TECHNOLOGY ACCEPTANCE IN EDUCATION: A STUDY OF PRE-SERVICE TEACHERS IN TURKEY

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ABSTRACT
The purpose of this study is to test a model that predicts the level of technology acceptance across pre-service teachers at the faculties of education in Turkey. The relationship among the factors that have influence on technology acceptance was investigated. Adopting a questionnaire developed by Timothy (2009) data was collected from 754 pre-service teacher education students attending five faculties of education. In addition to presenting descriptive statistics of the research variables, correlation, ANOVA, and regression analyses were carried out in the study. For the validity, confirmatory factor analysis (CFA) was used. The results indicated that there is a good fit between the model and data. A path analysis was also conducted to test the model. Contrary to the expectations, self-efficacy was not found to be very effective on technology acceptance levels of pre-service teachers.
Keywords: Technology acceptance, Pre-service teachers, higher education

I. INTRODUCTION
Technology acceptance issue has been occupying a central location in the literature concerning educational technology. This is mainly related to growing interest in integrating technology into classroom settings in an attempt to foster learning as well as advancing students' problem solving skills through utilizing technology. Towards this end, policy makers have set technology integration as the crucial part of educational reforms while beholding teachers as the major vehicles of this process who will carry technology into classrooms (Schlechty, 2001). Teachers' level of technology acceptance, therefore, has been regarded as one of the major determinants of such agenda. As Martin (2000) puts it, without teachers' acceptance of technology, it is almost impossible to develop educational technology projects. This is because teachers are both gatekeepers of technology and the most important sources of delivering information in the classrooms. The current study attempts to test a model that predicts the level of technology acceptance across pre-service teachers at the education departments in Turkey. It sets out to further our understanding about how perceived ease of use and perceived usefulness impact teachers' acceptance level of technology.

There have been various models developed for integrating technology into educational settings, one of which and the most popular is Technology Acceptance Model (TAM). TAM gained popularity across researchers rapidly with the help of empirical support particularly coming from the fields of business and education. However, this model couldn't find as much space in education as it did in the business field, possibly due to the nature of educational organizations which have more complex and undefined dynamics and have porous boundaries in comparison to clearly structured and well-defined business organizations. Besides, rather than scrutinizing organizational problems of integrating technology into educational settings, there exists a tendency towards blaming teachers' autonomy for almost all breakdowns of integration process (Hu, Clark, & Ma, 2003; Timothy, 2009). On the other hand, TAM provides an extremely useful theoretical tool in understanding how teachers' technology acceptance level impacts technology integration.

Davis, Bagozzi & Warshaw (1989) first introduced the TAM as a theoretical extension of the Theory of Reasoned Action (TRA). TRA congregates beliefs, attitudes, norms, intentions, and behaviors of individuals and asserts that these are all linked. According to this model, a person's behavior is determined by his/her behavioral intention of performing it. This intention is itself determined by the person's attitudes and his/her subjective norms towards the behavior (Ajzen & Fishbein, 1980). For instance, the TAM (see Figure 1) proposes that there are three main factors predicting computer use: Perceived Usefulness, Perceived Ease of Use, and Intention to Use (Milleri, Rainer & Corley, 2003). Perceived usefulness is a belief that if a person uses a certain technology, this will help increase his/her job performance. This is grounded on the proposition that people would tend to utilize an application when it is useful in performing his/her tasks. In the case for teachers, technology use in classroom settings would be perceived as useful when a teacher develop a belief that this will help him/her teaching and having more control over knowledge transaction (Hassan et al, 2011). On the similar background, Perceived ease of use refers to both intrinsic and extrinsic motivations towards using technology. People with high intrinsic motivations towards using a technology may underestimate the difficulties that the usage of a certain technology entails (Fagan,Neill, &Wooldridge, 2008).

Based on the Social Cognitive Theory of Bandura (1997), self-efficacy qualifies the confidence levels of individuals about handling a particular tasks and their capability of influencing events affecting their daily lives. "It is generally reported that individuals with higher self-efficacy perceive difficult tasks as meaningful challenges, despite the fact that others may find similar tasks discouraging (Tsai, Chuang, Liang, & Tsai, 2011, 223)." The notion "facilitating conditions" corresponds to the type of support that the individuals get with the aim of affecting their use of technology (Venkatesh et al., 2008). Facilitating conditions could be various in accordance with the settings and type of technology application. As for teachers, availability of technology training programs, knowledge, supporting services could be counted as facilitating conditions. Facilitating conditions play an important role on both infusion and adoption of new information systems. For example, in a study exploring WAP services adoption behavior in Taiwan, it is found that facilitating conditions are one of the critical factors influencing the adoption behavior (Lu, Chun-Sheng, & Chang, 2005).

2. THEORETICAL BACKGROUND

TAM suggests a causal relationship between perceived usefulness (PU), perceived ease of use (PEU), attitude towards computer use (ATCU), and behavioral intention (BI) to use computers. Perceived usefulness and perceived ease of use together lead to intention to use, and it results in usage behavior.

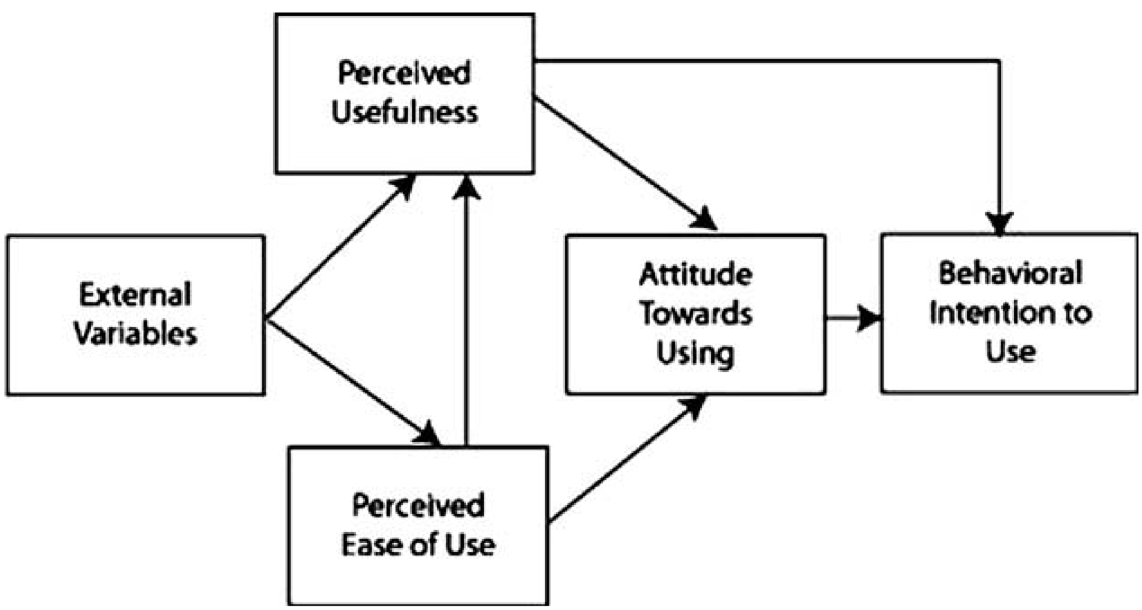

Figure 1. Technology acceptance model (TAM) (Davis, 1989: cited in Timothy, 2009).

On the similar aisle, studies concerning technology acceptance issues in education which are grounded on this model focus on various subjects including graphics, mainframe applications, accounting, and the internet (Timothy, 2009). Although all these studies conducted on the effects of integrating technology on teaching and learning suggest that technology brings about a positive transformation, in many cases, research results could not be translated into practices successfully. There could be numerous reasons for this unsuccessful translation such as organizational barriers, wrong policies, economic reasons, infrastructure problems etc. But, it would not be a mistake to claim that the level of teachers' technology acceptance also plays an important role on this outcome. In other words, teachers' use of technology is still very limited and technology is used minimally in teaching and learning processes (Lim & Khine, 2006). For example, in his research on the pre-service teachers in Singapore, Timothy (2009) grounded his work on TAM and found that the level of technology acceptance across teachers determines the extent to which technology could be integrated into classroom settings. Similarly, through using TAM, Dikbaş, Ilgaz & Usluel (2006) looked at the perceptions underlying the integration of technology into classrooms. They found in their qualitative study of 40 teachers in Turkey that Perceived Usefulness (PU) and Perceived Ease of Usefulness (PEU) are important for teachers in accepting technology. PEU is considered as the primary factor shaping teachers' attitudes towards technology acceptance because teachers tend to explore technical and practical characteristics of the technological products at the first hand. Teachers also tend to look for technologies that are easy to operate.

There is another body of research probing the ways of which teachers' social, demographic, and personal characteristics influence technology acceptance within educational settings. Bayhan, Olgun and Yelland (2002) found that 82 % of teachers do not use computers by any means in classrooms. They assert that teachers' low level of confidence and lack of professional development opportunities substantially contribute to this outcome. In another research using Woznew, Venkatesh and Abrami's (2006) framework, Aypay and Özbaşı (2008) investigated teachers' attitudes towards computers. They found that demographics, motivational factors, experience, teaching methods, and other in-school factors influence teachers' use of technology. An interesting finding of the same study pointed out that two-thirds of teachers whose computer literacy level is very low do not use computers in classrooms at all in comparison to teachers with a medium level computer literacy use computers commonly, indicating that the level of computer literacy directly relates to technology integration into educational settings.

Accordingly, research also documents that institutional and structural characteristics of educational settings have an impact on integrating technology into classrooms such as professional training opportunities, access to computers in schools, technical support, and providing computers to all teachers (Altun, 2003; Aşkar & Usluel, 2003; Aypay, 2010; Demiraslan & Usluel, 2005; Uşun, 2004; Akkoyunlu, 2002; Çağıltay, Çakıroğlu, Çağıltay & Çakıroğlu, 2001). Some researchers suggest that it is also an important factor to what extent one has been exposed to technology and/or used technological products throughout his/her life course. As Galloway (2011, p.1) puts it eloquently, one cannot integrate technology in education with a generation of non-computer-users. For Galloway (2001, p.1) integration of technology into education requires establishing a relational linkage between "(a) teachers' educational expectations, (b) computer educators' notions of how teachers learn computing, (c) what administrators believe teachers need, and (d) teachers' personal commitments to computing."

In the current study, the notion Technological Complexity (TC) as it is used by Timothy (2009, pp.304-305) refers as to whether users perceive technology relatively difficult to understand and use. Computer Self-efficacy (CSE) indicates one's judgment of his/her capabilities of organizing and completing courses of action required to achieve specific tasks (Bandura, 1977). Facilitating conditions (FC) are environmental factors that affect one's desire to perform a task. For the definitions of other variables and items see Appendix 1.

3. METHODOLOGY

In this study, an instrument developed by Timohty (2009) was adopted as a data conducting tool. The instrument has 18 items (see Appendix 1). Data were conducted from 754 pre-service teacher education students attending five faculties of education in Turkey. Descriptive statistics, correlations, regression, Confirmatory Factor Analysis (CFA), Path Analysis to test the model and Cronbach Alphas to check the reliability were carried out. The reliability for the whole instrument was .90 and the reliabilities of constructs were as follows: PU=.89, PEU=.78, ATCU=.77, TC=.87, FC=.86, CSE=.75, BI=.78. All of the constructs were found to be reliable.

3.1 Sample

In the following, the results of the data analysis are presented. The order is sample of the study, relationships among the study variables, and testing the model respectively. The distribution of 754 students to universities is as follows: Eskişehir Osmangazi University (112), Gazi University (79), Kastamonu University (190), Mehmet Akif University (94), Siirt University (279). There are 12 departments and these departments are: Physical Education and Sports (23), Computer Education and Instructional Technology (47), Electrics and Electronics (69), Science Education (64), Math Education (126), Pre-School Education (43), Classroom Teacher Education (237), and History Education (18). The breakdown of the students based on their class levels are: 161 freshmen, 216 junior, 183 sophomore and 159 senior. The mean age of students is 21. The majority of students (75 %) indicated that they have computers at home. On average, students pointed out that they have been using computers for 6 years. They also indicated that they use computers on average 1.9 hours a day.

3.2. Relationships among the study variables

Table1 presents Pearson correlation coefficients among the study variables. All the correlations are significant and mostly positive correlations exist among the study variables except CSE. High positive correlations were found between PU and PEU (.72), ATCU (.71), BI (.73). Also a high positive correlation between PEU and ATCU (.71) was found. There is medium positive correlation exist between PU and FC (.43), TC (.30). Medium positive correlations were found between PEU and FC (.45), BI (.65), and TC (.47). Medium positive correlations were also found between ATCU and FC (.44), BI (.68), and TC (.33). A medium positive correlation was found between FC and BU (.44). However, a low positive correlation was found between FC and TC (.24). A medium positive correlation existed between BI and TC (.31). Negative low correlations were found between CSE and PU (.-.16), and BI (-.12). Low correlations were found between CSE and TC (.24). Contrary to the expectations, CSE either had negatively related, or since so low correlations exist, they cannot be interpreted. Even if the correlation was positive as in TC, they were at a low level. This finding was surprising.

Table 1. Pearson correlation coefficients among the study variables.

Variables	Perceived Usefulness (PU)	Perceived Ease of Use (PEU)	Attitudes Towards Computer Use (ATCU)	Facilitating Conditions (FC)	Behavioral Intention (BI)	Technological Complexity (TC)	Self-Efficacy (CSE)
PU	1						
PEU	.72**	1					
ATCU	.71**	.70**	1				
FC	.43**	.45**	.44**	1			
BI	.73**	.65**	.68**	.44**	1		
TC	.30**	.47**	.33**	.24**	.31**	1	
CSE	-.16**	.10**	-.09*	-.12**	-.13**	.24**	1

** p<.01, *p<.05

4. RESULTS AND DISCUSSION

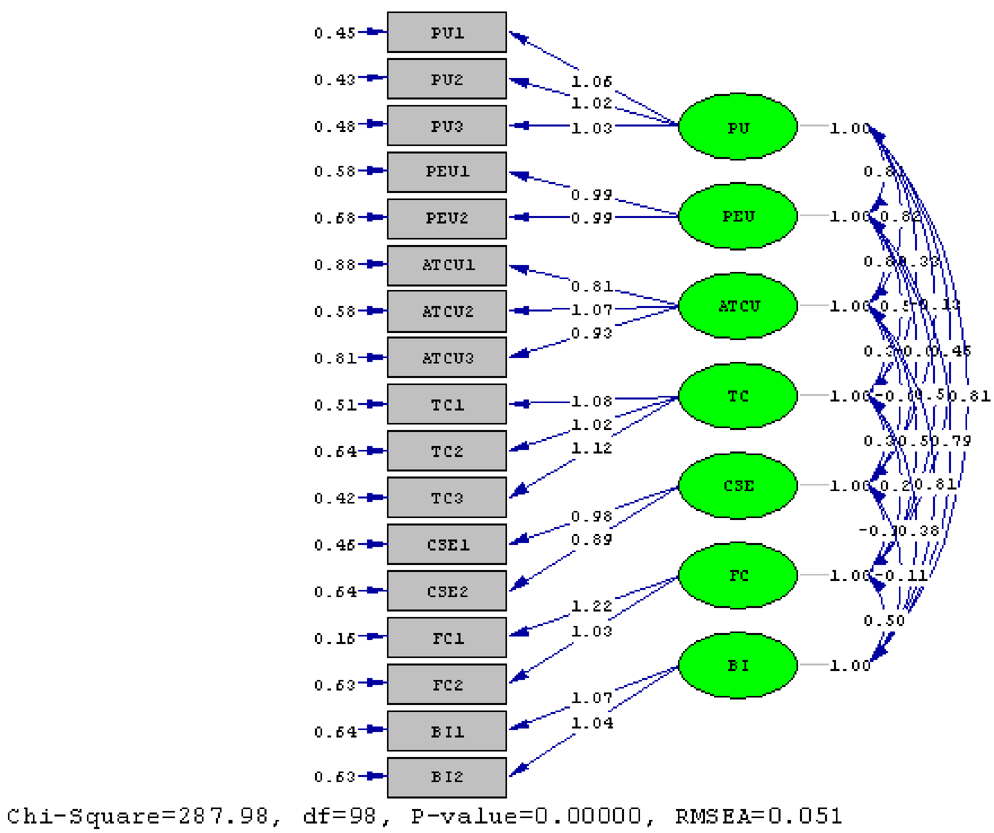

Figure 2. Results of confirmatory factor analysis.

The model fit in the study was tested with a Confirmatory Factor Analysis (CFA) with LISREL 8. An examination of the fit indices of CFA indicated a good fit. Chi square value (x^2=287.98 N=754, df=98, p=0.00) was found to be significant. When the chi-square ratio over degrees of freedom was lower than 3, one may argue that the model fit is quite well (χ^2 / df=287.98/98=2.93). If the ratio between chi-square over df (χ^2 / df) was lower than 3, it might be claimed as a very good fit (Şimşek, 2007; Çokluk, Şekercioğlu & Büyüköztürk, 2010). The root mean square error of approximation (RMSEA) was 0.099. When RMSEA value between 0 and 0.05 indicates a good fit, while it was between 0.05 and 0.1 indicates an acceptable fit. Thus, in this study, RMSEA value was 0.099 and standardized root mean residual (SRMR) was 0.044. These values indicated that there is an acceptable fit. The other fit indices were as follows: Normed fit index (NFI) was 0.98, comparative fit index (CFI) was 0.98, and incremental fit index (IFI) 0.98, relative fit index (RFI) was 0.90, Adjusted goodness-of-fit index (AGFI) was 0.91. When the goodness-of-fit indices are closer to 1, it indicates excellent fit (Şimşek, 2007; Çokluk, Şekercioğlu & Büyüköztürk, 2010). The results of analyses pointed out that all the indices were over 0.90 and this means the model fit was excellent.

A path analysis was conducted to see the standardized total effects. Table 2 shows direct and indirect effects of seven variables in the study. A path indicates a coefficient a direct effect from one variable to another variable and this is also named as a direct effect. An indirect effect indicates the effect of one on another variable through intervening variable(s). A total effect of less than 0.3 is considered a medium effect and the values equal or higher than 0.5 are considered large (Cohen, 1988 cited in Timothy, 2009). In this study, the only large effect is the path from PEU to PU (0.54). TC had no effect at all on PU. CSE had quite low negative effects on PEU (-0.12), PU (-0.08), and BI (-0.03). All the other effects were medium.

The indices of path analysis indicated that the chi-square value was significant (x^2=41.70 N=754, df=5, p=0.00). T-values among the variables were also significant except only CSE – BI and TC – PU. For the goodness-of-fit indices (See model fit section above) as the Table 3 indicates, out of thirteen hypotheses ten four of them are not supported.

Table 2. Results of hypotheses.

Hypotheses	Path	Path Coefficient	t-values	Results
H1	ATCU → BI	0.39	9.76	Supported
H2	PU → BI	0.42	11.30	Supported
H3	PU → ATCU	0.35	11.75	Supported
H4	PEU → PU	0.54	16.18	Supported
H5	PEU → ATCU	0.34	11.44	Supported
H6	TC → PU	0.00	0.11	Not supported
H7	TC → PEU	0.41	12.61	Supported
H8	CSE → PU	-0.08	-2.57	Supported
H9	CSE → PEU	0.12	-3.51	Not supported
H10	CSE → BI	-0.03	-0.90	Not Supported
H11	FC → PU	0.12	4.10	Supported
H12	FC → PEU	0.28	9.27	Supported
H13	FC → ATCU	0.11	4.47	Supported

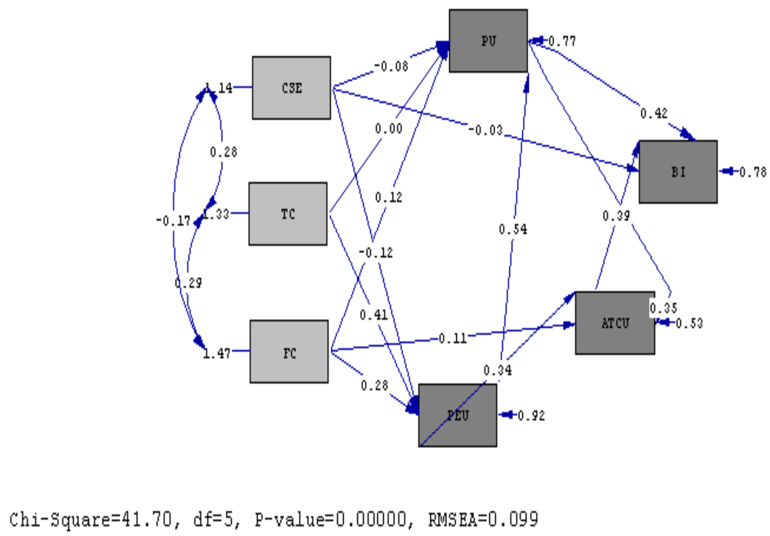

Figure 3. Path coefficients of the model.

A regression analysis in which the Behavioral Intention (BI) was set as a dependent variable was conducted. Table 3 shows the results of the multiple regression indicating that the independent variables explain 60 % of the total variance (R=,78, R^2=,60). Standardized regression coefficients (β) indicated that the relative importance of the independent variables and they are as follows: Perceived Use, Attitudes Toward Computer Use, Perceived Ease of Use, and Facilitating Conditions. Technological Complexity and Self-efficacy are not significantly related.

Table 3. Results of regression on the behavioral intention.

Variables	B	Std. Error	β	t	p
Constant	.355	.139	-	2.546	.011
1. Perceived Use (PU)	.455	.039	.428	11.557	.000
2. Perceived Ease of Use (PEU)	.133	.041	.128	3.267	.001
3. Att. Tow. Comp.Usage (ATCU)	.261	.041	.231	6.379	.000
4. Facilitating Conditions (FC)	.085	.026	.086	3.241	.001
5. Technological Complexity (TC)	.031	.029	.029	1.066	.287
6. Self-Efficacy (CSE)	-.31	.028	-.027	-1.102	.271
R=.78, R^2=.60, p=.05					

4.1. Discussion

The results of this study partially support TAM utilizing the model developed by Timothy (2009). Accordingly, the study showed that the two factors of the model, perceived usefulness and attitude towards computer use have direct effects on behavioral intention to use computers. Computer self-efficacy, on the other hand, is found to have a negative effect on behavioral intention to use computers. Technological complexity, perceived ease of use and facilitating conditions all have indirect effects on behavioral intention to use computers. If we evaluate the study in general terms, it could be said that confirmatory factor analysis results provided partial support for Timothy's (2009) model in Turkey. However, path analysis results indicate that computer self-efficacy does not have a direct effect on behavioral intention to use computers in this case.

Taking direct effects into account, the teachers participating in this study are more likely to use computers when they have positive attitudes towards computers and perceive computers useful. For the latter, it is well established in the literature that when individuals know how to use computers and/or become more comfortable with using them they are more likely to develop positive attitudes towards them as well (Timothy, 2009). One of the findings of this study, that is, the CSE has a negative effect on perceived usefulness, is different from what has been written in the literature. Hence, there is a need for conducting further studies exploring what lies behind this divergence. In the current study, such result might be related to low self-efficacy among teachers in terms of computer usage.

While, perceived usefulness has the biggest effect on behavioral intention to use computers, perceived ease of use has the same effect on perceived usefulness. These findings indicate that perception is very important for pre-service teachers to use computers. As it was expected, technological complexity plays the greatest role on perceived ease of use. In other words, when technological product gets simpler to operate, teachers tend to develop positive perceptions towards the usage of it, which in turn increases the likelihood of the usage behavior. On the other side, technological complexity has a negative effect on perceived usefulness. These results indicate that when technology is perceived complex, it may hinder technological acceptance. Facilitating conditions have positive effect on both perceived usefulness and perceived ease of use. Thus, if technological support is felt adequate, this might be leading pre-service teachers to develop a positive perception towards the use of computers.

Galloway's (2011) contention is once more relevant here: One cannot integrate technology in education with a generation of non-computer-users. Studies in Turkey concerning computer usage across teachers suggest that Turkish teachers are still struggling with using computers both in classrooms as well as their daily lives (Bayhan, Olgun & Yelland, 2002). However, more recent studies report that although computer usage is low among teachers, it shows a steady increase as the new generation of teachers with higher computer literacy skills enters into teaching profession (Aypay & Özbaşı, 2008; Dikbaş, Ilgaz, & Usluel, 2006). Thus one can claim that technology acceptance is also related to age as we are still in transition period from conventional to digital. Older generations without a formal education of computer usage, for example, might have more difficulties in adjustment than their younger colleagues during this period. In this sense, age ought to be integrated into studies as one of the variables impacting the perceptions towards technological products.

Findings of the current study point out that there is a need for carrying out more studies that would explore the relationship between computer self-efficacy and technology acceptance. This study also has implications for administrators and faculty members who work at teacher education faculties in Turkey. For example, helping teacher candidates with developing positive attitudes towards technologies would help future teachers adopting technological opportunities for their teaching practices. Getting them more familiar with technological products might be the most important step to take as this study suggests. Unfortunately, in the current system and because of various reasons such as infrastructure problems, lack of computer courses, and poor curriculum, pre-service teachers are not exposed to technology as much as they need.

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Appendix A

Data Collection Instrument

Construct	Item
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)
	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: Reverse coded items.