Analyzing the Correlations between Prospective Teacher's Competence in Designing Digital Materials and their Acceptance and Use of Technology

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Abstract: The aim of this study was to investigate the relationship between preservice teachers' digital material design competencies and their use and acceptance of technology. The study was designed based on the Unified Theory of Acceptance and Use of Technology developed by Venkatesh et. al. in 2003. Sample of the study consists of 199 pre-service teachers attending to the faculty of education in a state university in Ankara/Turkey. As data collection tools, Digital Material Design Competencies Scale developed by Göçen Kabaran ve Uşun, (2021) and Preservice Teachers' Acceptance and Use of Technology Scale developed by Kabakçı-Yurdakul, Ursavaş ve Becit-İşçitürk (2014) were used.As a result of the analysis of the data collected in the study, it was found out that; preservice teachers' digital material design competencies are at a high level. When preservice teachers' Acceptance and Use of Technology level is investigated, it was observed that the variables of performance expectancy, effort expectancy, social impact, facilitative situations, self-efficacy and attitudes towards technology use were significant predictors of pre-service teachers' behavioral intention for technology use. According to Pearson Correlation analysis, there is a statistically significant positive, linear and strong relationship between preservice teachers' digital material design competencies and their acceptance and use of technology (r=.914, p=.000).

Keywords: Use and Acceptance of Technology, Unified Theory of Acceptance and Use of Technology, Digital Material Design Competencies, Preservice Teacher

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Introduction

The continuous development of information and communication technologies (ICT) and their entrance into human life in several different ways also bring about many changes in social life. The changes require us to use technology in numerous areas in our life. One of the areas is education, which is in one-to-one interaction with

human life. Due to the fact that a goal of education is to raise individuals in accordance with the needs of the society, educational structure should also keep pace with such technological changes (Akkoyunlu, 1995: 106).

Teaching processes in which technology is included generally emerge as the use of digital teaching materials. Today's students are described as "digital students" and the description is used to mean that those students adopt technology and use it so as to discover, inquire and improve their personal learning and to contribute to others' knowledge (Smaldino et al. 2015). It is claimed that today's technology literate students' interest in technology will also facilitate them to have interest in knowledge presented through digital teaching materials and that the learning experiences designed with such materials will help them to develop positive attitudes towards learning (Yavuz-Konokman, 2019). In parallel to the continuous use of technology, the need for instruction and curriculum approaches which support bringing students and technology together arises. Technologies which keep developing enable teachers to create appropriate platforms on the internet and to generate teaching materials specific to them and to the class (Birişçi, et. al, 2018).

Prospective teachers who have completed their training at university are expected today to have the knowledge and self-confidence which enable them to use the computer technology in the classroom in the best way possible (Meral et al. 2001). It may be said that it is not enough for teachers in today's teaching processes to have only technological knowledge and that they are expected to synthesise technology with pedagogical knowledge and content knowledge as professional teaching knowledge. Teachers primarily should set their goals in including technology in learning environments. "For instance, questions to ponder could include, is the intent to teach technology skills or content knowledge? Is the ultimate goal of implementing technology systems to infuse technology into current teaching practices? Is the goal to promote student-centered learning, effectiveness and student success?" (Wedlock and Trahan, 2019). On the other hand, people react to novelties which they are not informed of or which they think they cannot use, and thus they resist changes (Çelik and Bindak, 2003: 29). The question of what might be the factors causing acceptance or refusal of technology has gained more importance through this process (Marangunić and Granić, 2015). Several models and theories have been developed so far in order to predict whether not individuals can use information and communication technologies (Teo and Noyes, 2014). The models in general aim to find what internal or external factors influence the intention to use- the basic component of using technology- and then to explain behaviours of adopting technology.

Technology acceptance model (TAM) is the model which was developed by Davis (1989) so as to determine individuals' behaviours of technology use. The model explains individuals' acceptance of technology through the variables of perceived benefits (PB) and ease of use (EU). PB is individuals' perception of whether they can increase their performance in using technology. EU, on the other hand, is individuals' perception of whether the technology they use is easy to use or not (Davis, 1989). The TAM is the model which has been widely used and approved in the area of ICT adoption research for different contexts and environments.

Technology acceptance model 2(TAM2) was created by adding new variables to TAM which was developed by Davis (1989). The new variables which influenced perceived benefits and intention to use were added to TAM by

Venkatesh and Davis (2000). Subjective norm, image, convenience to work, output quality and result demonstrability were the external variables which affected perceived benefits. Experience and volunteering were the regulatory variables which affected both the perceived benefits and the intention to use. Technology acceptance model 3 (TAM3) is the model developed by Venkatesh and Bala (2008) and known as the final shape of TAM. It contains the binding factors of perceived ease of use added to TAM2. The model examines the effects of other external variables on perceived ease of use (EU) and perceived benefits (PB)- the two significant belief internal variables.

While research studies conducted to develop TAM and TAM2 are concerned with identifying the correlations between variables, studies on TAM2 focus on generating more tangible and applicable outputs. Venkatesh and Bala (2008) argue that manager support before and after using a new technology is a significant component in individuals' process of technology acceptance. They emphasise that one of the tasks of managers is to develop applications which match individuals' perceptions of new technology with their job requirements and which encourage them to use the new technology (Venkatesh & Bala, 2008).

This study uses Unified theory of acceptance and use of technology (UTAUT) to explain prospective teachers' state in terms of technology acceptance and use. The UTAUT was developed by Venkatesh et al. (2003), and- as different from other theories- it has four external variables referred to as performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating condition (FC). PE is the technology using individuals' degree of expectations that increase in performance will be made possible in their work (Venkatesh et al. 2003). The moderator variables on the effects of PE on technology acceptance are gender and age. EE is the degree of conveniences that technology use will bring (Venkatesh et al. 2003).

Regulatory variables are gender, age and experience (Venkatesh et al. 2000). SI is the degree to which other people around consider the use of technology important; and the moderator variables are gender, age, volunteering and experience (Venkatesh et al. 2003). Facilitating condition (FC) can be defined as the availability of organisational or technical infrastructure which will be necessary during technology use (Venkatesh et al. 2003). The moderator variables described for FC are age and experience (Venkatesh et al. 2000). Behavioural intention in UTAUT is considered as a critical indicator of technology use (Venkatesh et al. 2003). Figure 1 shows the correlations between the components of the model and the variables.

As clear from Figure 1; performance expectancy, effort expectancy and social influence have direct effects on the behavioural intention to use technology whereas facilitation conditions and behavioural intention to use technology have direct effects on the use of technology. The variables of self-efficacy and attitudes towards use- which are available in the theory of planned behaviour- are not present in the unified model of technology acceptance and use as the direct determiners of behavioural intention. However, due to the studies arguing that these two variables affect behavioural intention available in the literature, they each were considered as factors by the developers of the scale used in the study.

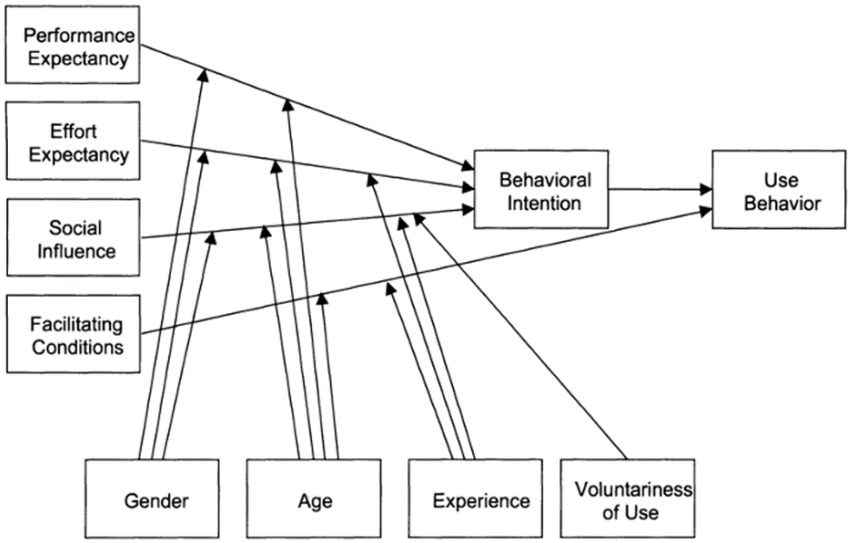

Figure 1. UTAUT (Venkatesh et al. 2003)

On examining the studies concerning the use of the technology acceptance model in education, it was found that Uğur (2017) analysed quantitatively educational faculty lecturers' levels of using the Web 2.0 tools and their purposes in using them, the problems they encountered and the factors influential in their use of them. The researcher used "web 2.0 tools use scale" developed on the basis of combined model of technology acceptance and use to collect the data and "web 2.0 tools use survey" to find the demographic information, levels of web 2.0 skills, goals in using web 2.0 tools and the problems encountered in using them. As a result, the researcher found that the most commonly used tools were videos, documents/storage, presentations, social networks, surveys and wiki. It was found in the study that such variables as gender, age, title and seniority did not have effects on the number of web 2.0 tools. The findings also indicated that lecturers used web 2.0 tools mostly in presenting the content, assignments, audio-visual enrichment, projects, communication, promoting cooperation and professional development. It was also found that skill levels in web 2.0 tools and age groups might have effects on performance expectancy, effort expectancy, facilitating conditions, self-efficacy, attitudes, anxiety and intention. Yıldız Durak (2019) analysed prospective teachers' use of online social networks for educational purposes on the basis of the unified theory of acceptance and use of technology. In consequence the study found that the use of online social networks for educational purposes was affected respectively by social effect, performance expectation and effort expectation, and behavioural intention of using these technologies. Diri and Açıkgül (2021) identified high school students' levels of mobile technology acceptance in learning mathematics on the basis of the unified theory of technology acceptance model 2. The researchers analysed students' levels of acceptance according to gender, types of school, age, having access to the internet, experience in using mobile technologies, competence in using mobile technologies, experience in using mobile technologies in learning mathematics, frequency in using mobile technologies in learning mathematics and levels of perceptions of self-efficacy. As a result, they found the students' levels of acceptance to be medium. They also found that the students' levels of acceptance differed significantly according to their access to the internet, their experience and competence in using mobile technologies, their frequency of and experience in using mobile technologies in

learning mathematics. Besides, their levels of perceptions of self-efficacy explained 5.7% of the variance in mobile technology acceptance.

Teo et al. (2012) evaluated the behavioral intentions of prospective teachers in Turkey to use computers in the future within the framework of TAM. It became apparent as a result of SEM which was done for data analysis that perceived usefulness, attitudes towards computer use and self-efficacy in computers had direct effects on prospective teachers' intention to use technology; that they had indirect effects on their perceived ease of use, technological complexity and facilitating conditions and that perceived benefits were the strongest determiner of behavioural intention. In the light of these results, it was concluded that the TAM model was effective in explaining prospective teachers' acceptance of technology. Libenberg, et al. (2018) analysed the factors influencing university students' acceptance of ICT use on the basis of the unified theory of acceptance and use of technology (UTAUT) model. As a result, it was found that PEx, FC and EfEx showed high practically significant relationships with BI. SE and ATT as mediators of the model are confirmed, however gender as moderator did not reflect the original findings of UTAUT. Hoi (2020), in a study which analysed 293 university students' use of mobile instruments in language education according to the unified theory of acceptance and use of technology model, found that attitudes and performance expectancy were influential in students' acceptance and use of technology.

The Significance and Purpose of the Study

Despite the fact that today's prospective teachers use digital media and information and communication technologies commonly, the same may not true for using instructional technologies. Use of technology in teaching environments can be disrupted if prospective teachers- who are learners and also the future teachers- consider technology only as an element of their daily. Instructional technologies should be adopted by students and teachers so that they can be fully used (Buzzard et al. 2011). It would be useful to investigate prospective teachers' acceptance of technology so as to make predictions on their use of technology in their classes in the future because teachers' skills, knowledge and beliefs are shaped during pre-service teacher training (Gürer, 2021). When the benefits that digital materials provide for students and the digital transformations occurring in the area of education are taken into consideration, it can be said that teachers' efficacy in designing the digital materials they are going to use in their classes is important. Hence, this study investigates whether or not there are any significant correlations between prospective teachers' competence in designing digital materials and their acceptance and use of technology.

The study conducted for this purpose uses descriptive survey model. Studies which enable collection of data to identify the desired features of a group are called studies of survey (Büyüköztürk et al. 2015: 14). The participants of the study were educated at a state university in Turkey/Ankara, from the faculty of education in German (3%), Physical Education (5.5%), CEIT (3.5%), Biology (2%), Science (10.1%), Physics (1.5%), French (1%), English (4.5%), Chemistry (1%), Elementary Mathematics (6%), Preschool (31.7%), Grade (9%), Turkish (11.6%), Secondary Education Mathematics (2.5%), PDR (2.5%), and Special Education (4.5%) departments,

who studied at different grade levels, successfully completed the Instructional Technology course 199 teacher candidates. When the distribution of the group by gender is examined, it is seen that 154 of the participants are female and 45 are male. The research problems were formulated as in the following:

1) How competent are prospective teachers in designing digital materials?
2) At what level are prospective teachers in terms of acceptance and use of technology?
3) Are there any correlations between prospective teachers' competence in designing digital materials and their acceptance and use of technology?

Method

Data Collection Tools

Competence in Designing Digital Materials Scale

The competence in designing digital materials scale (CDDMS), which was developed by Göçen Kabaran and Uşun (2021), is in 5-pointed Likert type and it contains 31 items. The scale has 4 sub-factors labelled as "competence in designing and developing" (CDD), "technical competence" (TC), "techno pedagogical competence" (TPC) and "competence in application and evaluation" (CAE). It can be used to determine competence of teachers of differing branches and of differing grade levels in designing digital materials. Cronbach's Alpha for the whole scale was found as .98. In addition to that, the figure was .97 for the factor of competence in designing and developing, .94 for the factor of technical competence, .96 for the factor of techno pedagogical competence and .95 for the factor of competence in application and evaluation.

Prospective Teachers' Acceptance and Use of Technology Scale (UTAUT-PST)

The scale- which was developed by Kabakçı-Yurdakul, et al. (2014)- consists of 23 items and 7 factors. The factors were labelled as "performance expectancy", "effort expectancy", "facilitating conditions", "social influence", "self-efficacy", "attitudes towards use" and "behavioural intention". The scale items are in 5-pointed Likert type and were formulated as "I absolutely agree", "I agree", "I am indecisive", "I disagree" and "I absolutely disagree". Cronbach Alpha coefficient for the whole scale was found as .95. It was found to range between .85 and .92 for the sub-factors. It was also confirmed through confirmatory factor analysis that the scale had 7-factor structure. All of the items in the scale are positive statements and the scale does not have any reversely coded items. According to the 4 factors of the scale, the distribution of the items is as in the following: Performance expectancy: items 7, 10, 20, 21 and 23; effort expectancy: items 3 and 4; facilitating conditions: items 1, 11 and 19; social influence: items 5,8 and 13; self-efficacy: items 6,12 and 14; attitudes towards use: items 2, 9 and 17 and behavioural intention: items 15, 16, 18 and 22. In coding in section 2 of the scale, 1 point was assigned to "I disagree", 2 points to "I agree partially", 3 points to "I am indecisive", 4 points to "I agree" and 5 points to "I absolutely agree". The interpretations for the findings were based on the calculations made through the arithmetic average. The minimum score receivable from the scale was 23 whereas the maximum score receivable was 115. Thus, the difference between the maximum score and the minimum score was 82.

Findings

This study sought answers to

1) How competent are prospective teachers in designing digital materials?
2) At what level are prospective teachers in terms of acceptance and use of technology?
3) Are there any correlations between prospective teachers' competence in designing digital materials and their acceptance and use of technology?

Table 1 shows the results of descriptive analysis done to reveal prospective teachers' competence in designing digital materials.

Table 1. Prospective Teachers' Levels of Designing Digital Materials

Factors of the Scale	x̄	SS	Level
Competence in Designing and Developing	3.7063	.58474	High
Technical Competence	3.7582	.63677	High
Techno Pedagogical Competence	4.0515	.62413	High
Competence in Application and Evaluation	4.0578	.62035	High
CDDMS	3.8768	.54306	High

An examination of the competence levels according to the average scores the participants received from the scale and from the factors of the scale- which are shown in Table 1 demonstrates that prospective teachers have high level of competence in the whole scale and in all the sub-factors of the scale. Descriptive statistics and multiple linear regression were used in relation to research problem two. The results of the analyses are shown in Tables 2 and 3.

Table 2. Prospective Teachers' Levels of Acceptance and Use of Technology

Sub-Factors	x̄	SS	Düzey
Facilitating Conditions	3,7437	,84066	I am indecisive - I agree
Performance Expectancy	4,2073	,59623	I agree
Effort Expectancy	4,2236	,67157	I agree
Social Influence	3,6533	1,09475	I am indecisive - I agree

Sub-Factors	x̄	SS	Düzey
Self-Efficacy	3,7521	,77123	I am indecisive - I agree
Attitudes Towards Use	4,0955	,65933	I agree
Behavioural Intentions	4,0138	,70541	I agree
UTAUT-PST	3,9574	,84066	I agree

When the descriptive statistics in Table 2 are examined, it is seen that the pre-service teachers tend to give the answer "I agree" to the items in the UTAUT-PST scale.

Table 3. The Results of Multiple Regression Done for Prospective Teachers' Intentions to Use ICT

	B	Sh.	β	t	p	R	R^2	F (6,199)	p
Facilitating Conditions	.130	.003	.209	46.332	.000				
Performance Expectancy	.190	.006	.216	31.205	.000				
Effort Expectancy	.086	.004	.110	19.231	.000				
Social Influence	.129	.002	.269	60.910	.000	.998	.997	8299.460	.000
Self-Efficacy	.136	.003	.199	39.258	.000				
Attitudes Towards Use	.160	.006	.200	26.516	.000				
Behavioural Intentions	.166	.005	.223	32.042	.000				

It is evident from Table 3 that performance expectancy, effort expectancy, social influence, facilitating conditions, self-efficacy and attitudes towards use are all effective in prospective teachers' behavioural intentions to use technology. According to the multiple linear regression, all of the variables are the significant predictors of acceptance and use of technology. ($F(6,199) = 8299.460$, $p<.05$). The six variables altogether explain 99% of the variance in the acceptance and use of technology.

Pearson's correlation test was done for the third and the last research problems. The results of the Pearson's correlation test-which was done to determine the correlations between prospective teachers' competence in developing digital materials and their acceptance and use of technology are shown in Table 4. According to the results of Pearson's correlation test, high level positive and linear correlations were found between the

participants' competence in developing digital materials and their acceptance and use of technology (r=.914, p=.000).

Table 4. The Correlations between Prospective Teachers' Competence in Developing Digital Materials and Their Acceptance and Use of Technology

Scale	N	r	p
Competence in Developing Digital Materials Acceptance and Use of Technology	199	.914	.000

Conclusion and Discussion

This paper, which investigated whether or not there were any significant correlations between prospective teachers' competence in designing digital materials and their acceptance and use of technology, primarily analysed the participants' competence in designing digital materials. They were found to have high levels of competence in all of the factors of technical competence, techno pedagogical competence and competence in application and evaluation. The basic reason for the result might be that all the participants had taken the Instructional Technologies and Materials Development course and passed the exams for the course and that they had prepared lesson plans containing several traditional and digital materials within the scope of the course.

An examination of prospective teachers' acceptance and use of technology according to such variables as performance expectancy, effort expectancy, social influence, facilitating conditions, self-efficacy and attitudes towards use demonstrated that the great majority of the participants had expectations that their performance in classes would increase, their effectiveness in teaching their classes would increase, their process of teaching the classes would be facilitated and that the case would be important for them, for their colleagues and for their parents through the use of technology. According to the results of multiple linear regression, all of the variables were the significant predictors of the acceptance and use of technology ($F(6,199) = 8299.460$, $p<.05$). The six variables altogether explained 99% of the variance in the acceptance and use of technology. In a similar vein, Wang et al. (2009) also aimed to determine the variables influential in the acceptance and use of mobile internet technologies. According to the results obtained in the study, the variables of the unified theory of the acceptance and use of technology model explained behavioural intention to use mobile internet technologies by 65%. Aliano et al. (2019), in a study which investigated the use of smart phones in education according to the unified theory of acceptance of technology model with the participation of 370 university students, found that all the factors were the significant predictors of the acceptance and use of technology. Persada et al. (2019) investigated Z-Generation students' inclinations towards digital learning by using the unified theory of acceptance and use of technology model. The results indicated that the UTAUT model explained 33% of the students' inclinations towards digital learning.

Another part of the research is to determine the relationship between pre-service teachers' digital material design

competencies and their acceptance and use of technology. In this study, it was concluded that pre-service teachers' digital material design competencies were positively and highly correlated with technology acceptance and use. According to this finding, technology acceptance and usage status has an impact on the ability to design digital materials. It is possible to say that pre-service teachers who internalize technology and accept to use it professionally consider themselves competent in designing digital materials.

Recommendations

Teachers gain their occupational skills, knowledge and beliefs during pre-service teacher training. They will feel comfortable if they learn during the pre-service period how to use instructional technologies in their classes effectively and how to integrate digital materials into their classes effectively. Thus, they will not have difficulty in integrating the new technologies into their classes, they will not have prejudices against such technologies and will have high levels of acceptance of them in their professional life. Therefore, courses and applications through which prospective teachers will experience new instructional technologies should be included in teacher training curricula.

The studies concerning prospective teachers' acceptance of technologies prioritise the idea that determining prospective teachers' behavioural intentions to use technology helps to make predictions about the use of technology in classrooms in the future and that it also helps teacher trainers and policy followers to design courses and teacher training curricula (Gürer, 2021). Therefore, the number of studies which investigate prospective teachers' levels of technology acceptance and variables influential in the issue should be increased.

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