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Investigation of K-12 Teachers' ICT Competences and the Contributing Factors in Acquiring these Competences

Abstract

This study investigates K-12 teachers' ICT competence levels, the differences in teachers' ICT competences based on their demographic characteristics, and factors that have impact on their ICT competences. The data were collected from 1,429 K-12 teachers by means of a questionnaire. The findings of the study indicate that the majority of the participants do not perceive themselves as competent in basic and advanced ICT. Gender, prior preservice education ICT courses, and computer ownership are significantly related to the perceived ICT competences of K-12 teachers. Personal interest, possession of a home computer, and family and friends were rated as the most influential factors in acquiring ICT competences.

Key Words: *ICT competences; acquiring ICT competences; factors that influence ICT competences; K-12 teachers; computer usage in K-12 schools*

1. Introduction

Information and communication technologies (ICT) play a proven critical role in enhancing the quality of education. They are particularly important in helping teachers and students to perform more effectively. To make the best use of ICT, teachers must be equipped with adequate ICT competencies. In the process of integrating ICT into education, both teachers' ICT competencies and how they perceive the role of ICT in their teaching/learning processes play key roles. Analysis, design, development, implementation, evaluation, and management of ICT in education require diversified competencies and knowledge (Kozma 2002, pp.1-6).

Competency has been defined in the literature as the state or quality of being adequately or well qualified to perform a task. For example, Mandl and Krause (2003) defined competence as a "system of prerequisites for successful action in certain domains that can be influenced by practice and learning" (p.69). According to Klein, Spector, Grabowski, and de la Teja (2004), competency is "a set of related knowledge, skills, and attitudes that enable an individual to effectively perform the activities of a given occupation or job function to the standards expected in employment" (p.14). According to Clark (2008), "a person gains competency through education, training, experience or natural abilities. While there are many definitions of competency, most of them have two common components: 1) the competencies are observable or measurable knowledge, skills and abilities; 2) these knowledge, skills and abilities must distinguish between superior and other performers" (p.1).

The demand for teachers with high ICT competencies and skills is increasing. In the literature (Algozzine, Bateman, Flowers, Gretes, Hughes, and Lambert 1999), there are two general clusters of ICT competencies as basic and advance competencies. Basic competencies are represented by entry-level skills related to basic computer operation, and the use of an array of software that supports and enhances professional productivity. Advanced competencies extend the application of basic competencies to teaching, administration and counseling, and to other professional activities. To determine the level of competencies, the International Society for Technology in Education (ISTE) formed technology standards for K-12 teachers. These standards define the fundamental concepts, knowledge, skills, and attitudes for applying ICT in educational settings. All teacher candidates seeking certification or endorsements in teacher education must meet these educational technology standards. It is the responsibility of preservice teacher education programs in all universities and at cooperating schools to provide instruction that will allow teacher candidates to meet these standards (ISTE 2000).

In order to use ICT effectively and to integrate it in K-12 schools, the schools should not only make investments in ICT, but also should provide the necessary training and support to enable teachers to become fully capable at using these technologies (Mims, Polly, Shepherd, and Inan 2006, p.17).

Investments in ICT cannot be fully effective unless teachers learn how to use and integrate ICT into their future teaching.

In keeping with international practices, the Ministry of National Education (MoNE) in Turkey also prepared standards for various types of teachers regarding effective and efficient ICT integration into educational settings (MoNE 2006). These standards reflect fundamental concepts, knowledge, skills, and attitudes that teachers should possess when applying ICT in educational settings. It is the responsibility of teacher education programs in Turkey to provide instruction that will allow all teachers to meet these standards. Turkish teacher education programs have accordingly redesigned their curricula to enable prospective teachers to become competent users of new technologies. Within both primary and secondary teacher education programs, ICT courses namely 'Computer' and 'Instructional Technology and Material Development (ITMD)' became compulsory requirements for attaining teaching credentials as of 1998 (Goktas, Yildirim, and Yildirim 2008, p.169).

In Turkey, the ICT integrated preservice teacher education curriculum has been in use since 1998. Although some of the prior studies, which were designed to facilitate the development of teacher education policies and the integration of ICT, have affected the ICT competencies of K-12 teachers (Becker 1999, p.24; MACQT 1999, pp.62-65; Moursund and Bielefeldt 1999, pp.22-25; SRI 2002, p.32; Thompson, Bull, and Willis 2001; Yildirim 2000, pp.488-492), there is currently insufficient research on this subject regarding Turkey. Very few research studies have investigated the outcomes of this curriculum. Hence, it is not presently clear whether this curriculum is sufficiently helping prospective teachers to acquire required ICT competencies, and what the contributing factors are in acquiring ICT competencies. Therefore, this study aims to investigate the current state of ICT competencies of Turkish K-12 teachers in regard to gender, computer ownership, ICT related courses and training, and the influencing factors in acquiring ICT competencies. This study addresses the following research questions:

(1) What are the K-12 teachers' perceived ICT competencies?

(2) Are there significant differences in perceived ICT competencies among K-12 teachers regarding to gender, preservice ICT courses, in-service ICT training, and computer ownership?

(3) What are the contributing factors that influence the acquisition of ICT competencies of K-12 teachers?

2. Method

In this study, the descriptive research method was used to investigate K-12 teachers' perceived ICT competencies and the related issues. The data were collected by means of a questionnaire. According to the MoNE statistics, there were 558,876 primary and secondary school teachers in Turkey as of 2004. In the study, initially the K-12 teachers were clustered into twelve statistical regions using Nomenclature of Units for Territorial Statistics (NUTS) Level 1 as representative of the population. Subsequently, 92 K-12 schools in 35 provinces (including at least one province from each region) were selected by the convenience sampling method. The questionnaires were sent to 3,353 K-12 teachers from the selected schools in May 2005. Follow-up questionnaires were sent to those who did not respond to the first query in June and July 2005. In all, 1,429 K-12 teachers responded to the questionnaire. The return rate was 42.6 percent (see Table 1).

The questionnaire used in this study was developed by the researchers following a review of similar instruments in the literature (Preston, Cox, and Cox 2000; Orhun 2000, pp.131-146; Queitzsch 1997; SEIRTEC 1998). It consisted of three main sections: demographics, ICT competencies, and influencing factors in acquiring ICT competencies. The demographics section consisted of 16 open-ended and multiple choices items. The ICT competency section consisted of 24 five-point Likert-type items (1 indicating 'Completely Insufficient' to 5 indicating 'Completely Sufficient') of which 13 items for basic ICT competencies and 11 items for advanced ICT competencies. The influencing factors in acquiring ICT competencies section was composed of 11 five-point Likert-type items (1 indicating 'Strongly Disagree' to 5 indicating 'Strongly Agree'). After a peer review by four graduate students, seven test construction and ICT experts examined the instrument, and based on their feedback, the

instrument was revised. It was then checked by a Turkish language expert for clarity. After the revision, a pilot test was conducted with 121 K-12 teachers from three different provinces, and the Cronbach Alpha coefficient was calculated as 0.81. After gathering data from 1,429 K-12 teachers, the Cronbach Alpha coefficient was recalculated as 0.97. Both values are higher than the 0.80 criterion which is regarded as internally reliable (Bryman and Cramer 1997, p.257). Subsequently, a factor analysis was calculated to identify whether the items measured two factors: basic ICT competencies and advanced ICT competencies. The Cronbach Alpha was found to be 0.97 for factor 1, and 0.94 for factor 2.

The data collected by means of the questionnaire were analyzed using descriptive and inferential statistics. Descriptive analysis was used to investigate the K-12 teachers' perceived ICT competencies and the influencing factors. The data were coded and prepared for analysis using the statistical analysis software SPSS 12.0. Frequencies, means, percentages, and standard deviations of each item were calculated, and then the items were rank ordered from highest to lowest. Inferential statistics methods, such as Pearson Correlation, Univariate Analysis of Variances (ANOVA), and Post-Hoc tests, were used to investigate the relationship between demographic characteristics (gender, computer ownership, preservice ICT courses, and prior in-service ICT training) and perceived ICT competencies, and differences in perceived ICT competencies relating to demographic characteristics.

3. Findings

Before presenting the results of this study, demographics of the participants were provided in the following section. The findings of the study are then provided in relation to the research questions.

3.1. Demographic Information of the Participants

As shown in Table 1, 61.2% of the K-12 teachers who participated in this study were male, and 38.8% were female. Regarding computer access, 59.8% of the teachers had computers at home, and 35.3% of the teachers who owned a computer had Internet access. 87.1% of the teachers indicated that they had computer access at school, and 75.4% of those had Internet access. While 57.6% of the teachers had taken

in-service ICT training, 35.4% had not received any ICT training. As can be seen in Table 1, approximately 57% of the teachers had taken preservice ICT courses during their undergraduate study.

Table 1. Demographic characteristics of the K-12 teachers

	f	%		*f*	%
Gender			**School Computer**		
Male	875	61.2	No Response	25	1.7
Female	554	38.8	No school computer	160	11.2
Preservice ICT Courses			Have school computer	1244	87.1
No Response	100	7.0	With Internet access	1077	75.4
Had Not Taken	506	35.4	Without Internet access	167	11.7
Had Taken Only 'Computer' Course	293	20.5	**Home Computer**		
Had Taken Only 'ITMD' Course	259	18.1	No Response	19	1.3
Had Taken both Courses	271	19.0	No home computer	556	38.9
In-service ICT Training			Have home computer	854	59.8
No Response	106	7.4	With Internet access	504	35.3
Not Taken	846	59.2	Without Internet access	350	24.5
Had Taken in-service ICT training	477	33.4			

n=1429

3.2. Perceived ICT Competencies of the K-12 Teachers

The perceived ICT competencies were examined using the ICT competency subscale in the questionnaire. The subscale includes competencies on 1) basic ICT knowledge and skills, and 2) advanced ICT knowledge and skills. The participants rated their levels of agreement with the questionnaire statements by using a five-point Likert-type scale.

As presented in Table 2, the findings indicate that the majority of the participants did not perceive themselves as competent in both basic ICT competencies (M=3.26) and advanced ICT competencies (M=2.97). The majority were neutral regarding most of these competencies. The majority of the K-12 teachers perceived their competency levels as 'sufficient' or 'completely sufficient' in the "use of operating systems" (71.5%, M=3.64), "identifying legal, ethical, and societal issues related to ICT" (64.5%, M=3.57), and "use of word processor for personal and institutional purposes" (68%, M= 3.55). On the other hand, "use of hypermedia and multimedia tools to support instruction" (33.1%,

M=2.61) was perceived as the lowest competency. The mean scores of the remaining competency statements were at the 'neutral' or 'insufficient' level (ranging from M=3.26 to M=2.61).

Table 2. Perceived ICT competencies of the K-12 teachers

Competencies	%					M	SD
	Completely Insufficient (1)	Insufficient (2)	Neutral (3)	Sufficient (4)	Completely Sufficient (5)		
Basic ICT competencies (Factor 1)							
Use of operating systems	7.4	15.3	5.8	49.2	22.3	3.64	1.19
Identify legal, ethical, and societal issues related to use of ICT	12.1	13.0	10.4	34.8	29.7	3.57	1.35
Use of word processors for personal and institutional purposes	11.5	13.2	7.3	44.8	23.2	3.55	1.29
Use of spreadsheets for personal and institutional purposes	14.3	19.6	10.2	37.6	18.3	3.26	1.34
Use of ICT for communication	15.5	17.7	10.5	40.4	15.9	3.24	1.33
Use of ICT for collecting data	15.8	17.6	10.7	40.9	14.9	3.22	1.33
Use of ICT for knowledge management	17.5	19.6	13.9	36.6	12.4	3.07	1.32
Use of presentation software for personal and institutional purposes	18.8	21.3	12.2	32.6	15.1	3.04	1.37
Use of ICT for decision-making	19.9	20.1	19.6	30.9	9.6	2.90	1.29
Use of ICT for problem solving	21.2	21.5	16.8	31.5	8.9	2.85	1.31
Factor 1 overall						**3.26**	1.07
Advanced ICT competencies (Factor 2)							
Use of communication tools to support instruction	14.0	20.5	12.1	42.5	10.9	3.16	1.26
Use of ICT to enhance personal development	15.1	20.1	11.5	40.3	12.9	3.16	1.30
Use of ICT to support instruction out of classroom	14.1	21.2	11.3	42.6	10.8	3.15	1.27
Use of ICT to support instruction process in classroom	16.6	22.0	10.7	38.9	11.9	3.08	1.32
Use of computer-aided instruction materials	17.0	21.5	10.2	39.8	11.5	3.07	1.32
Use of ICT in assessment process of a course	19.8	20.3	13.2	36.1	10.7	2.98	1.33
Evaluation of computer-aided instruction materials	18.0	22.3	15.4	34.8	9.3	2.95	1.29
Use of ICT in implementation process of a course	20.6	20.9	12.6	35.2	10.7	2.94	1.34
Identify, select, and evaluate ICT resources	17.0	23.6	18.5	32.4	8.5	2.92	1.25
Use of ICT in design process of a course	20.8	21.9	16.3	31.7	9.2	2.87	1.31
Use of ICT in development process of a course	21.3	21.4	15.8	33.1	8.4	2.86	1.30
Integrate ICT into courses	19.4	23.2	17.9	31.3	8.2	2.86	1.27
Use of ICT in analysis process of a course	21.9	23.6	18.8	28.3	7.4	2.76	1.27
Use of hypermedia and multimedia tools to support instruction	28.2	24.2	14.5	24.2	8.9	2.61	1.34
Factor 2 overall						**2.97**	1.10
Overall						**3.10**	1.05

3.3. The Effects of Demographic Characteristics on the K-12 Teachers' Perceived ICT Competencies

The second issue investigated in this study is the differences in the K-12 teachers' perceived ICT competencies in relation to their demographic characteristics: gender, computer ownership, ICT courses taken during their preservice teacher education program, and prior in-service ICT training. For this purpose, correlation analysis, ANOVA, and Post-Hoc tests were conducted. The teachers' demographic characteristics are shown in Table 1.

Table 3 presents the correlation analysis results between perceived ICT competencies and the demographic characteristics. Three of the demographic characteristics: 'gender' (-.094), 'preservice ICT courses' (.162), and 'computer ownership' (-.212), are related significantly to perceived ICT competencies scores. However, the 'gender' and 'computer ownership' variables have a negative correlation with perceived ICT competencies scores.

Table 3. Correlations between perceived ICT competencies and the demographic characteristics

Variable	1	2	3	4	5
1. Gender		.061*	.023	-.017	-.094**
2. Preservice ICT courses			.066*	-.020	.162**
3. In-service ICT training				.045	-.039
4. Computer ownership					-.212**
5. ICT Competency					

Note: levels of significance: p<0.01 level: **, p<0.05 level: *

Table 4 presents the ANOVA results. There were main significant effects from 'gender' (p=.000), 'preservice ICT courses' (p=.000), and 'computer ownership' (p=.000). The other main effects did not reach a significant level.

Table 4. Main and interaction effects of demographic characteristics on perceived ICT competencies

Source	*df*	*F*	Sig.	Partial η2
Gender	1	14.529**	.000	.012
Preservice ICT courses	3	9.408**	.000	.023
In-service ICT training	1	.451	.502	.000
Computer ownership	1	41.986**	.000	.034
Gender * Preservice ICT courses	3	.422	.737	.001
Gender * In-service ICT training	1	2.616	.106	.002
Preservice ICT courses * In-service ICT training	3	2.963*	.031	.007
Gender * Preservice ICT courses * In-service ICT training	3	.109	.955	.000
Gender * Computer ownership	1	.001	.981	.000
Preservice ICT courses * Computer ownership	3	.856	.463	.002
Gender * Preservice ICT courses * Computer ownership	3	1.006	.389	.003
In-service ICT training * Computer ownership	1	.062	.803	.000
Gender * In-service ICT training * Computer ownership	1	.015	.903	.000
Preservice ICT courses * In-service ICT training * Computer ownership	3	.978	.402	.002
Gender*Preservice ICT courses*In-service ICT training*Computer ownership	3	.535	.659	.001
S within-group error	1187			

Note: levels of significance: p<0.001 level: **, p<0.05 level: *

3.3.1. Gender

The ANOVA results indicate that there is a significant effect of 'gender' on 'perceived ICT competencies' scores; F (1, 1187)=14.529, p<.001, η^2=0.012 of the variance in the perceived ICT competencies scores was due to gender (see Table 4). Moreover, as presented in Table 5, the 'perceived ICT competency' mean score of the males (M=3.18) is higher than that of the females (M=2.97). It can be stated that the males perceived themselves to be more competent ICT users than the females did. This is a consistent result in the correlation analysis. In this correlation analysis, males were coded as 1 and females as 2. That is, while gender is increasing, perceived ICT competencies score is decreasing, and negative correlation between gender and perceived ICT competency was observed (see Table 3).

Table 5. The K-12 teachers' perceived ICT competencies in relation to gender

Gender	N	Factor 1 (basic ICT competencies)		Factor 2 (advanced ICT competencies)		Overall	
		M	SD	M	SD	M	SD
Male	875	3.34	1.06	3.06	1.09	3.18	1.04
Female	554	3.12	1.09	2.84	1.10	2.97	1.05

3.3.2. Preservice ICT Courses

The ANOVA results (see Table 4) indicate that ICT courses taken in preservice teacher education programs exerted a significant effect on perceived ICT competencies scores; F (3, 1187) = 9.408, p<.001, η^2=0.023 of the variance in the perceived ICT competencies scores was due to ICT courses taken in preservice. Follow-up Post-Hoc tests were performed for the main effect of the four groups. The follow-up tests consisted of all pair-wise comparisons. The results of these tests, and the means and standard deviations of the groups, are presented in Table 6. As indicated in the table, there are significant differences among the groups. Those K-12 teachers who had taken either both courses ('Instructional Technology and Material Development,' and 'Computer') or only the 'Computer' course perceived their ICT competencies to be higher compared to K-12 teachers who had not taken any ICT courses. This could mean that K-12 teachers who take 'Computer' or both ICT courses during their preservice teacher education program tend to perceive themselves as more competent ICT users than those teachers who do not take 'Computer' or both ICT courses.

Table 6. Tukey HSD analysis results regarding differences among the groups

Groups	N	Factor 1 (basic ICT competencies)		Factor 2 (advanced ICT competencies)		Overall		Differences			
		M	SD	M	SD	M	SD	1	2	3	4
1.Had Not Taken Any Preservice ICT Courses	506	3.05	1.11	2.78	1.12	2.90	1.08	–	*		*
2.Took Only 'Computer' Course	293	3.33	1.03	3.06	1.07	3.19	1.02		–		*
3.Took Only 'ITMD' Course	259	3.18	1.06	2.92	1.09	3.05	1.04			–	*
4. Took Both Courses	271	3.64	0.94	3.30	1.02	3.43	0.94				

Note: * = significant according to Tukey HSD analysis.

3.3.3. In-service ICT Training

The ANOVA results (see Table 4) show that there was no significant effect from in-service ICT training on perceived ICT competencies scores; F (1, 1187) = 0.451, p>.001, η^2=0.000. Table 7 presents the perceived ICT competency mean scores and standard deviations of K-12 teachers who had taken and

who had not taken ICT training. Though there is a slight difference between the mean scores in favor of having ICT training, the difference is not significant.

Table 7. K-12 teachers' ICT competencies in relation to having in-service ICT training

	N	Factor 1 (basic ICT competencies)		Factor 2 (advanced ICT competencies)		Overall	
		M	SD	M	SD	M	SD
Had in-service ICT training	477	3.33	1.04	3.07	1.06	3.19	1.01
Did not have	846	3.26	1.07	2.97	1.11	3.10	1.05

3.3.4. Computer Ownership

As presented in Table 4, the ANOVA results indicate that there is a significant effect from computer ownership on perceived ICT competency scores; F (1, 1187) = 41.986, p<.001, η^2=0.034 of the variance in perceived ICT competencies scores was due to computer ownership. The means and standard deviations for computer ownership are reported in Table 8. The perceived ICT competency mean score of K-12 teachers who owned a computer is higher than the score of who did not. It can be concluded that K-12 teachers who own a computer perceive themselves to be more competent ICT users. This finding is consistent with the correlation analysis (see Table 3).

Table 8. K-12 teachers' ICT competencies in relation to computer ownership

	N	Factor 1 (basic ICT competencies)		Factor 2 (advanced ICT competencies)		Overall	
		M	SD	M	SD	M	SD
Have Own Computer	584	3.45	1.02	3.15	1.07	3.28	1.01
Do Not Have	556	2.96	1.08	2.70	1.08	2.82	1.04

3.4. Factors that Influence K-12 Teachers' ICT Competencies

The third issue examined in this study is the factors that influence K-12 teachers in acquiring their ICT competencies. As can be seen in Table 9, the findings show that personal interest (M=4.32) and possessing a home computer (M=4.04) were rated as the most influential factors, while administrative staff in school (M=2.98) and technology resource teachers (TRTs; M=2.91) were rated as the least influential factors. The other leading factors that contributed to the acquisition of ICT competencies were my family

and friends (M=3.73) and experienced teachers in my school (M=3.44). The results also indicate that 'ITMD' and 'Computer' undergraduate courses are not the leading factors (M=3.08, M=3.02 respectively) that influence ICT competencies. Less than half of participants rated these two preservice ICT courses as important factors in acquiring ICT competencies.

Table 9. Factors that influence K-12 teachers while they are acquiring their ICT competencies

Factors	N	%					M	SD
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree		
Personal Level								
Personal interest	1177	2.0	3.1	3.9	42.6	48.3	4.32	0.85
Having a home computer	980	6.8	7.4	4.3	37.4	44.0	4.04	1.18
My family and friends	1039	4.9	14.1	6.4	51.9	22.7	3.73	1.10
Private courses	799	16.1	52.3	11.3	32.5	14.8	3.05	1.34
School Level								
Experienced teachers in my school	1039	9.6	18.5	7.5	46.6	17.8	3.44	1.24
In-service ICT training	1048	10.4	19.5	11.5	43.6	15.1	3.33	1.24
Computer teachers in my school	962	14.7	22.6	7.3	39.1	16.4	3.20	1.35
Administrative staff in school	1076	12.1	29.9	15.1	33.6	9.2	2.98	1.22
Technology resource teachers[1]	897	17.6	27.9	11.7	31.4	11.4	2.91	1.32
Preservice Training Level								
'ITMD' undergraduate course	743	14.5	26.8	9.3	34.9	14.5	3.08	1.33
'Computer' undergraduate course	882	17.9	28.6	6.2	27.7	19.6	3.02	1.44
Overall	**1330**						**3.54**	

Note: [1]Technology resource teachers: These are the teachers trained by the Ministry of National Education to become "ICT trainer teachers." Their role is to train other teachers, and help successful ICT integration at the school level.

4. Discussion

The analysis of the data reveals that overall, the K-12 teachers did not perceive themselves as competent in ICT, and they responded neutrally regarding both the basic ICT competencies and the advanced ICT competencies. Specifically, the K-12 teachers perceive themselves to be less competent in regard to integrating ICT into the educational process. Ertmer (1999, p.58), Graham, Culatta, Pratt

and West (2004, p.130), Mims, Polly, Shepherd, and Inan (2006, p.19), and Yildirim (2007, pp.179-183) have all stated that teachers are instructed in basic ICT applications rather than in advanced ICT applications. Teachers need to learn not only how to use ICT, but also how to integrate ICT into their future teaching.

The findings indicate that there is a significant difference between male and female teachers' perceived ICT competencies in favor of the males. In the literature, some studies report similar results (Cinar 2002, p.66; Lynch 2001, p.113; Toker 2004, p.77; Torkzadeh, Pflughoeft, and Hall 1999, pp.263-275) while others report different findings (Nanasy 2001, p.75; Snider 2003). These different findings might be due to the social roles of males and females in the Turkish society. While the males were expected to perform better on technical tasks, the females were expected to perform better on domestic tasks. Another reason may be limited financial conditions. People who do not own a computer use public environments such as Internet cafes to access ICT. Cultural factors within Turkish society might encourage males to make greater use of public computer environments than females, as Yalcinalp and Yildirim (2006) mentioned. Thus, cultural factors may be one of the reasons for the difference (Odabasi 2003, p.1041; Toker 2004, p.89).

Another finding of the study is that taking preservice ICT courses has a significant effect on perceived ICT competencies. K-12 teachers who had taken 'Computer' or both ICT courses during their preservice teacher education program perceived themselves to be significantly more competent ICT users than those who had not taken any ICT courses. Though the perceived ICT competency mean score of the K-12 teachers who had taken ICT courses during their preservice teacher education program was not very high, it is promising that ICT courses in the teacher education programs did make some difference for a portion of the teachers. Altun (2003) found a parallel result, which suggests that there is a significant difference between those who have taken a 'Computer' course and those who have not. Regarding ICT integration, the redesign of the teacher education curricula by the Higher Education Council in 1998 was successful to a certain extent. Another reason for the significant differences might be the increased access

to and availability of ICT facilities in schools and homes since 1998. It can be concluded that well-designed preservice ICT courses in teacher education programs and available ICT facilities can increase teachers' ICT competency levels.

In-service ICT training did not have a significant effect on perceived ICT competencies scores. In-service training activities which instruct teachers in the use of ICT are typically organized at the local level. It is clear that in-service ICT training for K-12 teachers has some limitations. It may be argued that in-service ICT training needs to be revised to be more efficient and effective. When planning in-service ICT training, personal, reinforcing, and enabling factors must be taken into consideration. For instance, training programs can be designed according to the K-12 teachers' subject area needs. The training could also focus on "teaching with ICT" rather than "basic ICT applications" in either short-term workshops or seminars. In-service training may be concentrated on pedagogical uses rather than on technical skills or background knowledge for ICT. According to McCarney (2004, p.70), in-service training that is based on technical skills or background knowledge for ICT is unsatisfactory in terms of its impact on the teachers' uses of ICT in the classroom. It is important that the pedagogy of ICT should be made the main focus of in-service training, and this should be built upon in a constructive manner in order to allow teachers to experience more benefits from using ICT in their classrooms (McCarney 2004, p.71; Wu, Chen, Lee, Ho, and Chiou 2004, pp.3453-3455).

Computer ownership was found to have a significant effect on perceived ICT competencies scores. K-12 teachers who have their own computer perceived themselves as more competent in ICT. This finding is consistent with the literature (Toker 2004, pp.76-77; Askar and Umay 2001, p.2263; Cinar 2002, p.69). Owning a computer appears to increase the practical usage of ICT, as it allows the owner to gain more experience. Therefore, it is not surprising that this factor has a positive effect on perceived ICT competencies scores. The results suggest that computers should be made available and accessible to teachers for use in schools. With this in mind, in the past few years, MoNE has initiated a campaign to

purchase PCs and notebooks at low-cost for K-12 teachers. Further studies are required to ascertain the results of this campaign.

In this study, the factors which influence the acquisition of ICT competencies were categorized into three levels: the personal level, the school level, and the preservice training level. The findings show that the majority of the participants perceived the personal level factors—such as personal interest, possessing a home computer, and family and friends—to be more influential than the school level and preservice training level factors. The results also show that preservice ICT courses were not regarded as important influencing factors in the acquisition of ICT competencies. This may be due to the fact that the majority of the participants completed their preservice teacher education programs before the curriculum revision in 1998. The factor most significant in influencing K-12 teachers ICT competencies were personal interest. Another interesting finding is that the factor TRTs was rated as the least influential factor in the acquisition of ICT competencies. The purpose of having a TRT in schools is to help other teachers learn and integrate ICT. According to Moallem and Micallef (1997, p.240) TRTs were effective in increasing teachers' ICT competencies. This statement could be true in Turkey if the innovator teachers could have been selected and trained as TRTs. However, the findings indicated that having TRTs in the current school system may not fulfill its intended aim.

5. Conclusion and Implications

Ultimately, we hoped to provide both teacher educators and professional developers with specific suggestions for preparing and supporting preservice and in-service teachers in their efforts to become effective ICT integration. These suggestions may help policy makers in other countries to create a roadmap which will lead teachers to become sufficient users of ICT in their classes.

This study highlighted that K-12 teachers need to be aware of more advanced ICT applications than the basic ones (like MS Office), and they need to be further educated regarding methods of integrating ICT into educational processes. The classic in-service ICT training in the K-12 schools was found to be ineffective. The evidence suggests that alternative training methods and strategies should

instead be employed. New training procedures can be designed according to the K-12 teachers' subject area needs, and these procedures should also focus on "teaching with ICT" rather than "basic ICT applications". Instead of having TRTs in schools, "innovators and early adapters" within the teacher population might be identified and encouraged to help other teachers with the ICT integration process. We also suggest that special funds may be created to financially assist every teacher to purchase a personal computer. Regarding future research, further studies utilizing random sampling should be designed to increase the generalizability of these findings. In addition, follow-up interviews or observations would help to generate a fuller understanding of our reported survey results. To be able to explicate the findings of the current study more deeply about TRTs, further research studies that examine the selection criteria used, their field of expertise, ICT conditions provided for them, their course load need to conducted.

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