# The relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and intention of technology acceptance

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**Abstract:** Use of technology takes time and requires a paradigm change for teachers to adopt it. Teachers' readiness, how they behave and perceive technology integration or adoption process is particularly critical. The current study investigates the relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and intention of technology acceptance. The results indicate that computer ownership, the internet access and amount of daily computer use do not correlate with the attitude towards computer-assisted education (CAE). The internet access and computer ownership variables do not seem to have any relationship with the intention to technology acceptance. There is a significant and positive relationship among computer competence, attitude towards CAE, and intention to technology acceptance. Perceived usefulness and enjoyment have positive relationship with attitude towards CAE. Although perceived ease of use similarly has significant positive relationship with the attitude towards CAE, it does not predict the attitude towards it.

**Keywords:** computer competence; technology acceptance; attitude; gender; computer-assisted education; CAE.

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#### 1 Introduction

Use of technology in the field of education is a globally prominent issue and investments for it increases steadily. Education investment actually falls into technologies targeting the K-12 classroom, technologies or services focused on secondary education, continuing education and professional learning, and consumer-facing educational products and services in the USA (Shieber, 2014). Murali (2013) reported that venture in K-12 education technology was up 6% in 2013, with a budget of \$452 million. This indicates that a great amount of investment in the field of educational technologies was made for K-12.

This happens to be the same in Turkey. For instance, for the project named 'Movement of Increasing Opportunities and Improving Technology-FATIH', approximately 200 million dollars were invested in order to purchase 675,000 tablet PCs (MNE, 2013a), and 700 million dollar budget was allocated in total just for the year 2013 (MNE, 2013b). However, these investments disappointingly do not often bring the expected returns. In the field of information technologies, investments on technologies do not always end up with effective use of them by the teachers (Vanderlinde et al., 2012). The perceptions of teachers are principally significant for effective use and adoption of innovative technologies. Besides, how they behave and perceive technology integration or adoption process is particularly critical as they are key stakeholders in the process of educational transformation (Fullan, 2007). They are often expected to be able to use computers, and more critically, understand how to integrate technology into their

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teaching with appropriate instructional methods. In the literature, there are studies carried out to increase quality in teaching-learning activities with technology (Hudson, 2004; Swain, 2006; Livingstone, 2012).

Despite the support and encouragement provided by decision makers and/or administrators, teachers might by some means reject technology adoption. These barriers developed by them in information technology integration are described in two primary categories; extrinsic (first-order) and intrinsic (second-order) in the literature (Ertmer, 1999). Extrinsic barriers could be lack of resources, adequate training, technical support, and time; intrinsic barriers include teacher beliefs, visions of technology integration, and views about teaching, learning, practices, and knowledge (Ertmer et al., 1999). Although extrinsic barriers are easily overcome via effective planning and efficient investments, intrinsic barriers are difficult to overcome. It takes time and sometimes a paradigm change for teachers to adopt the technological innovations. The theory of 'Diffusion of Innovations' by Rogers (2003) further manifests that adoption of innovations occurs in different ways in varied cultures and academic disciplines and that it is highly subject to the type of adopters and innovation-decision process. As the theory indicates, four main elements might influence the spread of these technological innovations in educational settings: the innovation, communication channels, time, and the social system. As aforementioned encouragement, support and opportunities are significant factors to increase teachers' motivation for improving the level and quality of ICT use in classrooms (Uluyol and Şahin, 2014), whereas, techno-phobia is another intrinsic barrier hindering technology adoption (Cuban, 2009).

#### 2 Literature review

# 2.1 Teacher's technology acceptance

Previous studies on the use of computers (or computer technologies) frequently examined attitudes towards computers (Akkoyunlu, 1996; Pamuk and Peker, 2009), anxiety towards computers (Beckers et al., 2007), and integration of information technologies (Sang et al., 2010; Kaya and Koçak Usluel, 2012; So et al., 2012). Acceptance of computers, on the other hand, is a prominent theme in those studies (Pynoo et al., 2011; Teo et al., 2009). Computer self-efficacy, technical support, individual innovativeness, computer anxiety, and cultural differences are measures particularly studied in technology adoption research studies (Teo et al., 2008, 2012; Van Raaij and Schepers, 2008; Sang et al., 2010; Kulviwat et al., 2015).

In today's educational environments, teachers easily access to computers. To integrate technology into education, teachers' acceptance of computers is particularly vital (Kumar et al., 2008). However, there are many teachers who cannot use this technology due to the barriers either aforementioned by Ertmer (1999) or some others. Technology acceptance model (TAM) proposed by Davies (1989) is one of the most often used and valid models regarding technology adoption (Teo et al., 2012). TAM explains how users accept and use technology and focuses on two dimensions: perceived usefulness (PU) and perceived ease of use (PE) for technology acceptance. PU is defined as an individual's belief for a specific technology that affects one's work performance whereas PE is defined as solely the belief of an individual for a specific technology. PU

indicates one's attitude towards computer use whereas PE indirectly indicates the attitude of an individual through PU (Davis, 1989; Davis et al., 1989).

PU and PE were actually incorporated in the theory of reasoned action (TRA) by Fishbein and Ajzen (1975). Both of these influence an individual's attitude towards using a system, which, in turn, explain the individual's behavioural intention to use the system. Besides these, perceived enjoyment was measured as an intrinsic motivator by Venkatesh et al. (2002). PU, PE, and perceived enjoyment, were altogether described as 'technology acceptance factors' in their study by Hsu and Lin (2008). The current study adopted and examined this three-dimension TAM in the context of CAE.

#### 2.2 How teachers perceive computer technologies and teaching with it?

Van Braak (2004) states that computer competence is a broad concept that is closely related to similar concepts of computer experience, computer proficiency, computer achievement, computer skills and computer literacy. Marcinkiewicz (1994) defined computer competence as the level of computer use in education. Tinmaz (2004) defined it as the perception of technology use for an educational purpose. In fact, the definition of computer competence has changed in time according to the developments and needs in the field of information technologies. While computer programming was the focus of the definition in 1990s, in 2000s the definition has focused on the skills regarding software and web usage. This indicates that the perceptions of the people towards the definition of computer competence have changed.

Much of the educational literature which examines students' use of computers at home confirms that the domestic computing environment makes a positive contribution to students' general computer competence (Mumtaz, 2001; Subrahmanyam et al., 2001). Similarly, teachers' ICT competences have positive association with their technology use, which is labelled as 'Institutionalized ICT use' (Vanderlinde et al., 2014). Albirini (2006) similarly found that teachers have positive attitudes toward ICT in education which were predicted by computer attributes, cultural perceptions and computer competence. The results point to the importance of teachers' vision of technology itself, their experiences with it, and the cultural conditions that surround its introduction into schools in shaping their attitudes toward technology and its subsequent diffusion in their educational practice (Albirini, 2006).

International Society for Technology in Education (ISTE, 2008) the premier association for educators and educational leaders, identified standards for teachers and pre-service teachers' computer competence for technology integration in teaching. The standards included effective use of technology in teaching and the promotion of digital citizenship to develop students' creativeness and reinforce retention. According to So et al. (2012), previous studies on pre-service teachers' integration of information technologies in education usually focused on the measures of self-efficacy, attitude, epistemological and pedagogical beliefs, and individual differences towards ICT use. There is also large body of research regarding computer-assisted education (CAE hereafter), perceptions of computer self-efficacy, computer anxiety, and the technological attitudes of teachers and teacher candidates (Berkant, 2013; Celik and Yeşilyurt, 2013). The impact of CAE on students' achievement (Camnalbur, 2008; Pilli and Aksu, 2013) and motivation (Papastergiou, 2009; Balanskat et al., 2006) were investigated in those studies. Differing from previous studies, the current study examined perceived computer competence, attitudes towards CAE, intention of technology acceptance and the correlations among them. It is warranted to study the relationship among these constructs for pre-service teachers and effective computer supported education. Hence, this study aims to investigate the following research questions:

- 1 Will pre-service teachers' gender, computer ownership, internet access and daily computer use predict their computer competence, attitudes towards CAE, and intention of technology acceptance?
- 2 Is there a relationship between pre-service teachers' computer competence, attitudes towards CAE, and intention of technology acceptance?
- 3 Can PE, usefulness and enjoyment of pre-service teachers towards computers predict attitudes towards CAE?

# 3 The method

A survey research was adopted to examine the potential association among the three constructs (computer competence, attitudes towards CAE and intention of technology acceptance) for pre-service teachers. Empirically validated scales were used to measure the constructs. Quantitative survey responses were analysed using regression and correlation analyses.

# 3.1 The participants

There were 476 pre-service teachers from various departments of Education Faculty at a higher education institution of Turkey participating in the study. The details regarding these participants' gender, department and class are given in Table 1.

	N	Р
Gender		
Male	177	37.2
Female	299	62.8
Department		
Science Education	157	33.0
Elementary Education	110	23.1
Computer Education*	74	15.5
Physical Education	79	16.6
Psychological Counselling and Guidance	56	11.8
Class		
Freshman	167	35.1
Sophomore	147	30.9
Junior	113	23.7
Senior	49	10.3

 Table 1
 Demographics of the participants

Note: \*Computer education and instructional technology.

Around 72.9% of participants (n = 347) had their own computers at home and 64.9% of the participants (n = 309) had the internet access. And 61 participants reported daily use of a computer, 118 used it less than 1 hour, 174 used it between 1–2 hours, 87 participants used it between 3–4 hours, and 36 participants used it more than 5 hours.

#### 3.2 The instruments

Three scales were used in this study to measure pre-service teachers' computer competence, attitudes towards computer-based education, and for levels of technology acceptance. The participants' demographics were also collected. The first two of these scales were in Turkish and developed for the use of pre-service teachers and teacher candidates, who were the participants of the current study.

#### 3.2.1 Computer competence scale

This instrument was developed by Tinmaz (2004) in order to measure pre-service teachers' perceived computer competence in the values of novel, medium level, and experienced. The reliability of the scale was tested by Tinmaz (2004) and the Cronbach alpha was measured 0.87. In the current study the Cronbach alpha was found to be .81. The computer skills were measured in a spectrum of 10 item scale: 1 = Basic concepts;2 = Hardware; 3 = Operating system; 4 = Word processor; 5 = Spreadsheets;6 = Demonstration programs; 7 = Databases; 8 = Web page development; 9 = Internet;10 = E-mail.

#### 3.2.2 Attitude scale in relation to CAE

This scale was developed by Arslan (2006) to measure teacher candidates' attitudes towards CAE. There were 20 items in the scale. Cronbach alpha was measured as 0.93 by Arslan (2006). Each item was measured on a five-point Likert scale, ranging from 'disagree strongly' (1) to 'agree strongly' (5). In the current study the Cronbach alpha was found to be 0.91.

# 3.2.3 Technology acceptance scale

This scale was adapted from the study of Hsu and Lin (2008). They indicated technology acceptance factors as:

- a PU: The degree to which a person believes that using a technology enhances his or her performance (3 items)
- b PE: The degree to which a person believes that using a technology is free of effort (4 items)
- c Perceived enjoyment: Degree of fun and enjoyment in interaction with a technology (3 items).

Hsu and Lin (2008) used this scale for measuring technology acceptance factors for blog use. The researchers in the current study slightly customised it for computer technology acceptance. Each item was measured on a five-point Likert scale, ranging from 'disagree

strongly' (1) to 'agree strongly' (5). The scale was translated and its content validity was checked. The statements in the items were short and quite clear and did not cause any ambiguity in comprehension for the participants. The reliability for each subscale was found to be .90, .80, and .89 respectively for the sub-scale of PU of technology, PE, and perceived enjoyment. The researchers ran reliability analysis for each subscale and the reliability alpha was found higher than .80.

## 4 Data analysis

Multiple regression analyses were conducted to examine whether pre-service teachers' gender, computer ownership, the internet access and daily computer use would predict their computer competence, attitudes towards CAE, and their intention of technology acceptance. Correlation analyses were also conducted to examine the relationship between computer competence, attitudes towards CAE, and intention of technology acceptance. A regression analysis was then conducted to examine whether PU, ease of use, and enjoyment of technology would predict attitudes towards CAE.

# 5 Findings

# 5.1 Finding on research question 1

The multiple regression model with the predictors of gender, ownership of a computer, the internet access, and daily computer use on participants' computer competence produced  $R^2 = .17$ , F(4, 475) = 23.44, p < .001. The hours spent daily in computer use had significant positive regression weights ( $\beta = .28$ ), indicating pre-service teachers with more daily computer use tend to have higher computer competence. The other three predictors, including gender, did not contribute to the multiple regression models.

The multiple regression model with the predictors of gender, ownership of a computer, the internet access, and daily computer use on participants' attitudes towards CAE produced  $R^2 = .01$ , F(4, 475) = 2.74, p < .05. None of the four predictors, contributed to the multiple regression model, though computer ownership, internet access, and daily computer use positively correlated with participants' attitudes towards CAE (r = .11, .10, and .13 respectively, p < .01).

The multiple regression model with the predictors of gender, ownership of a computer, the internet access, and daily computer use on participants' intention of technology acceptance produced  $R^2 = .05$ , F(4, 475) = 5.83, p < .001. Gender had a significant negative regression weights ( $\beta = -.08$ ), indicating male tend to have more intention of technology acceptance. Daily computer use had a significant positive regression weights ( $\beta = .14$ ), indicating participants working/studying more hours on computer tend to demonstrate more intention of technology acceptance. The other two predictors did not contribute to the multiple regression models.

#### 5.2 Findings on research question 2

Correlation analyses indicated a significant and positive association between computer competence, attitudes towards CAE, and intention of technology acceptance. The results were outlined in Table 2.

Table 2	Relationship between computer competence, attitudes towards CAE, and intention of
	technology acceptance

	Computer competence	<i>Attitudes</i> towards CAE	Intension of technology acceptance
Pearson correlation	1	.301**	.322**
Correlation coefficient sig. (two tailed)		.000	.000
Ν	476	476	476

Note: \*\*Correlation is significant at the 0.01 level (two-tailed).

#### 5.3 Finding on research question 3

The multiple regression model with the construct, intention of technology acceptance and its predictors of PE, usefulness and enjoyment of technology on participants' attitudes towards CAE produced  $R^2 = .31$ , F(4, 475) = 69.80, p < .001. PU and enjoyment had significant positive regression weights ( $\beta = .32$  and .25, respectively), indicating pre-service teachers with a higher perception of usefulness and enjoyment of technology tend to have more positive attitudes towards CAE. PE, though significantly and positively correlated with the attitudes towards CAE (r = .33, p < .001), did not contribute to the multiple regression model.

#### 6 Discussion

The study indicated that the constructs of gender, computer ownership, and the internet access do not predict computer competence, but daily computer use positively predicts computer competence. In their study carried out with pre-service teachers, Goktas et al. (2009) found that gender significantly affects computer competence. Similarly, in another study computer competence of teachers was reported to change significantly with respect to their gender (in favour of males), computer ownership and access to computers (Russell and Bradley, 1997). In another study the results from a path model demonstrated that self-perceived computer competence (quality of application use) was affected by four factors: computer confidence, computer experience expressed in time, intensity of computer use and home access to a computer (Van Braak, 2004). The four variables accounted for a significant proportion of the variation (54%) in the perceived computer competence (Van Braak, 2004). Non-significant gender difference might be case-based but the reason for the non-significant impact of the technological variables, computer ownership and access to the internet in the current study could be explained by the mediation effect of the accessibility to computer technologies.

In the current study, gender, computer ownership, the internet access and amount of daily computer use did not predict the attitude towards CAE. The same findings regarding gender have been reported in other studies (Kutluca and Ekici, 2010; Yıldırım and Kaban, 2010). In another study, there was a similar about computer ownership as having non-significant effect on CAE (Sezer, 2011). In fact in their study with pre-service teachers, Chen et al. (2010) found that the core ICT application skills, daily computer use in the current case, do not necessarily translate into sophisticated skills of these teachers like CAE.

According to the findings, the internet access and computer ownership variables do not seem to have any relationship with the intention to technology acceptance; but males tend to report a higher intension to technology acceptance and daily computer use positively predicts technology acceptance. The study of Wong et al. (2012) supported that gender significantly affects technology acceptance of individuals. Conversely, Teo et al. (2008) stated in his study that there is no relationship between gender and intention to technology acceptance. Significant gender differences in computer acceptance were reported in the study of Yuen and Ma (2002) in favour of females. In their study, Tondeur et al. (2012) stated that access to resources (hardware software, learning material, documentation, etc.) is an important condition for technology integration.

The study found a significant and positive relationship among computer competence, attitude towards CAE, and intention to technology acceptance. Albirini (2006), similarly, found that teachers' positive attitudes toward ICT in education were predicted by their computer competence. Roussos (2007) also stated that computer acceptance and using a computer as a professional tool or introducing computer applications into the classroom are all affected by attitudes towards computers. The study of Wong et al. (2012) supported that computer teaching efficacy is a significant variable in technology acceptance. In another study, it was reported that attitude to technology and perceived computer self-efficacy are important predictors of teacher candidates' attitude toward using computer supported education (Celik and Yeşilyurt, 2013).

PU and enjoyment were found to have a significant positive relationship with the attitude towards CAE. Although PE was found to have a significant positive relationship with the attitude towards CAE, it does not predict the attitude towards computer-assisted instruction. Yuen and Ma (2002) reported that PU and PE directly affect the intention to computer use as stated in the TAM. Furthermore, significant gender differences in computer acceptance were also found for both measures in favour of females.

#### 7 Conclusions and recommendations for further studies

According to the results of the current study, one of the constructs that predict pre-service teacher's computer competence is the amount of their daily computer use. This result supports the idea that activities that help to increase the amount of daily computer use of pre-service teachers should appear more in the curricula of teacher training faculties or institutions. The finding indicates that more practice, the more competence of computers. Besides, it is important that pre-service teachers need to be trained about technological innovations and learn to use these technologies for education and their individual development.

None of the constructs of gender, computer ownership, the internet access and daily computer use were found to predict attitude towards CAE. However, making use of computers in class teaching had relationship with pre-service teachers' technology access and their amount of daily computer use. There is a need to carry out more studies further investigating this situation and some other predictors that affect CAE.

Daily computer use and gender in favour of males predict intention of technology acceptance. The policy makers at higher educational settings should take some steps to increase female pre-service teachers' level of computer use and acceptance, such as including more technology and computer-based courses in the teacher training faculties' curricula. As indicated in the demographics, female are more dominant in number than males in teacher training faculties. Besides, female pre-service teachers should be encouraged to participate in technological social clubs and associations of educational technologies.

Due to the significant relationship among computer competence, attitude towards CAE, and intention of technology acceptance, pre-service teachers' computer competence should be enhanced so that their technology acceptance levels will as well be increased. And this will probably lead to much more implementation of CAE. Pre-service teachers should be informed and trained about how and why CAE supports effective and efficient learning and how it is useful and enjoyable when implemented in a learning environment; therefore, they should be informed more about the comparative studies investigating traditional and CAE. They should be encouraged to implement CAE in their teaching.

The study has some limitations. First, the participants of the study were only pre-service teachers. A similar study could be conducted with teachers. Due to time and transportation restricts, this study is limited in its sampled population, and hence the results cannot be generalised to all pre-service teachers. The other limitation is that, computer competence levels of the participants were identified via self-reports through a scale. An objective ICT test that measures their level of computer competence might be adopted in future studies. The fact that the participants are students of the departments of Science Education, Elementary Education, Computer Education, Physical Education and Psychological Counseling and Guidance may limit the generalisation of findings to all pre-service teachers. This study should be replicated with a higher number of pre-service teachers of different disciplines.

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The authors equally contributed to this work.

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