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Factors that influence pre-service teachers' ICT usage in education

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The purpose of the current study was to investigate the role of internal factors (e.g. attitudes towards computers and internet, self-confidence, and knowledge) and external factors (perceived support) on the level of information and communication technology (ICT) usage. The participants were 1898 pre-service teachers in Turkey. The results revealed that Turkey, like many other developing countries in the world, is in the early phase of ICT integration in education. Most pre-service teachers reported that they use only basic ICT applications for educational purposes. Internal and external factors were found to be related to each other and to ICT usage level. In general, male pre-service teachers' knowledge and usage levels of ICT were higher than that of female teachers.

Keywords: attitude towards computers; ICT integration; pre-service teacher education; self-confidence; perceived support

Introduction

Innovations in information and communication technology (ICT) have challenged the use of traditional instruction methods, changed learning and teaching practices, and made a contribution to emerging new teaching methods. With the possibilities and opportunities that it offers, ICT has become a critical part of educational reform efforts and is seen as an integral component of school curriculum (Al-Mahmood and Gruba 2007; International Technology Education Association 1996; Niederhauser and Stoddart 2001; Papanastasiou and Angeli, 2008). As development indexes (ITU 2009; World Bank 2007) have pointed out, many countries have allocated enormous budgets for ICT integration in education, defined ICT standards, developed programmes, and put ICT courses in teaching education programmes, in order to educate pre-service and in-service teachers on the use of ICT in education (Eurydice 2001, 2004; Şahinkayası 2008; Tondeur, Braak and Valcke 2007; Uşun 2009).

Although efforts have been made to educate teachers on ICT integration, many research studies have revealed that most teachers do not integrate ICT into their classroom activities effectively (Bullock 2004; Kiridis, Drossos and Tsakiridou 2006; Lim 2007; OECD 2004; Tezci 2009; Valcke et al. 2007; Yalın, Karadeniz and Şahin 2007; Yıldırım 2007). It should be noted that ICT alone may not contribute significantly to educational reform efforts without the integration of ICT into education.

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Research studies have shown that having a positive attitude towards ICT is necessary, but not sufficient by itself, in achieving effective ways of using ICT in education. In addition to attitude, other factors, such as beliefs, self-confidence (Galanouli and McNair 2001; Li and Kirkup 2007; Sam, Othman and Nordin 2005; Smarkola 2008), ability, knowledge (Alev 2003; Jones 2002; Markauskaite 2007), school climate, and support (Albirini 2006; Butler and Sellbom 2002; Goktaş, Yıldırım and Yıldırım 2009; Hoffman 2001; Papanastasiou and Angeli 2008) play a pivotal role in successful ICT integration. According to Papanastasiou and Angeli (2008, 69), failure in educational reform efforts springs mainly from ignoring factors such as values, beliefs, and attitudes.

The extent to which pre-service teachers attain necessary knowledge levels regarding ICT in teacher education programmes, and factors that affect their knowledge levels, have received little attention by researchers and policymakers (Albirini 2006; Uşun 2003). Uşun (2003) indicated that comprehensive research is necessary to understand where the country of Turkey is in terms of ICT integration in education. It is also necessary to identify factors that affect pre-service teachers' use of ICT. Although many researchers conducted studies regarding this issue, they focused on few factors and used a small number of participants (e.g. Alev 2003; Birisci, Metin and Karakaş 2009; Goktas, Yildirim and Yildirim 2008, 2009; Gülbahar 2008a, 2008b; Gülbahar and Güven 2008; İşman and Canan 2008; İşman and Çelikli 2009; Usluel 2007).

It is clear that conducting a new study, which involves a large number of pre-service teachers who represent different departments and universities, is necessary to identify attitudes towards, self-confidence about, perceived support for, frequency of, and ways of using ICT. Therefore, the current study was undertaken to address this missing component. Information from the current study might help policymakers, researchers, and teacher educators understand where the country of Turkey is in terms of ICT integration in education. Pre-service teachers are the teachers of the future. They are expected to integrate ICT into their future classroom activities. Thus, it is important to identify their knowledge and use of ICT in education, and understand factors associated with that knowledge and use. The current study used both internal factors (such as self-confidence and attitudes) and external factors (such as perceived support) to investigate their role in ICT integration in education. Information regarding these factors is given below.

Attitudes towards ICT

Attitudes 'are general evaluations people make about themselves, other persons, objects or issues and ... involve lasting likes and dislikes, preferences, and aversions, toward specific aspects of the external world' (Baron and Byrne 1991, 137). Attitudes have three components: cognitive, affective, and behavioural (Smith 1968). For example, a classroom teacher might think that computers are helpful in education (cognitive component). Thus, he might like computers (affective component) and might advise his colleagues to use computers in their classroom (behavioural component). Attitudes towards computers involve individuals' beliefs, values, and judgements about them.

Attitudes towards computers and the Internet play an important role in computer-related behaviour. For example, Khine (2001) found a positive and significant correlation between attitude towards computers and computer usage for educational

purposes. In her Master's thesis, Gulbahar (2008a) found a positive correlation among pre-service teachers' experiences with computers, their attitudes towards them, and their confidence in using computers in the classroom. Studies conducted in the UK (Garland and Noyes 2004) and Greece (Roussos 2007) revealed a positive correlation between attitude towards computers and computer confidence. Torkzadeh, Chang and Demirhan (2006) identified a positive correlation between attitudes towards ICT and its use in education, and suggested that positive experiences with computers play an important role in developing positive attitudes towards them.

Research studies that looked at the role of gender on attitudes produced mixed results. Although some researchers (e.g. Arch and Cummins 1989; Ogletree and Williams 1990; Schumacher and Morahan-Martin 2001) found that males' attitudes towards computers were more positive than females' attitudes, other researchers (Jackson et al. 2001; Oyelaran-Oyeyinka and Adeya 2004; Shapka and Ferrari 2003) did not identify a significant gender difference between males and females in terms of their computer attitudes. Some researchers (Murphy 2000) found that as computer experiences increase, gender differences decrease.

ICT experience

Personal knowledge and experiences of ICT play an important role in integrating technology into education, and attitudes towards computers (Alev 2003; Ertmer 2005). Although some studies identified a high correlation between experiences and attitudes (Alev 2003; Gülbahar 2008a; Roussos 2007; Schumacher and Morahan-Martin 2001; Tsai, Lin and Tsai 2001), other studies (Garland and Noyes 2004) identified small correlations. Using a sample of Chinese and English students, Li and Kirkup (2007) examined the relationship between attitudes and experiences, and found that these two variables are related, but the magnitude of this relationship differed by culture and gender. Murphy (2000) compared the data from 1996–1997 and 1999–2000, and found that gender differences between ICT usage was nullified in 1999–2000.

A European Commission (2001) report indicated that, as university students' experiences with computers increased, their attitudes towards ICT became more positive; however, using ICT in light of traditional teaching methods had a negative impact on the students' attitudes. The same report also revealed that the students knew how to use word processing programmes, the Internet, and e-mail, and used them more frequently when compared to other types of ICT applications. Moreover, it was indicated that culture, gender, and the departments in which students enroll play an important role in experience with ICT.

In the literature, researchers proposed different ways of measuring ICT experiences. Garland and Noyes (2004) examined researchers' studies and came up with four ways of ICT experience measurement, based on the literature: the amount of time using computers (e.g. hours in a week); access to the computers (e.g. from home or work); frequency of using hardware and software; and ability level regarding computers and the Internet.

ICT self-confidence

Self-confidence plays an important role in effectively deploying knowledge and skills in real-life situations. Thus, this subject has received a great deal of attention

by researchers studying ICT. Some researchers identified a positive correlation between experience and ICT self-confidence, and pointed out that the development of self-confidence depends partly on having positive experiences (İşman and Çelikli 2009; Li and Kirkup 2007; Sam, Othman and Nordin 2005; Usluel 2007). Moreover, experiences and self-confidence depend on gender. In a study conducted in Iran, Shashaani and Khalili (2001) found that male students' ICT self-confidence were higher than that of female students. ICT self-confidence is important, because it affects the level of computer usage. In a study conducted in Malaysia, Sam, Othman and Nordin (2005) identified a positive correlation between Internet self-confidence and the level of software usage.

School climate and support

Research conducted in different European countries revealed that ICT integration did not receive sufficient organisational support (see European Schoolnet 2006). In addition, the same report indicated that teachers need to possess a high level of self-confidence with ICT. Thus, they need to be very well educated on how ICT can be integrated into education so that they become confident users of ICT in the classroom. These findings indicate the importance of organisational support in educating pre-service and in-service teachers. Galanouli and McNair (2001) conducted a study on pre-service teachers in Northern Ireland, and found that the pre-service teachers possessed positive attitudes towards ICT, but they needed support to integrate ICT into education. İşman and Canan (2008) pointed out the importance of technical, personal, and academic support in removing barriers associated with ICT integration in Turkey. Similarly, Demiraslan and Usluel (2008) indicated that school support played an important role in helping Turkish teachers to integrate ICT into their classroom.

In summary, research findings associated with ICT integration have revealed that experiences, attitudes, and self-confidence are highly correlated. There were mixed findings associated with gender differences. Organisational support plays an important role in ICT integration. Although extensive research has been conducted to examine factors that influence ICT integration in education, researchers typically focused on few factors in their study. For example, Niederhauser and Perkmen (2010) focused only on internal factors (self-efficacy, expectations, and interests) and found that these factors are inter-related. Based on the literature, the current study used many factors to investigate what influences ICT usage.

The main purpose of this study was to identify Turkish pre-service teachers' perceived experience (knowledge and usage level of ICT), attitudes, self-confidence, and perceived external support, regarding the use of ICT in schools. More specifically, this study was undertaken to uncover inter-relationships among internal factors (e.g. self-confidence, perceived experience, and attitudes) and external factors (e.g. perceived external support and computer ownership) that might affect pre-service teachers' use of ICT.

Method

Participants

There were two groups of participants in this study. The first group consisted of 275 pre-service teachers enrolled in Necatibey Faculty of Education at Balıkesir

University, Turkey. This group was used to test the validity and reliability of the research instruments. The second group consisted of 1898 pre-service teachers in 18 different Turkish universities. Because one of the objectives of the study was to identify the level of ICT knowledge that the pre-service teachers attained at their university, all of the participants were selected from among senior students. Just over half (51%) of the participants were enrolled in social science departments, including early childhood education, elementary education, social studies education, sociology, philosophy, religious studies, and counseling psychology; 28% were enrolled in science departments, including mathematics education, science education, physics education, chemistry education, and biology education; and the rest represented other departments, including art departments (8%), foreign language education (6%), and computer education and instructional technology (CEIT) (6%). The majority of the students (60%) were enrolled in universities established before 1982 (the year that the Turkish Higher Education Institution was established), 20% were enrolled in universities established between 1982 and 1997, and 30% represented new universities, established after 1997. Over three-quarters (78%) of the participants had a personal computer. Of these participants, 58% were female and 42% male. Less than half (45%) of the participants had access to the Internet from home, 14% from school, 32% from Internet cafes and 8% from both home and school.

Instruments

The research instrument used in the current study consisted of five parts: a personal inquiry form; a self-reported ICT experience scale; computer and Internet attitude scales; a perceived self-confidence scale; and a school climate and support scale. The participants indicated their gender, faculty, department, ways of accessing the Internet, and ownership of a computer in the personal inquiry form.

The ICT Software Knowledge Scale (ICT-SKS) and ICT Educational Purpose Scale (ICT-EPS) used in this study were developed by Papanastasiou and Angeli (2008). These scales had been translated into Turkish and used in another study (Tezci 2009). The ICT-SKS consisted of 15 items. The participants indicated their knowledge levels of several types of software on a five-point scale, ranging from 1 (do not know at all) to 5 (know very well). The ICT-EPS consisted of 15 items. The participants indicated the extent to which they use these software packages for an educational purpose on a five-point scale, ranging from 1 (never) to 5 (almost every day). The scores for the items were added up and divided by the number of questions in each scale. Thus, scores in each scale ranged from 1 to 5.

The validity and reliability of these two scales were tested on 275 pre-service teachers. Principal component analysis with varimax rotation was conducted to examine the construct validity of the scales. Cronbach's alpha was reported as an indication of the internal consistency of participants' responses to the scale items.

The principal component analysis on the ICT-SKS resulted in a two-factor solution, which accounted for 61% of the variance among the scale items. The first factor consisted of seven items and accounted for 33% of the variation. The second factor consisted of eight items and accounted for 28% of the variation. The Cronbach's alpha of the overall ICT-SKS was 0.87–0.93 for the first factor and 0.85 for the second factor.

The principal component analysis on the ICT-EPS resulted in a two-factor solution, which accounted for 63% of the variance among the scale items. The first factor consisted of eight items and accounted for 38% of the variation. The second

factor consisted of seven items and accounted for 24% of the variation. The Cronbach's alpha of the overall ICT-EPS was 0.87–0.94 for the first factor and 0.84 for the second factor. These findings agreed with studies by Tezci (2009) and Papanastasiou and Angeli (2008), and provided evidence that both the ICT-EPS and ICT-SKS possess good psychometric properties.

The Computer Attitude Scale (CAS), Self-Confidence Scale (SCS) and School Climate/Support Scales (SCSS) used in the current study were originally developed by Papanastasiou and Angeli (2008). The Internet Attitude Scale was developed by the researcher of the current study. Participants indicated their level of agreement with each item on a five-point scale, ranging from 1 (do not agree at all) to 5 (totally agree). Some items were worded negatively and reverse scored at the data entry stage. The scores for the items were added up and divided by the number of questions in each scale. Thus, scores in each scale ranged from 1 to 5. For the computer attitude and Internet attitude scales, higher scores indicated more positive attitudes. Higher scores for the self-confidence scale indicated stronger self-confidence. Higher scores for the school climate/support scale indicated more positive perceived support.

These scales were used in a previous study, conducted with in-service teachers in Turkey. Because the current study involved pre-service teachers, some scale items were revised to make them relevant for the current study. To ensure content and construct validity, the scales were examined by four instructional technology experts. Based on their opinions, new items were added to the climate/support scale. The new items included: 'our school organises seminars and workshops about computer-assisted instruction', 'our school curriculum offers sufficient courses that help us improve our knowledge about the use of computers and Internet in the classroom', and 'there is no restriction in our schools about using computers and the Internet'. One item, 'the inspector encourages me to integrate computers in teaching and learning', was excluded from the scale, because it was not relevant to the current study. After the revisions, the Internet attitude scale consisted of 23 items, the computer attitude scale 15 items, the self-confidence scale 8 items and the school climate/support scale 14 items.

The scales were administered to 275 pre-service teachers for the pilot study. Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity values were examined first to determine if there was sufficient data for the factor analysis. Results presented in Table 1 reveal that KMO values approached 1 and Bartlett sphericity values were less than .01. These values clearly indicate that the data were suitable for the factor analysis. After this, principal component analysis was conducted on each scale, to determine its construct validity. Table 1 also shows the results of principal component analysis and Cronbach's alpha values as indicators of internal consistency of the participants' responses (reliability analysis).

Principal component analysis on the computer attitude scale resulted in a two-factor solution, which accounted for 56.39% of the variation among the scale items. The first factor accounted for 32.34% of the variation and consisted of nine items. The second item accounted for an additional 24.05% of the variation and consisted of five items. One item, 'I can do what the computer can do equally as well', did not load heavily on any factor; thus, it was excluded from further analysis. The internal consistency of the scale, as indicated by the Cronbach's alpha, was found to be 0.88.

The 23-item Internet attitude scale consisted of three factors, which accounted for 56.13% of the variance among the scale items. The first factor, with 10 items, was

Table 1. Results of factor and reliability analysis.

	KMO Value	Bartlett's Test of Sphericity	Factors	% of Variance	Cumulative %	Cronbach's Alpha
CAS	.898	.000	1. Factor (9 items)	32.34	32.34	.98
			2. Factor (5 items)	24.05	56.39	.86
					Overall	.88
IAS	.916	.000	1. Factor (10 items)	26.57	26.57	.92
			2. Factor (7 items)	18.30	44.87	.86
			3. Factor (6 items)	11.26	56.13	.71
					Overall	.89
SCS	.874	.000	One Factor (8 items)	55.80	55.80	.88
SCSS	.897	.000	1. Factor (8 items)	28.26	28.26	.88
			2. Factor (6 items)	27.68	55.94	.87
					Overall	.89

labelled as 'educational benefits of the Internet'; the second factor, with seven items, as 'effects of the Internet in daily lives'; the third factor, with six items, as 'drawbacks of the Internet'. The overall reliability of the scale was found to be 0.89.

Principal component analysis on the self-confidence scale resulted in a one-factor solution, indicating that all the scale items reflected a unitary self-confidence construct. The one-factor solution accounted for 55.8% of the variation among the scale items. The overall reliability of the scale was found to be 0.88.

The 14-item school climate/support scale consisted of two factors, which accounted for 55.94% of the variance among the scale items. The first factor, with eight items, was labelled as 'educational support in the school' and the second factor, with six items, as 'support regarding infrastructure'. The overall reliability of the scale was found to be 0.89.

Data analysis

Descriptive statistics were analysed to identify the participants' level of knowledge, usage, computer and Internet attitudes, self-confidence, and perceived support regarding ICT. A *t* test was conducted to examine gender difference. An ANOVA was conducted to examine if participants' responses differed by their department. Pearson correlation analysis was carried out to examine the inter-relations among the variables of interest. Finally, stepwise regression analysis was conducted to examine the relative contribution of factors that predicted the level of ICT usage.

Findings

ICT knowledge (ICT-K)

As stated above, the participants indicated their knowledge level of 15 types of ICT on a five-point scale, from 1 (do not know how to use at all) to 5 (know very well). The results of analysis involving ICT-K are presented in Table 2. The participants' overall knowledge level of ICT was found to be low (Mean (M) = 2.48, Standard Deviation (SD) = 0.68) More specifically, their knowledge levels about advanced applications, such as concept mapping (M = 2.20, SD = 1.25), database (M = 2.08, SD = 1.15), animation (M = 1.86, SD = 1.14), microworlds/simulations (M = 1.30,

Table 2. Participants' level of ICT-K (knowledge).

	Percent %							Degree of Freedom = 1896			
	NK	LK	MK	HK	VHK	Mean	SD		Mean	SD	t
Word processing	3.9	8.9	15.2	49.6	22.4	3.78	1.01	M	3.78	1.05	.029
								F	3.78	.99	
Databases	41.8	26.0	17.9	11.0	3.3	2.08	1.15	M	2.15	1.17	2.349*
								F	2.03	1.13	
Spreadsheets	16.7	23.3	26.0	26.7	7.3	2.85	1.20	M	2.97	1.20	3.923*
								F	2.75	1.19	
Graphics	14.6	15.5	23.4	30.5	16.0	3.18	1.29	M	3.16	1.30	.688
								F	3.20	1.27	
Multimedia authoring software	57.7	19.8	12.3	7.4	2.7	1.78	1.09	M	1.92	1.17	4.769*
								F	1.67	1.02	
Presentation software	7.5	10.5	14.1	39.7	28.1	3.71	1.20	M	3.68	1.20	−.745
								F	3.72	1.20	
Concept mapping	41.9	20.3	18.3	15.0	4.5	2.20	1.25	M	2.22	1.24	.505
								F	2.19	1.26	
Internet	1.5	2.5	9.8	45.3	40.9	4.22	.84	M	3.99	.82	1.130
								F	4.20	.84	
Email	5.8	4.8	11.8	39.3	38.3	3.99	1.10	M	3.99	1.08	−.014
								F	4.00	1.12	
Publishing software	62.6	15.9	10.0	7.7	3.7	1.74	1.14	M	1.89	1.24	4.818*
								F	1.63	1.05	
Webpage authoring software	64.4	16.1	9.0	7.3	3.2	1.69	1.10	M	1.83	1.20	4.970*
								F	1.58	1.01	
Programming languages	68.8	15.2	9.5	5.0	1.5	1.55	.96	M	1.65	1.02	3.742*
								F	1.48	.90	
Modelling software	80.7	12.1	4.9	1.9	0.5	1.30	.69	M	1.39	.78	4.914*
								F	1.23	.61	
Microworlds/ Simulations	81.5	10.5	5.1	1.9	0.9	1.30	.74	M	1.38	.83	3.595*
								F	1.23	.66	
Animatation	55.1	18.9	13.6	9.6	2.8	1.86	1.14	M	2.04	1.21	5.788*
								F	1.73	1.07	
Overall ICT-K	40.3	14.7	13.4	19.9	11.7	2.48	.68	M	2.55	.73	4.027*
								F	2.43	.63	

Notes: *$p < 0.05$; M = Male (n = 806), F = Female (n = 1092); NK = No knowledge at all, LK = Little knowledge, MK = Moderate knowledge, HK = High knowledge, VHK = Very high knowledge.

SD = 0.74), modelling software (M = 1.30, SD = 0.69), programming languages (M = 1.55, SD = 0.96), web authoring software (M = 1.69, SD = 1.10), publishing software (M = 1.74, SD = 1.14), and multimedia software (M = 1.78, SD = 1.09) were very low. For such advanced programmes, male participants' knowledge was found to be higher than female students' knowledge.

The participants' knowledge level of the Internet was high (M = 4.22, SD = 0.84). More specifically, 86.2% of them indicated that they knew how to use the Internet 'very well' or 'well'. Their knowledge levels of applications such as e-mail (M = 3.99, SD = 1.10), word processing (M = 3.78, SD = 1.01), and presentation software (M = 3.71, SD = 1.20) were moderately high. In general, no gender differences existed for knowledge of such basic applications.

Although the male pre-service teachers' overall knowledge level (M = 2.55, SD = 0.73) was found to be higher than the female pre-service teachers' knowledge level (M = 2.43, SD = 0.63), this finding should be interpreted with caution. This study used a very high number of participants. Even small differences might become statistically significant. Thus, the effect size was calculated to examine the magnitude of difference. Cohen's d value was found to be 0.19, which indicates a small effect size. This result suggests that the difference between male and female pre-service teachers has little practical importance.

ICT usage (ICT-U)

As stated above, the participants indicated their level of usage of 15 ICT applications for educational purposes on a five-point scale, ranging from 1 (never) to 5 (almost every day). The results of analysis involving ICT-U are presented in Table 3. The overall ICT usage for educational purposes was found to be low (M = 2.15, SD = 0.51). The male participants' levels of ICT usage (M = 2.24, SD = 0.57) were higher than that of the female participants (M = 2.08, SD = 0.46). Cohen's d value was found to be 0.31, which indicates a moderate effect size. This finding suggests that the difference between male and female participants has practical importance and thus deserves close attention.

A closer examination of Table 3 reveals that the participants use ICT to access the Internet (M = 4.16, SD = 1.03) and to communicate with other people (M = 3.90, SD = 1.11) more frequently than for other types of ICT applications. Other frequent usage of ICT was for word processing (M = 3.26, SD = 1.08), making presentations (M = 2.81, SD = .89), and playing games (M = 2.65, SD = 1.31). On the other hand, the least frequent methods of using ICT were found to be for modelling complex systems (M = 1.18, SD = 0.57), writing computer programmes (M = 1.26, SD = 0.66), publishing materials (M = 1.38, SD = 0.75), and developing web pages (M = 1.41, SD = 0.86). As indicated by the *t* test scores, male participants, in general, use ICT for educational purpose more frequently than do female students.

Computer attitude (CA), Internet attitude (IA), self-confidence (SC), and school climate/support (SCS)

The analysis of descriptive statistics revealed that the participants' overall attitudes towards computers (M = 3.71, SD = 0.50) and the Internet (M = 3.60, SD = 0.44) were, in general, positive. Their overall self-confidence (M = 3.41, SD = 0.66) was moderately strong. Their perceived school climate/support was relatively low

Table 3. Participants' level of ICT usage for educational purposes.

	Percent %							Degree of Freedom = 1896			
	N	OTS	OTM	OTW	AED	Mean	SD		Mean	SD	t
Playing games	25.1	25.5	18.4	21.6	9.4	2.65	1.31	M	3.01	1.28	10.488*
								F	2.38	1.27	
Making presentations	4.2	36.1	37.2	19.6	2.9	2.81	.89	M	2.83	.92	.732
								F	2.80	.88	
Word processing	4.9	21.5	29.3	31.6	12.7	3.26	1.08	M	3.25	1.10	−.182
								F	3.26	1.07	
Publishing materials	74.5	16.7	5.8	2.3	.7	1.38	.75	M	1.50	.88	5.780*
								F	1.29	.64	
Preparing spreadsheets	71.7	17.6	7.6	2.4	.6	1.43	.78	M	1.56	.91	6.513*
								F	1.33	.66	
Creating graphics	27.8	39.4	18.6	10.9	3.3	2.23	1.07	M	2.32	1.11	3.293*
								F	2.16	1.03	
Communication	4.6	7.8	15.5	36.5	35.4	3.90	1.11	M	3.87	127	−1.016
								F	3.93	1.11	
Accessing Internet	3.8	4.5	10.3	34.2	47.1	4.16	1.03	M	4.25	.97	2.946*
								F	4.10	1.07	
Developing web pages	75.5	13.6	6.4	2.6	1.7	1.41	.86	M	1.55	1.00	5.925*
								F	1.31	.72	
Developing multimedia	73.7	16.2	6.1	2.6	1.4	1.42	.83	M	1.56	.91	6.320*
								F	1.32	.98	
Authoring microworlds /simulations	79.6	14.6	3.7	1.5	.5	1.29	.65	M	1.40	.79	6.301*
								F	1.21	.52	
Concept mapping	62.2	27.0	7.6	2.5	.6	1.52	.79	M	1.55	.84	1.362
								F	1.50	.74	
Modelling complex systems	87.7	8.6	2.1	.9	.6	1.18	.57	M	1.26	.70	5.013*
								F	1.12	.44	
Computer programming	83.0	10.8	3.9	1.5	.6	1.26	.66	M	1.32	.75	3.410*
								F	1.21	.58	
Using educational CD	26.2	36.4	21.7	12.4	3.2	2.30	1.08	M	2.33	1.11	1.100
								F	2.27	1.06	
Overall ICT-U	47	19.7	13	12.2	8.1	2.15	.51	M	2.24	.57	6.609*
								F	2.08	.46	

Notes: *p< 0.05; M = Male (n = 806), F = Female (n = 1092); N = Never, S = Once or twice a semester, M = Once or twice a month, W = Once or twice a week, ED = Almost every day.

(M = 2.85, SD = 0.72). The male participants' overall computer attitudes (M = 3.75, SD = 0.52) were more positive than the female participants' (M = 3.69, SD = 0.49); however, the effect size was found to be very low (Cohen's d = 0.12). No gender differences existed for Internet attitude, self-confidence and school climate/support.

In addition to gender differences, the participants' overall scores were compared based on the departments in which they enrolled (see Table 4). Not surprisingly, the CEIT students' overall scores for each scale were higher than those of the students enrolled in other departments. In addition, students enrolled in science departments use ICT more frequently than do students enrolled in social departments.

Correlation and regression analysis

Results presented in Table 5 reveal that all of the variables are correlated to each other. ICT knowledge (Pearson Correlation Value (r) = 0.72, $p < 0.01$) has the highest correlation with ICT usage, followed by self-confidence ($r = 0.51$, $p < 0.01$). Self-confidence is moderately correlated with ICT knowledge ($r = 0.51$, $p < 0.01$)

Table 4. One way ANOVA results for differences based on department.

Scales	Science field	N	Mean	SD	MS	F (4,1893)	p	η^2	Tukey
ICT-K	1-Social	982	2.35	.58	28.031	70.233	0.000*	0.129	5 > 2 > 1,3;5 > 4
	2-Science	530	2.58	.72					
	3-Art	165	2.37	.62					
	4-Language	109	2.42	.61					
	5-CEIT	112	3.36	.64					
ICT-U	1-Social	982	2.05	.44	11.800	49.345	0.000*	0.094	5 > 2 > 1; 5 > 3,4
	2-Science	530	2.23	.56					
	3-Art	165	2.14	.49					
	4-Language	109	2.08	.45					
	5-CEIT	112	2.69	.54					
CAS	1-Social	982	3.71	.48	3.407	13.819	0.000*	0.028	5 > 1,2 > 3; 5 > 4
	2-Science	530	3.71	.50					
	3-Art	165	3.53	.56					
	4-Language	109	3.79	.55					
	5-CEIT	112	3.97	.44					
IAS	1-Social	982	3.59	.44	1.740	9.227	0.000*	0.019	5 > 1,2,3
	2-Science	530	3.58	.41					
	3-Art	165	3.52	.47					
	4-Language	109	3.65	.54					
	5-CEIT	112	3.82	.34					
SC	1-Social	982	3.32	.64	15.986	39.339	0.000*	0.077	5 > 1,2,3,4
	2-Science	530	3.39	.63					
	3-Art	165	3.46	.71					
	4-Language	109	3.45	.67					
	5-CEIT	112	4.11	.49					
SCSS	1-Social	982	2.79	.73	8.575	16.927	0.000*	0.035	5 > 1,2,3,4
	2-Science	530	2.87	.62					
	3-Art	165	2.89	.83					
	4-Language	109	2.71	.77					
	5-CEIT	112	3.35	.66					

Note: * $p < 0.05$

Table 5. Correlations among the variables of interest.

	ICT-U	ICT-K	SC	CA	IA	SCS
ICT-U	–					
ICT-K	0.72	–				
SC	0.51	0.51	–			
CA	0.33	0.31	0.44	–		
IA	0.29	0.27	0.40	0.57	–	
SCS	0.23	0.23	0.35	0.15	0.18	–

Note: All of the correlations were significant at .01 level.

and computer attitudes ($r = 0.44$, $p < 0.01$). In addition, a moderate relationship exists between computer attitude and Internet attitude ($r = 0.57$, $p < 0.01$).

In the stepwise regression analysis, the variables of ICT-K, computer attitude, Internet attitude, self-confidence, school climate/support, gender, ownership of a personal computer, and access to a computer served as the predictor variables. The dependent variable was ICT-U. The results reveal that ICT knowledge ($\beta = 0.47$) self-confidence ($\beta = 0.08$), school climate/support ($\beta = 0.05$), gender ($\beta = 0.10$), and access to computer ($\beta = 0.13$) each made independent contributions to the equation predicting ICT usage. ICT knowledge emerged as the most significant predictor of ICT usage, alone accounting for 55.6% of the variation in ICT-U. The other variables, collectively, accounted for an additional 44.4% of the variation in the ICT.

Discussion

Effective and successful integration of ICT into education depends on a number of factors, such as experience, self-efficacy, attitudes, support, and access (Ertmer 1999; Gülbahar and Güven 2008; Joo 1999; Lim 2007). Some studies focused on internal factors (Perkmen and Cevik 2010; Niederhauser and Perkmen 2010; Sang, Valcke, Braak Tondeur 2010). Although other studies used both internal and external factors (Gübahar 2008b; Jones 2002; Lumpe and Chambers 2001; Usluel 2007), they used a limited number of variables. The current study used a high number of variables in order to predict ICT usage level. Thus, this study provided a more comprehensive perspective in understanding factors that might play an important role in effective and successful integration of ICT into education.

The results of the current study indicate that pre-service teachers might have difficulty with integrating technology into the teaching and learning process. This situation stems from the fact that their knowledge levels regarding technology integration are low. To alleviate this problem, classes focusing on technology integration should be designed in a way that helps the pre-service teacher understand how effective and successful technology integration takes place in the classroom. In addition to the compulsory introductory technology integration classes, elective courses should be added to the curriculum. Technology should also be used for more than just support of traditional teaching methods. A research study by the European Commission (2001) revealed that using technology to support traditional teaching methods negatively affects people's attitudes towards technology use in the classroom.

Another report (European Schoolnet 2006) revealed that most developing countries in Europe are in the early phase of ICT integration in education. Most teachers

use ICT as a productivity tool to complete simple tasks. Consistent with this report, this study revealed that Turkish pre-service teachers used basic ICT applications (e.g. word processing programmes and presentation software). The pre-service teachers also reported that their knowledge level about advanced ICT applications (e.g. modelling software) was low.

The pre-service teachers' attitudes towards computers and the Internet were found to be moderately positive. This discovery is consistent with other studies conducted in different countries (Galanouli and McNair 2001; Garland and Noyes 2004; Hong, Ridzuan and Kuek 2003; Sam, Othman and Nordin 2005; Shashaani and Khalili 2001; Valasidou and Bousiou-Makridou 2008). In the present study, male and female students differed in terms of their computer attitudes. Male students' attitudes towards technology and the Internet were more positive. This supports the findings of Arch and Cummins (1989), Ogletre and Williams (1990), and Schumacher and Morahan-Martin (2001), but contradicts other studies (Gülbahar 2008a; Roussos 2007; Shashaani and Khalili 2001; Shaw and Marlow 1999; Sam, Othman and Nordin 2005).

In this study, no gender differences were found to exist in terms of attitudes towards the Internet. This finding agrees with many other studies (Altun 2003; Garland and Noyes 2004; Shaw and Marlow 1999; Tavşancıl and Keser 2002), but contradicts other studies as well (Li and Kirkup 2007; Tsai, Lin and Tsai 2001). In addition to differences due to gender, the participants' faculty and department was found to be related to their attitudes towards technology and the Internet. Those enrolled in departments such as language teaching and computer education had more positive attitudes towards computers and the Internet than those enrolled in other programmes. The attitude scores were also found to be positively related to knowledge. This suggests that interventions designed to increase pre-service teachers' knowledge might also positively impact their attitudes.

The participants' self-confidence levels regarding ICT were found to be moderate. In a previous study, self-efficacy (a similar construct) was found to be positively related to pre-service teachers' motivation towards the use of technology in the classroom (Niederhauser and Perkmen 2010). Thus, pre-service teachers' self-efficacy or self-confidence regarding ICT should be high in order for them to be more motivated users of ICT, which in turn would lead to successful ICT technology integration. In the current study, no gender difference existed in terms of self-confidence towards ICT. This finding supports another international study conducted in Malaysia (Sam, Othman Nordin 2005). However, other studies did identify gender differences (İşman and Çelkli 2009; Li and Kirkup 2007; Ogletre and Williams 1990; Shashaani and Khalili 2001). The participants' self-confidence levels were also found to be related to their department and faculty: those enrolled in CEIT departments had higher levels of self-confidence than those enrolled in other departments. These differences among the participants might stem from the fact that computer education students had more computer knowledge than the other students did.

The participants' perception of school climate and support were found to be relatively low. Support is considered be an external factor that influences effective ICT integration. Perceived support in the current study was also found to be correlated with internal factors, including attitudes towards computers and the Internet, self-confidence, and knowledge. This result suggests that internal and external factors are inter-related and play an important role in ICT use.

Based on the technology adoption model (Yuen 2000), many European countries spent huge amounts of money on ICT infrastructure in schools. The basic idea behind this model is 'build it and they will come, that is, if teachers were provided with access to computers, they would use it with their students' (Niederhauser and Perkmen 2010, 436). However, many research studies revealed that the mere availability of ICT in the classroom does not guarantee that teachers automatically use it (Bullock 2004; Gülbahar 2008b; OESD 2004; Pelgrum and Law 2003; Sam, Othman and Nordin 2005). Teachers should be supported, both motivationally and technically, so that they can make full use of ICT in the classroom. One possible way to provide teachers with support is to adopt the cultural integration model (Yuen 2000). Pelgrum and Law (2003) indicated that effective ICT integration depends on school leaders' perception and vision regarding ICT and school culture. Tondeur, van Keer, van Braak and Valcke indicated that effective ICT integration occurs when a school has a shared vision, it develops ICT policies, and its teachers 'share the values expressed within the school policy and understand their implications' (Tondeur et al. 2008, 220). In light of the cultural integration model, pre-service and in-service teachers should learn not only how to use technology to enhance traditional ways of teaching (e.g. making a PowerPoint presentation) or as a productivity tool (e.g. preparing exams or grading), they also should learn from a student-centered perspective how ICT can be integrated into classroom activities, in order to promote student learning. Thus, effective ICT integration requires a school culture and support (an external factor) that provides its pre-service and in-service teachers with the necessary knowledge and experience (internal factors) regarding effective and successful ways to integrate ICT into classroom activities.

Creating a school culture regarding ICT integration in teacher education programmes depends partly on faculty members. They should provide a role model for their students by integrating ICT into their classroom activities. They also should create a classroom environment that provides pre-service teachers with hands-on experiences regarding ICT integration. Through observing role models and being exposed to hands-on experiences, pre-service teachers might learn how ICT integration might take place in the classroom effectively, which, in turn, enhances their knowledge, experience, and self-confidence. If this happens, ICT integration goals in Turkey, as well as in other European countries, can be reached more easily.

Notes on contributor

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