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An Assessment of Pre-Service Teachers' Technology Acceptance in Turkey: A Structural Equation Modeling Approach

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The purpose of the study is to examine the pre-service teachers' self reported future behavioral intentions to computer use in Turkey. Four hundred eighty-seven pre-service teachers (n =487, females = 284, males = 203) at Rize University, North East of Turkey took part in the study as participants. Data was collected by a self-reported questionnaire administered to the participants and it based on their responses to six constructs. The Technology Acceptance Model (TAM), as a research framework, and structural equation modeling (SEM) were employed as an analytical technique for the proposed model in the study. This study contributes to the growing interest in using Information Science models to explain the intention to use technology in educational contexts. Overall, the results indicated that (1) perceived usefulness, attitudes to computer use, and computer self-efficacy had direct effects on pre-service teachers' intentions to use technology; (2) pre-service teachers' perceived ease of use, technological complexity, and facilitating conditions had effects on technology acceptance indirectly; and (3) perceived usefulness appeared to be the strongest determinant of behavioral intention. Also, six variables corresponded to approximately 39% of the variance in behavioral intention. These findings propose that TAM is an effective model to explain pre-service teachers' technology acceptance.

Keywords: technology acceptance model, intention, structural equation modeling, pre-service teachers.

The teacher is the key to effective use of technology in teaching and learning. As such, it is important to understand the factors that drive and motivate teachers to use technology for teaching and learning. From the literature, the factors affecting teachers' ability to use technology are classified into two groups: external and internal factors (Eteokleous, 2008). Ertmer (1999) described the external factors as the access to computer technologies, availability of instruction software, time, and technical and management support. The internal factors referred to teachers' beliefs and attitudes to computer technologies, existing classroom environment, and responses to change.

Although the support structure for technology usage has been put in place in many education systems, it has been observed that teachers still do not integrate technology in direct ways (Demiraslan & Usluel, 2005; Gülbahar, 2008; Kadijevich, 2006; Knight, Knight & Teghe, 2006; Mayya, 2007; Orlando, 2009; Teo, Chai, Hung & Lee, 2008; Umay, 2004; van Braak, 2001). For example, Demiraslan and Usluel (2005) found out that all the 114 teachers in their study did not integrate ICT in teaching and learning although they could use the computer. Umay (2004) noted that despite the adequate support structure in the school, teachers were not fully trained to utilize the technologies for their professional tasks and this may be the result of the lack of confidence and professional development. Other studies have corroborated with this study attesting to the need to equip teachers with the necessary skills for effective integration of ICT into the teaching and learning (Cüre & Özdener, 2008; Seferoğlu, Akbıyık, & Bulut, 2008;

Usluel, Mumcu, & Demirarslan, 2007). According to Rosen and Weil (1995), when a teacher doesn't use a computer although there is one in the classroom, students formulate a negative attitude of computers and perceive them to be scary, not easy to learn, and to be avoided. It is also noted that such teachers may, actively or passively, cause arise of technophobia (fear of technology) among students. For these reasons, studies have been conducted to identify the conditions or factors that explain why teachers accept and use technology (Legris, Ingham, & Collerette, 2003).

Also known as technology acceptance, researchers have studied some of the previously mentioned factors for the last two decades (Venkatesh, Morris, Davis, & Davis, 2003). Research on the technology acceptance has involved: (1) determining the factors that cause individuals to accept or reject new technology, (2) designing appropriate implementation strategies and interventions that mitigate problems associated with the rejection of technology, and (3) factors that ensure further and continuing usage of technology (Teo & Schaik, 2009; Teo, Wong, & Chai, 2008). Consequently, several models were developed to explain and predict the technology acceptance. One of these models, the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) is a widely-used and validated model in technology acceptance studies. Overall, the TAM has received empirical support as a valid model in various contexts and a variety of technologies. Figure 1 shows the TAM.

LITERATURE REVIEW

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Davis (1989) and it aims to explain how users perceive and use technology. Theoretically, the TAM was based on the TRA (Theory of Reasoned Action) by Ajzen and Fishbein (1980). The TRA is a socio-psychology behavior theory which posited that social behaviours are dependent on individuals' attitude (Olson & Zanna, 1993). The TAM was formulated with an attempt to identify fundamental variables suggested by previous research that explained the cognitive and affective aspects of technology acceptance. The model specifies the relationships among perceived usefulness, perceived ease of use, attitude towards computer use, and behavioural intention to technology use. Since its development, the TAM has been used as a research framework in many studies under different contexts such as digital library system (Lee & Chung, 2009, Park, Roman), business management (Hernández, Jiménez & Martín, 2008), health care (Aggelidis & Chatzoglou, 2009; Holden & Karsh, 2010), e-shopping (Ha & Stoel, 2009), internet banking (Al-Somali, Gholami, & Clegg, 2009), mobile commerce (Min, Ji, & Qu, 2008; Wu & Wang, 2005), Internet usage (Kim, Park, & Lee, 2007; Porter & Donthu, 2006), social networks (Hossain & Silva, 2009), information technology (Legris, Ingham, & Collerette, 2003), school teachers (Hu, Clark, & Ma, 2003; Yuen & Ma, 2002) and pre-service teachers (Teo, 2009; Teo & van Schaik, 2009).

From the TAM, perceived ease of use is hypothesized to have a direct influence on perceived usefulness. Perceived usefulness is related to the expected relevance of technology with job performance (process and result). On the other hand, perceived ease of use is related with the factors considering the process of technology use (Davis, 1993). Together, perceived usefulness and perceived ease of use have direct influences on attitude towards computer use which, in turn, influences behavioral intention to use technology directly. Finally, the TAM proposed that usage is determined by behavioral intention.

Although TAM has been widely-used, Dishaw and Strong (1999) recommended that the TAM be studied further to obtain more insights into its validity. Another recommendation is to include other variables so that technology integration can be better explained and a wider perspective can be introduced within the TAM framework (Legris et al., 2003). Arising from these suggestions, researchers have identified and examined the relationship between external factors and those specified in the TAM. Among these are computer self-efficacy (Hasan, 2006),

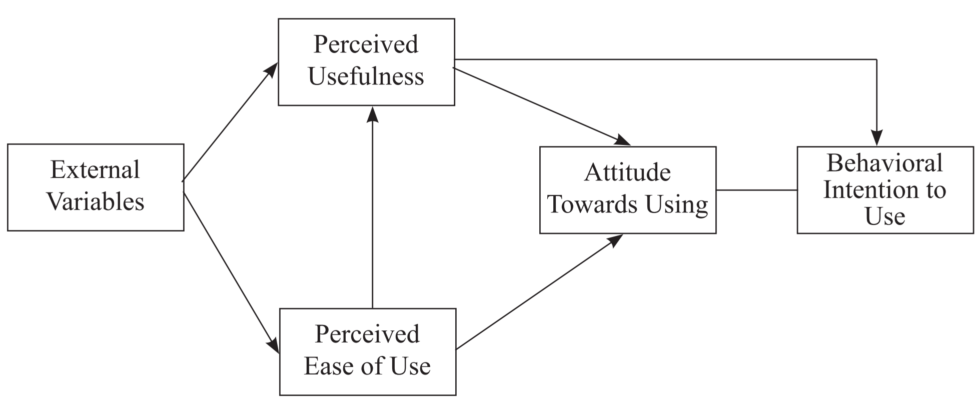

Figure 1. Technology Acceptance Model (Davis, 1989).

facilitating conditions (Cheung & Huang, 2005), and technological complexity (Ngai, Poon, & Chan, 2007).

Aim of this Study

With the prevalence of information and communication technologies use at the individual and institutional level in recent years, changes have taken place in the educational scene in Turkey. These included bringing computers and internet connectivity into the state schools, training teachers to use computer technologies, and integrating information technologies with the education system (Çağıltay, Çakıroğlu, Çağıltay, & Çakıroğlu, 2001). Davis (2003) stated that applying information and communication technologies in teacher education would help future teachers to be equipped with the necessary skills to adequately prepare students to function effectively in the information era. In Turkey, teachers gain most of the necessary skills and behavior for their career during their pre-service teacher training. Hence, it is reasonable to expect that teachers' behavioral intention towards the use of information technologies could be shaped and determined at this stage. In this way, understanding the factors affecting the use of the behavioral intention to use technology would allow teacher educators and policy makers to teach and tailor the curriculum in ways that would imbue and foster positive attitudes among the pre-service teachers to minimize avoidance behaviors towards technology.

Although studies have been conducted on Turkey pre-service teachers in areas of computer anxiety (Ceyhan & Gürcan-Namlu, 2003), computer attitude, and computer self-efficacy (Köseoğlu, Yılmaz, Gerçek, & Soran, 2007), few have explored technology acceptance by using models such as the TAM or its extended models. This study has the potential to give greater clarity to the relationships among the TAM constructs and the efficiency of the TAM for use in Turkey, a Middle-Eastern society. The aim of this study is to determine the technology acceptance of a sample of pre-service teachers in Turkey. The following research questions are formulated for this study:

- What is the validity of the TAM to explain pre-service teachers' technology acceptance?
- Which are the significant relationships among the variables that predict pre-service teachers' technology acceptance?
- What is the contribution of the external variables in the TAM namely, technological complexity, computer self-efficacy and facilitating conditions to explain pre-service teachers' technology acceptance?

RESEARCH MODEL AND HYPOTHESES

TAM hypotheses

Over the years, TAM has been widely accepted as a robust, powerful, and parsimonious model capable of explaining user's technology acceptance in a variety of contexts such as social networks, e-shopping, online games, and healthcare. In addition, since the TAM has been found to possess predictive validity in a number of studies whose participants were pre-service teachers (e.g., Kiraz & Ozdemir, 2006; Ma, Andersson, & Streith, 2005; Teo, 2009, 2010; Teo, Lee, & Chai, 2008), it was adopted in this study. The following TAM hypotheses were formulated:

H_1: Attitudes towards computer use will have a significant influence on behavioral intention.
H_2: Perceived usefulness will have a significant influence on behavioural intention.
H_3: Perceived usefulness will have a significant influence on attitudes towards computer use.
H_4: Perceived ease of use will have a significant influence on perceived usefulness.
H_5: Perceived ease of use will have a significant influence on attitudes towards computer use.

Technological complexity (TC)

Complexity refers to the degree to which an innovation is perceived to be difficult to understand and use (Rogers, 2002), and technological complexity is defined as the degree to which a technology is difficult to understand and use (Thompson, Higgins, & Howell, 1991). Studies have found a significant relationship between TC and perceived usefulness (Lu, Yu, Liu, & Yao, 2003) and perceived ease of use (Cheung & Huang, 2005). The following hypotheses were generated:

H_6: Technological complexity will have a significant influence on perceived usefulness.
H_7: Technological complexity will have a significant influence on perceived ease of use.

Computer self-efficacy (CSE)

Self-efficacy refers to an individual's belief and perception about her/his capacity for coping with various situations, and arranging and performing tasks successfully to show a certain performance (Bandura, 1986). Applied to computers, it refers to an individual's perception of her/his computer usage skills (Gürcan, 2005), Specifically, computer self-efficacy refers to an individual's perception regarding her/himself in relation with computer use and the ability to cope with the challenges (Karsten & Roth, 1998). For example, it has been found that teachers' computer self-efficacy were related to those of their students (Watson, 2006). In an educational environment, computer self-efficacy affects teachers in the way they use technology in the everyday instructional practice and this is important because technology has the potential to transform the roles teachers play in the classroom, from that of a knowledge transmitter to a facilitator of learning. The following hypotheses were formulated:

H_8: Computer self-efficacy will have a significant influence on perceived usefulness.

H_9: Computer self-efficacy will have a significant influence on perceived ease of use.

H_{10}: Computer self-efficacy will have a significant influence on behavioral intention.

Facilitating conditions (FC)

Facilitating conditions refers to factors that are present in the environment which exert an influence over a person's desire to perform a task (Teo, 2010). In other words, facilitating conditions are factors in the environment that influence a person's perception of how easy or difficult to perform a task; for example, using technology. Facilitating conditions include the availability of training and provision of technical support. In education, Groves and Zemel (2000) found that facilitating supports (e.g., skills training, information or materials available, and administrative support) were rated as very important factors which affected the use of instructional technologies in teaching. Lim and Khine (2006) revealed that the teachers in their study had cited poor facilitating conditions (e.g., lack of access to computers, inadequate technical support given to teachers) as barriers to ICT integration in the classroom. Specifically, facilitating conditions were found to have a positive effect on attitude to computer use (Ngai et al., 2007; Teo, 2010). The following hypotheses were proposed:

H_{11}: Facilitating condition will have a significant influence on perceived usefulness.

H_{12}: Facilitating condition will have a significant influence on perceived ease of use.

H_{13}: Facilitating condition will have a significant influence on attitudes towards computer use.

METHOD

Research design

This study employs a structural equation modelling (SEM) approach to analyze an extended TAM that represents the relationship among the seven constructs: behavioural intention, attitude towards computer use, perceived usefulness, perceived ease of use, computer self-efficacy, technological complexity, and facilitating conditions. Data were gathered by using a survey questionnaire comprising questions on demographics and multiple items for each construct in the study (Figure 2). Normal procedures for SEM analysis were applied in this study. Data were screened for missing data and outliers. Then, convergent and discriminant validities of the data were established.

Participants and data collection

Five hundred thirteen pre-service teachers at Rize University (North East of Turkey) were invited to participate in this study (53% of all pre-service teachers). Of these, 487 responded (females = 284, males = 203) to the questionnaire, making the response rate approximately 94%. The mean age of the sample was 19.41 years (SD = 1.60) and the participants were enrolled in the primary school education program. Many of the participants had access to a computer at home (44.1%) and the mean years of computer usage was 4.76 (SD = 2.64). The reported mean hours of daily computer usage was 3.10 (SD = 1.29). Before the survey questionnaire was administered, participants were informed about the purpose of this study and were told that they had a right to withdraw from the study at any time during or after the study. All the participants were volunteers and no payment in money or kind was made to them. They took between eight to 12 minutes to complete the questionnaire and instructions for accomplishing the task were presented in both written and verbal forms. Table 1 shows the profile of the participants.

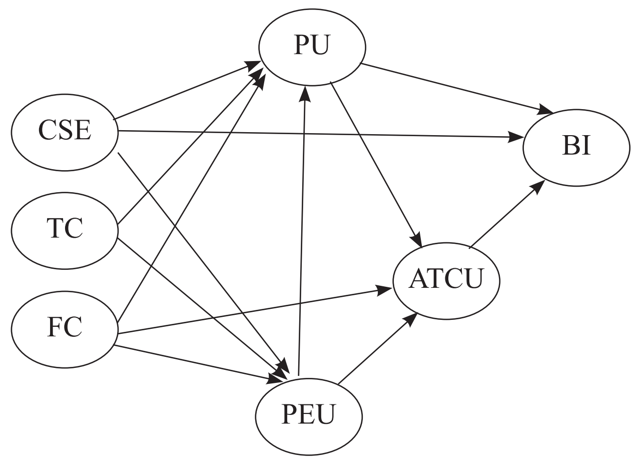

Figure 2. Research model.

Table 1

Demographic Information of the Participants (N=487)

Variable	Number	(%)
Gender		
Female	284	58,3
Male	203	41,7
Computer ownership		
Yes	215	44,1
No	272	55,9
Age	19.41(SD=1.61)	
Mean years of computer usage	4.76(SD=2.64)	
Mean hours of daily computer usage	3.10(SD=1.29)	

Measures

The scale items were adapted from Teo (2009) and listed in the Appendix. It comprised two sections–the first required participants to provide their demographic information, and the second contained 18 statements on the seven constructs in his study. They are: perceived usefulness (PU) (three items), perceived ease of use (PEU) (three items), attitudes towards computer use (ATCU) (three items), technological complexity (TC) (three items), computer self-efficacy (CSE) (two items), facilitating conditions (FC) (two items), and behavioral intention (BI) (two items). Each item was measured on a five-point Likert scale with 1 = strongly disagree and 5 = strongly agree.

In order to render the questionnaires fully comprehensible to the Turkish students, the original survey instrument was translated from English into Turkish by linguists who are competent and experienced in both languages. The Turkish version of the scale was piloted on 110 Turkish students and the result revealed acceptable reliability, with Cronbach alpha coefficient values for constructs. .899 for ATCU, .940 for PU, .951 for PEU, .783 for FC, .844 for TC, .892 for CSE, and .832 for BI were obtained in this pilot study.

RESULTS

Descriptive statistics

The descriptive statistics of the constructs are shown in Table 2. Except for CSE, all means are above the midpoint of 3.00. The standard deviations indicate a narrow spread around the mean and skewness. Also, the kurtosis indices reflect an acceptable degree of normality for the purposes of structural equation modeling (Kline, 2005).

Convergent validity

Fornell and Larcker (1981) proposed three procedures to assess for convergent validity of a set of measurement items: (1) item reliability of each measure, (2) composite reliability of each construct, and (3) the average variance extracted. On the item reliability of an item level, a factor loading of 0.70 and above was recommended (Hair, Black, Babin, & Anderson, 2010). In this study, the factor loadings of all the items in the measurement model ranged from 0.720 to 0.929 (Table 3); thus, they demonstrated convergent validity at the item level.

At the construct level, an alpha of 0.70 and higher was recommended to reflect adequate reliability (Nunnally & Bernstein, 1994). As shown in Table 3, the reliabilities of all the constructs ranged from 0.81 to 0.92, which were above the recommended level by Nunnally and Bernstein. The third indicator of convergent validity, average variance extracted, measures the overall amount of variance that is attributed to the construct in relation to the amount of variance which is attributable to measurement error (Fornell & Larcker, 1981). Convergent validity is judged to be adequate when average variance extracted equals or exceeds 0.50, when the variance captured by the construct exceeds the variance due to the measurement error (Segars, 1997). As shown in Table 3, the convergent validity for the proposed constructs of the measurement model is adequate.

Discriminant validity

Discriminant validity is typically defined as "…the extent to which latent variable A discriminates from other latent variables (e.g., B, C, D)" (Farrell, 2010, p.324). It was assessed by comparing the square root of the average variance extracted (AVE) for a given construct with the correlations between that construct and all other constructs. If the square roots of the AVEs are greater than the off-diagonal elements in the corresponding rows and columns in a correlation matrix, this suggests that a construct is more strongly correlated with its indicators than with the other constructs in the model. In Table 4, the diagonal elements in the correlation matrix have been replaced by the square roots of the average variance extracted. Discriminant has validity and appeared satisfactory for all constructs at both the item and construct levels; hence the constructs in the proposed research model are deemed to be adequate for further analyses.

Table 2
Descriptive Statistics of the Study Constructs

Construct	Item	Mean	SD	Skewness	Kurtosis
PU	3	4.08	0.88	-1.36	2.25
PEU	3	3.21	0.84	0.002	-0.217
ATCU	3	3.56	0.88	-0.332	-0.165
TC	3	3.33	0.78	-0.268	-0.071
CSE	2	2.26	0.74	0.720	1.423
FC	2	3.69	0.92	-0.566	0.171
BI	2	4.21	0.83	-1.421	2.678

Note: PU, perceived usefulness; PEU, perceived ease of use; ATCU, attitude toward computer use; TC, technological complexity; CSE, computer self-efficacy; FC, facilitating conditions; BI, behavioral intention.

Table 3
Results for the Measurement Model

Latent Variables	Item	Factor loading (>70)[a]	Average variance extracted AVE(>50)[a]	Composite reliability (CR) (>0.70)[a]
PU			0.77	0.91
	PU1	0.840		
	PU2	0.920		
	PU3	0.883		
PEU			0.73	0.89
	PEU1	0.816		
	PEU2	0.878		
	PEU3	0.870		
ATCU			0.70	0.87
	ATCU1	0.866		
	ATCU2	0.861		
	ATCU3	0.787		
TC			0.62	0.83
	TC1	0.811		
	TC2	0.720		
	TC3	0.828		
CSE			0.68	0.81
	CSE1	0.836		
	CSE2	0.820		
FC			0.86	0.92
	FC1	0.928		
	FC2	0.929		
BI			0.79	0.88
	BI1	0.879		
	BI2	0.898		

[a] Indicates an acceptable level of reliability or validity.
Fit indices: χ^2 = 204.362 (p = 0.0001), df = 98, χ^2 / df = 2.085, SRMR = 0.060, RMSEA = 0.047 (LO: 0.038, HI: 0.056), CFI = 0.972, TLI = 0.957.
Notes: CR is computed by $(\Sigma\lambda)^2 / (\Sigma\lambda)^2 + (\Sigma\eta)$; AVE is computed by $(\Sigma\lambda^2) / (\Sigma\lambda^2) + (\Sigma\eta)$.

Model fit

The model fit of the research model in this study was tested using AMOS 17.0. From the literature, it is recommended to use several fit indices to measure model fit (Harrington, 2009; Kline, 2005). According to Brown (2006), fit indices are classified into three categories: (1) absolute fit indices, (2) parsimony indices, and (3) comparative fit indices. Absolute fit indices measure how well the proposed model reproduces the observed data. The most common fit index is the model chi-square (χ^2). Another absolute fit index commonly referred to is standardized root mean square residual (SRMR). The next category of fit indices, parsimonious indices, is similar to the absolute fit indices except that it takes the model's complexity into account. An example is the root mean square error of approximation (RMSEA). Finally, the comparative fit indices are used to evaluate a model fit relative to an alternative baseline model (Harrington, 2009). Examples of comparative fit indices include the comparative fit index (CFI) and Tucker–Lewis index (TLI). In this study, all the fit indices mentioned would be used. The commonly used measures of model fit, based on results from an analysis of the structural model, are summarized in Table 5. It also shows the recommended level of acceptable fit and the fit indices for the research model in this study. Except for the χ^2, all values satisfied the recommended level of acceptable fit. Hair et al. (2010) noted that, as the sample size increases, there is a great tendency for the χ^2 to indicate significant differences. For these reason, the ratio of χ^2 to its degree of freedom be computed (χ^2 /df) was used, with a ratio of five or less being indicative of an acceptable fit between the hypothetical model and the sample data. The result of the model fit as shown by the various fit indices in Table 5 indicates that the research model has a good fit.

Hypothesis testing

From the results, ten out of thirteen hypotheses were supported by the data. All the hypotheses relating to the TAM variables were supported. Among the external variables, technological complexity did not have a

Table 4
Discriminant Validity for the Measurement Model

	PU	PEU	ATCU	TC	CSE	FC	BI
PU	(0,88)						
PEU	0,307**	(0,85)					
ATCU	0,632**	0,462**	(0,83)				
TC	0,110*	0,440**	0,208**	(0,78)			
CSE	-0,392**	-0,284**	-0,301**	-0,125**	(0,82)		
FC	0,255**	0,357**	0,224**	0,275**	-0,358**	(0,92)	
BI	0,586**	0,283**	0,446**	0,183**	-0,427**	0,324**	(0,88)

*$p < 0.05$; **$p < 0.01$.
Diagonals in parentheses are square roots of the average variance extracted from observed variables (items); Off-diagonal are correlations between constructs.

Table 5
Fit Indices for the Research Model

Model fit indices	Values	Recommended guidelines*
χ^2	15,333, $p < 0.05$	Non-significant
χ^2/ df (degrees of freedom)	3.067	< 5
TLI	0.953	=>0.90
CFI	0.989	=>0.90
RMSEA	0.065 (0.030, 0.104)	< 0.08 (fair fit)
SRMR	0.0278	< 0.05

*Hair et al. (2010); Schumacker & Lomax (2010)

Table 6.
Hypothesis Testing Results

Hypothesis	Path	Path coefficient	t-value	Results
H_1	ATCU → BI	0.105^{*}	2.309	Supported
H_2	PU → BI	0.431^{**}	9.074	Supported
H_3	PU → ATCU	0.545^{**}	15.625	Supported
H_4	PEU → PU	0.210^{**}	4.407	Supported
H_5	PEU → ATCU	0.304^{**}	8.410	Supported
H_6	TC → PU	0.043	0.941	Not supported
H_7	TC → PEU	-0.367^{**}	-9.140	Supported
H_8	CSE → PU	0.315^{**}	7.145	Supported
H_9	CSE → PEU	0.164^{**}	3.952	Supported
H_{10}	CSE → BI	0.223^{**}	5.798	Supported
H_{11}	FC → PU	0.078	1.697	Not supported
H_{12}	FC → PEU	0.197^{**}	4.605	Supported
H_{13}	FC → ATCU	-0.024	-0.665	Not supported

$^{*}p < 0.05$; $^{**}p < 0.001$.

significant influence on perceived usefulness ($\beta = 0.043$, $p > 0.05$), thereby, it did not support H_6 but had a significant influence on perceived ease of use ($\beta = -0.367$, $p < 0.001$), supporting H_7. Computer self-efficacy had a significant influence on perceived usefulness ($\beta = 0.315$, $p < 0.001$), perceived ease of use ($\beta = 0.164$, $p < 0.001$), and behavioral intention ($\beta = 0.223$, $p < 0.001$), supporting H_8, H_9, and H_{10}, respectively. Finally, facilitating conditions did not have a significant influence on the perceived usefulness ($\beta = 0.078$, $p > 0.05$) and attitude towards computer use ($\beta = -0.024$, $p > 0.05$), thus H_{11} and H_{13} were not supported but they had a significant influence on perceived ease of use ($\beta = 0.197$, $p < 0.001$), supporting H_{12}. Four endogenous variables were tested in the model. Behavioral intention was found to be significantly determined by perceived usefulness, attitude towards computer use, and computer self-efficacy, resulting in an R^2 of 0.39. This means that perceived usefulness, attitude to computer use, and computer self-efficacy explained 39% of the variance in behavioral intention. The other three endogenous variables, attitude towards computer use, perceived usefulness, and perceived ease of use were explained by their determinants in the amounts of 47%, 20%, and 27%, respectively. Table 6 also shows the results of the hypothesis.

Path analysis

In path analysis, two types of effects were computed. The first is the direct effect, and the second is the indirect effect. When variable has an arrow directed towards another variable, there is a direct effect. When a variable has an effect on another variable through the other variables, there is an indirect effect. A total effect on a given variable is the sum of the respective direct and indirect effects. The effect sizes with values less than 0.1 were considered small, those with less than 0.3 are medium, and values with 0.5 or more were considered large (Cohen, 1988). Table 7 shows the standardized total effects, direct and indirect effects associated with each of the seven variables. The most dominant determinant of behavioral intention is perceived usefulness, with a total effect of 0.488. This is followed by perceived ease of use and attitude towards computer use with a total effect of 0.134 and 0.105, respectively. Among the three variables external to the TAM, computer self-efficacy has

Table 7
Direct, Indirect, and Total Effects of the Research Model

Outcome	Determinant	Standardised estimates		
		Direct	Indirect	Total
Behavioural intention ($R^2 = 0.394$)	PU	0.431	0.057	0.488
	PEU	-	0.134	0.134
	ATCU	0.105	-	0.105
	TC	-	-0.028	-0.028
	CSE	0.223	0.176	0.399
	FC	-	0.062	0.062
Attitude towards computer use ($R^2 = 0.479$)	PU	0.545	-	0.545
	PEU	0.304	0.114	0.418
	TC	-	-0.130	-0.130
	CSE	-	0.240	0.240
	FC	-0.024	0.125	0.101
Perceived usefulness ($R^2 = 0.205$)	PEU	0.210	-	0.210
	TC	0.043	-0.077	-0.034
	CSE	0.315	0.034	0.349
	FC	0.078	0.041	0.119
Perceived ease of use ($R^2 = 0.278$)	TC	-0.367	-	-0.367
	CSE	0.164	-	0.164
	FC	0.197	-	0.197

the strongest effect on behavioral intention, with a total effect of 0.399. Technological complexity and facilitating conditions, with their total effects of -0.028 and 0.062, have little effects on behavioral intention. Together, these six determinants account for approximately 39% of the variance in behavioral intention to use technology.

For attitude towards computer use, the prominent determinants are perceived usefulness and perceived ease of use, with the total effects of 0.545 and 0.418, respectively. Besides, technological complexity, computer self-efficacy and facilitating conditions, with their total effects of -0.130, 0.240 and 0.101 had medium effects on attitude towards computer use. The strong relationship between perceived usefulness and computer self-efficacy is demonstrated by the latter being the prominent determinant of the former, with a total effect of 0.349. For perceived ease of use, the dominant determinant is technological complexity with a total effect of -0.362, which is entirely a direct effect. Of the four endogenous variables, attitude towards compute use has the greatest amount for variance account by its determinants, at approximately 47%. This is largely due to the effects contributed by perceived usefulness and perceived ease of use, thus stressing the importance of the relationship among these three variables.

DISCUSSION

In many societies, education is one of the beneficiaries of the developments on information and communication technologies. This study examined the factors influencing Turkish pre-service teachers' acceptance of technology. It is suggested that perceived usefulness, attitude towards computer use, and computer self-efficacy have direct effects on behavioral intention to use technology, while perceived ease of use, and technological complexity, and facilitating conditions affect behavioral intention use indirectly. This result supported the findings of the study by Teo (2009) on pre-service teachers in Singapore. The findings in this study also show that TAM is a valid model to explain the Turkish pre-service teachers' behavioral intention toward technology. Together, these six variables in the proposed research model explain approximately 39% of the variance in behavioral intention to use technology.

The results suggested that, when technology is perceived to be useful and using it would improve their performance and make them more efficient, pre service teachers are more likely to use technology. In addition, perceived usefulness is significantly influenced by perceived ease of use. This suggested that pre-service teachers are likely to see technology as useful when they think that it does not require much effort to use. This is consistent with Davis et al. (1989) who found that both perceived usefulness and perceived ease of use are meaningful indicators of behavioral intention. Also, Ma et al. (2005) found teachers' perceived usefulness to be a robust estimator in determining their behavioral intention. This study also found that attitude towards computer use is another variable which has a meaningful and positive effect on the behavioral intention suggesting that when computer users have positive feeling towards computer use, they are likely to continue using it.

Another result derived from the study is that behavioral intention is significantly influenced by computer self-efficacy. This denotes a positive relationship between pre-service teachers' self-efficacy and their intention to use computer. In other words, when pre-service teachers possess a favorable view of their ability to use the computer, they tend to be inclined to use related technology. Computer self-efficacy has a direct effect on the perceived ease of use and perceived usefulness. It is noteworthy in that, of the two beliefs variables which are known to have significant influence on behavioral intention in the TAM, computer self-efficacy has a greater effect on perceived usefulness (0.349) and less effect on perceived ease of use (0.164), suggesting that it is possible that computer self-efficacy may be conceived as a similar construct as perceived ease of use. This observation was upheld by other studies that found computer self-efficacy as a significant indicator for perceived ease of use (Chan & Lu, 2004; Teo, 2009; Venkatesh, 2000).

The results of this study also revealed that facilitating conditions have the greatest significant direct positive effect on perceived ease of use, followed by negative and non-significant effect on attitude towards computer use and positive but non-significant effect on perceived usefulness. This suggests that pre-service teachers' perception of adequate support (e.g., technical, personnel) has more influence on the extent to which a task involving technology is free from effort than how much the use of technology enables one to be more productive or efficient. Technological complexity has a negative significant direct impact on perceived ease of use and a positive but non-significant effect on perceived usefulness. This suggests that when users perceive technology as complex and difficult to learn, they are likely to perceive technology to be difficult to use and understand, requiring great effort in order to benefit from it. On the other hand, the positive effect between technological complexity and perceived usefulness suggests that when users perceive a technology to be complex, they tend to see the technology as not useful to the extent that it they would be unlikely to be productive and efficient by using it (Teo, 2009).

Implications for practice

This study has several implications for policy makers and teacher educators. Although, it has been found out that perceived usefulness and perceived ease of use could predict acceptance, they do not remain static (Teo, 2009). Teachers who perceive computers to be useful and easy to use may soon experience limitations if they do not participate in continuing professional development to keep abreast with more current skills and knowledge on the use of computers. Sugar, Crawley, and Fine (2004) revealed that when students have experienced the affordances of technology in their learning, they would expect technology integration to continue and over time, this may cause anxiety and insecurity to teachers. In order to support teachers to integrate technology in the classrooms, school administrators need to implement strategies that ensure effective, successful experiences for teachers in the use of technology for teaching and learning. In addition, school administrators could put in place structures and support that serve to decrease teachers' perceived complexity of the technology they are required to use (Askar, Usluel, & Mumcu, 2006). Teachers acquire most of their cognitive and affective behaviors needed for their career during their professional training. During the pre-service teachers' education, necessary provisions could be made by establishing the extent at which they acquire these behaviors. For example, Swain (2006) suggested requiring pre-service teachers engage technology when they complete their assignments and take notes during lectures.

Limitations of the study

The research model in this study included three variables external to the TAM: self-efficacy, technological complexity, and facilitating conditions. The variance in behavioral intention was explained by the six variables by approximately 39%. However, 61% of the variance in behavioral intention was unexplained. Future study may consider other variables that might have direct or indirect influences on behavioral intention. Some examples include computer anxiety, computer thought, teachers' self-esteem, and teachers' beliefs about technology. Another limitation is the use of self-reports to collect data in this study. Despite its benefits, the use of self-reports has the potential to lead to the common method variance, a situation that may inflate the true associations between variables.

CONCLUSION

This study contributes to the literature by validating the TAM on a Turkish sample. Previous studies have highlighted the need to validate the TAM in different cultures to enhance its generalizability (Teo, Lee, Chai, & Wong, 2009; Teo, Wong, & Chai, 2009; Yoo & Donthu, 2001). It can be concluded from the findings that the proposed model in this study could help us to have a better understanding of technology adoption and the factors that influence its use.

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Appendix
List of constructs and corresponding items

Construct	Code	Items
Perceived usefulness	PU1	Using computers will improve my work.
	PU2	Using computers will enhance my effectiveness.
	PU3	Using computers will increase my productivity.
Perceived ease of use	PEU1	My interaction with computers is clear and understandable.
	PEU2	I find it easy to get computers to do what I want it to do.
	PEU3	I find computers easy to use.
Attitudes toward computer use	ATCU1	Computers make work more interesting.
	ATCU2	Working with computers is fun.
	ATCU3	I look forward to those aspects of my job that require me to use computers.
Technological complexity	TC1	Learning to use the computer takes up too much of my time. (R)
	TC2	Using the computer involves too much time. (R)
	TC3	It takes too long to learn how to use the computer. (R)
Self-efficacy	CSE1	I could complete a job or task using the computer if I could call someone for help if I got stuck. (R)
	CSE2	I could complete a job or task using the computer if someone showed how to do it first. (R)
Facilitating conditions	FC1	When I need help to use the computer, someone is there to help me.
	FC2	When I need help to learn to use the computer, someone is there to teach me.
Behavioral intention	BI1	I will use computers in future.
	BI2	I plan to use the computer often.

(R) This item has been reverse coded.