. As indicated by Ageyi and Voogt (2011) that technology competency is a predictor to employ technology in teaching and learning successfully. In this regard, Lee and Lee (2014) report based on their literature review that teachers' self-efficacy beliefs for technology integration is one of the most important factors to determine teachers' actual use of technology in their teaching practices. Teachers should be competent not only in basic ICT skills but also in integrated ICT skills to use ICT as a tool to support teaching and learning process. As Smarkola (2008) argued that teachers must move beyond being "computer literate" to "technology competent" to integrate technology into education effectively. According to Ertmer and Ottenbreit-Leftwich (2010) "although knowledge of technology is necessary, it is not enough if teachers do not also feel confident using that knowledge to facilitate student learning (p.261)". These results have implications for both pre-service and starting teachers. As far as pre-service teachers are concerned, changes should be made in the teacher training programs to enable them to integrate ICT into education more competently and confidently. In this regard, Tondeur et al. (2012) developed a SQD-model (Synthesis of Qualitative Evidence) to prepare pre-service teachers to use technology in their classes. The model involves some strategies (e.g., using teacher educators as role models, reflecting on the role of technology in education, learning how to use technology by design, collaboration with peers, authentic technology experiences and providing continuous feedback) to be implemented in teacher training programs. Through the application of these strategies in the program, pre-service teachers could be more competent and more comfortable in using technology in K-12 settings. As for the starting teachers, they need to participate into professional development trainings to increase their competence in ICT. As Brun and Hinostroza (2014) suggested that both professional development opportunities and pedagogical support should be provided to teachers to promote more innovative pedagogical practices in teaching practices. The starting teachers could be more competent and confident in their integration of ICT into their courses through the opportunities and pedagogical support provided in the trainings.

It was found out that the teacher groups' attitude towards technology was positive. As argued by Teo (2011), teachers' positive attitudes towards the use of computers reinforce their intentions to use technology. It can be inferred that the teacher groups would seem to conceptualize the notion of the integration of ICT into their teaching practices. Besides, the pre-service teachers seemed to be more anxious than the starting teachers with regard to the usage of ICT in their teaching practices. The pre-service teachers' computer anxiety could stem from not being necessarily competent in integrated ICT skills. As Sang et al. (2010) pointed out that more competent teachers use computers more frequently and experience less computer-related anxiety. It appears that there is a reverse correlation between ICT competency and computer anxiety. On the other hand, the starting teachers' being less anxious for computer could be accounted for the fact that they typically focus on getting acquainted with curriculum and classroom management instead of ICT integration in their first few years (Chen, 2010).

The study showed that the pre-service teachers encountered more external barriers than the starting teachers with regard to ICT integration. On the whole, the teacher groups had a significant external barrier for the effective integration of ICT into education. This finding is in parallel with the study by Aslan and Zhu (2015). As Tondeur et al. (2015) stressed out that access to appropriate and well-supported infrastructure is a key component for teachers to use the technology in their educational practice. In this regard, more investment

should be made in ICT infrastructure both at universities and schools to enable both pre-service and teachers to utilize technology in their teaching practices more effectively.

It was found out that the ICT-related courses, pedagogical courses and prior experience concerning ICT training at secondary education level were moderately effective to develop the teacher groups' ICT competence. The results show that changes have to be conducted in the ICT-related courses and pedagogical courses with regard to the pre-services' acquisition of ICT competences. In addition to the above mentioned strategies to be implemented in the teacher training program, Web 2.0 technologies such as blogs, wikis and social bookmarking should be integrated into the ICT—related courses. As suggested by Sadaf, Newby and Ertmer (2012) that teacher education programs should prepare pre-service teachers to use Web 2.0 technologies in their future K-12 classrooms due to their potential to enhance teaching and learning process effectively. According to Nelson, Christopher and Mims (2009), these technologies can promote student learning and facilitate the lifelong skills such as collaboration, creative thinking and knowledge construction when they are used by skilled teachers. It is important for pre-service teachers to use Web 2.0 technologies in their courses proficiently. The competent teachers in these technologies can contribute to enabling their students to be lifelong learners appealing to collaboration, creative thinking and knowledge construction. Besides, pre-service teachers should be exposed to more intensive ICT training at secondary education level. So, they could be more experienced in using ICT in education. In the teacher training program, they could enhance their ICT skills and integrate ICT into their teaching practices innovatively.

### **Integration of ICT into the teaching practices of the Teacher Groups**

The study found out that the pre-service teachers used technology more often than the starting teacher in their teaching practices. Besides, the teacher groups integrated ICT into education to a moderate extent. It appeared that they mostly dealt with using search engines to look for information on the Internet, evaluate information on the Internet in terms of social, legal and ethical issues, creating instructional materials through ICT, using data-show projectors and presentation programs to present their subject matters in their teaching practices. It was understood that their integration of ICT was limited to basic level and demonstrative purposes. On the other hand, they moderately prepared sound effects to enhance learning concepts through ICT and create lesson plans with ICT and underused simulated tasks for experience, discovery and experiment. These findings are in parallel with the study by Brun and Hinostroza (2014) indicating that teachers have a tendency to utilize commonly computers, projection systems and some software products as opposed to other ICT sources such as interactive whiteboards in their teaching practices. Chien et al. (2012) suggested that pre-service teachers should move from the role of passive users of technology to active designers of technology. This requires teachers to be competent in ICT to integrate technology into education effectively.

### **The Relationship between the Predicting Variables and the Teacher Groups' Integration of ICT into Teaching Practices**

The results showed that the variables accounted for more than half of the percentage of the teacher groups' dependent variable as a result of the multiple regression analysis. Perceived competence in ICT integration, computer anxiety, perceived ICT competence and gender variables significantly predicted the pre-service teachers' the integration of ICT into teaching practices. On the other hand, perceived competence in ICT integration and pedagogical knowledge variables were seen to significantly predict the starting teachers' dependent variable. These results indicated that competency in ICT was an important determiner to what extent teachers integrated ICT into education. Besides, we found out that pedagogical knowledge was a significant predictor for teachers' integration of ICT into their teaching practices as well. As Nelson, Christopher and Mims (2009) argued that teachers know how to relate concepts through technology, demonstrate pedagogical practice and facilitate technology use in technology integration. In this regard, Ertmer (2005) suggested that teachers' existing pedagogical beliefs should be taken into account to increase teachers' uses of technology supporting student learning.

The study indicated that gender was a significant predictor in the pre-service teachers' integration of ICT into education, while it was not an important predictor in the starting teachers' case. Gender is a contradictory issue in teachers' use of ICT in education. Aslan & Zhu (2016) found out that gender is not a significant variable to predict teachers' use of technology in education. It can be deduced that the differences among male and female teachers with regard to use of technology in education are decreasing and teachers seem to use technology in their teaching practices regardless of their genders.

## Limitations and Implications

This study is limited to 200 pre-service teachers from the subject areas of Turkish language, social sciences, elementary mathematics and science in their fourth year of training programmes and 105 starting teachers who have been teaching not more than for three years in the mentioned subjects. Because of the sampling size, it would be hard to generalize the results. The sampling size could be increased to generalize the results of this study. Observations and interviews could be carried out with pre-service and starting teachers. Mixed method research could be conducted to gain a deeper understanding of teachers' perceptions with regard to ICT integration into education.

The findings of this study provide educational researchers with some insights to understand the factors and influencing the integration of ICT into education for both the pre-service and starting teachers. It is obvious from the teacher groups' responses that the teacher training programs are not effective for the pre-service and starting teachers to acquire the competency to use ICT in their teaching practices. The universities should work in close collaboration with the Ministry of National Education to develop ICT policies for teachers to use technology in education effectively and innovatively. In this context, they could develop the strategies and policies concerning the integration of ICT into education for pre-service and in-service teachers in the teacher training programs and professional development trainings to be competent users of technology to facilitate teaching and learning process.

## Conclusion

The research model of this study was turned out to significantly predict and account for ICT-related variables with regard to teachers' integration of ICT into their teaching practices in the Turkish context. The study indicated that there were main differences and commonalities in relation to the teacher groups' perceptions for their use of ICT in education. It was revealed that the pre-service teachers needed more training to be competent in ICT and therefore, they experienced more computer anxiety. On the other hand, the starting teachers needed more training to be a competent user of ICT in education as well. However, they were less anxious for computers in their teaching practices. This could be due to the fact that they allocate more time to be familiar with the curriculum, classroom management in their first years rather teaching with ICT (Chen, 2010).

Besides, pedagogical knowledge is a significant predictor in in-service teachers' real classroom environment, whereas it is not a predictor in pre-service teachers' teaching practices. This shows that pedagogical knowledge really matters in real classroom settings. It was found out that the teacher groups' integration of ICT was limited to basic level and demonstrative purposes and they underused simulated tasks for experience, discovery and experiment. These findings demonstrate that changes are necessary in the teacher training programs to prepare pre-service teachers to use ICT for educational purposes. Some strategies such as using teacher educators as role models, reflecting on the role of technology in education, learning how to use technology by design, collaboration with peers, authentic technology experiences and providing continuous feedback (Tondeur et al., 2012) should be implemented in the teachers training programs to enable pre-service teachers to use ICT in education competently and confidently. Besides, the use of Web 2.0 technologies should be integrated into the curriculum of the programs to facilitate teaching and learning process effectively. As for the starting teachers, they need to be provided professional development opportunities and pedagogical support in professional development trainings to enhance more innovative pedagogical practices in teaching practices (Brun & Hinostrroza, 2014).

## References

- Agyei, D. D., & Voogt, J. M. (2011). Exploring the potential of the will, skill, tool model in Ghana: predicting prospective and practicing teachers' use of technology. *Computers & Education*, 56, 91-100.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Albion, P. R., Tondeur, J., Forkosh-Baruch, A., & Peeraer, J. (2015). Teachers' professional development for ICT integration: towards a reciprocal relationship between research and practice. *Education and Information Technologies*, 20(4), 655-673.
- Aslan, A., & Zhu, C. (2015). Pre-service teachers' perceptions of ICT integration in teacher education in Turkey. *The Turkish Online Journal of Educational Technology*, 14(3), 97-110.

- Aslan, A., & Zhu, C. (2016). Investigating variables to predict Turkish pre-service teachers' ICT integration into teaching practices. In press in *British Journal of Educational Technology*: doi:10.1111/bjet.12437.
- Aydin, M. K., Gürol, M., & Vanderlinde, R. (2016). Evaluating ICT integration in Turkish K-12 schools through teachers' views. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(4), 747-766.
- Brun, M., & Hinostroza, J. E. (2014). Learning to become a teacher in the 21st century: ICT integration in initial teacher education in Chile. *Educational Technology & Society*, 17(3), 222-238.
- Chen, R. (2010). Investigating models for preservice teachers' use of technology to support student-centered learning. *Computers & Education*, 55, 32-42.
- Chien, Y., Chang, C., Yeh, T., & Chang, K. (2012). Engaging pre-service science teachers to act as active designers of technology integration: A MAGDAIRE framework. *Teaching and Teacher Education*, 28, 578-588.
- Cohen, J., Cohen, P., West, S. G., & Alken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. Third Ed. New Jersey: Lawrence Erlbaum Associates Publishers.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of technology. *MIS Quarterly*, 13(3), 319-340.
- Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, 51, 187-199.
- Ertmer, P. A. (1999). Addressing first-and second – order barriers to change: Strategies for technology integration. *Educational Technology Research and Development*, 47(4), 47-61.
- Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: how knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255-284.
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: a critical relationship. *Computers & Education*, 59, 423-435.
- Franklin, C. (2007). Factors that influence elementary teachers use of computers. *Journal of Technology and Teacher Education*, 15(2), 267-293.
- Fullan, M. (2007). *The new meaning of educational change* (Fourth edition). New York: Teachers College Press.
- HEC (2006). Eğitim fakülte uygulanacak yeni programlar hakkında açıklama. (2013, April 26). Retrieved from [http://www.yok.gov.tr/egitim/ogretmen/yeni\\_programlar\\_ve\\_icerik.htm](http://www.yok.gov.tr/egitim/ogretmen/yeni_programlar_ve_icerik.htm)
- Jung, I. (2005). ICT-pedagogy integration in teacher training: application cases worldwide. *Educational Technology & Society*, 8(2), 94-101.
- Kaufman, K. (2014). Information communication technology: challenges & some prospects from pre-service education to the classroom. *Mid-Atlantic Education Review*, 2(1), 1-11.
- Lee, Y., & Lee, J. (2014). Enhancing pre-service teachers' self-efficacy beliefs for technology integration through lesson planning practice. *Computers & Education*, 73, 121-128.
- Mouza, C., Karchmer-Klein, R., Nandakumar, R., Ozden, S. Y., & Hu, L. (2014). Investigating the impact of an integrated approach to the development of preservice teachers' technological pedagogical content knowledge (TPACK). *Computers & Education*, 71, 206-221.
- Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. *Journal of Information Technology for Teacher Education*, 9(3), 319-341.
- Nelson, J., Christopher, A., & Mims, C. (2009). TPACK and Web 2.0: transformation of teaching and learning. *TechTrends*, 53(5), 80-85.
- ÖSYM (2012). ÖSYS Yükseköğretim programları ve kontenjanları kılavuzu. (2013, February 12). Retrieved from <http://www.osym.gov.tr/belge/1-13589/2012-osys-yuksekogretim-programlari-ve-kontenjanlari-ki.html>
- Pamuk, S., & Peker, D. (2009). Turkish pre-service science and mathematics teachers' computer related self-efficacies, attitudes, and the relationship between these variables. *Computers & Education*, 53(2), 454-461.
- Sadaf, A., Newby, T. J., & Ertmer, P. A. (2012). Exploring pre-service teachers' beliefs about using Web 2.0 technologies in K-12 classroom. *Computers & Education*, 59, 937-945.
- Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education*, 54(1), 103-112.
- Sang, G., Valcke, M., van Braak, J., Tondeur, J., & Zhu, C. (2011). Predicting ICT integration into classroom teaching in Chinese primary school: exploring the complex interplay of teacher-related variables. *Journal of Computer Assisted Learning*, 27(2), 160-172.
- Smarkola, C. (2008). Efficacy of a planned behavior model: beliefs that contribute to computer usage intentions of student teachers and experienced teachers. *Computers in Human Behavior*, 24, 1196-1215.

- Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In *International Handbook of Information Technology in Primary and Secondary Education* (eds J. Voogt & G. Knezek), pp. 449-460. Springer, New York, NY.
- Teo, T. (2011). Factors influencing teachers' intention to use technology: model development and test. *Computers & Education*, 57, 2432-2440.
- Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: a synthesis of qualitative evidence. *Computers & Education*, 59, 134-144.
- Tondeur, J., Krug, D., Bill, M., Smulders, M., & Zhu, C. (2015). Integrating ICT in Kenyan secondary schools: an exploratory case study of a professional development program. *Technology, Pedagogy and Education*. doi:10.1080/1475939X.2015.1091786.
- Vanderlinde, R., Aesaert, K., & van Braak, J. (2015). Measuring ICT use and contributing conditions in primary schools. *British Journal of Educational Technology*, 46(5), 1056-1063.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27(3), 425-478.