Education and Science

Vol 39 (2014) No 176 81-93

Secondary School Students Tablet Computer Acceptance and Readiness: A Structural Equation Modelling

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Abstract

Many educational institutions have been using lots of technologies in classrooms to increase the effectiveness of learning activities. In recent years, tablet PC (TPC)'s have been the primary of these technologies. Technology especially comes to exist in busy environments and gets even more important in the environments where students defined as "digital native" can use technology effectively. However, there have been no sufficient studies about the acceptance, readiness and use of tablet PC's in secondary schools. In this research, secondary school students' acceptance of tablet PC was examined with technology acceptance model, and readiness variable was also added. As a result of the research, it was found that secondary school students' acceptance level of tablet PC is explained at a good level. It was also found that readiness is an important variable for intention to use tablet PC. Also it was found that self-efficacy and anxiety in acceptance of tablet PC are important external variables.

Keywords

Technology acceptance
Tablet PC
Readiness
Anxiety
Self-efficacy

Article Info

Received: 06.13.2014
Accepted: 11.05.2014
Online Published: 12.16.2014

DOI: 10.15390/EB.2014.3500

Introduction

Technology can be considered as the building block that helps forming the information age. Technological tools are used at home, workplaces, entertainment, namely in every area of daily life today. When the spreading speed of the information and communication technologies (ICT) is considered, it is seen that the fastest spreading technologies are computers, Internet and mobile phones (International Telecommunication Union, 2009). When the computer is examined among those, it is obvious according to data from 2012 that 36.2% of the people in the world, 35.2% people in Turkey have computer in their home (International Telecommunication Union, 2012). When looked at the information and communication technology development indexes of the countries, Turkey is the 59th country with a score of 4.2 (International Telecommunication Union, 2011).

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When it is considered that today's children are good at technology, it is very important to increase the use of technology for digital natives in all areas. One of these main areas is education. Because both technology literacy could be gained and it would be possible to raise technology experts through education. Moreover, information and communication technologies are very efficient tools utilized in education of children and adults both in and out of the school today. To provide education from the womb to the grave is realized through the use of the technological equipment.

The use of tools in education is possible with having the knowledge about these tools and using them. However, the acceptance of the technology is very important for using a tool at first. When related literature is examined, it was shown that the use of technology is associated with the belief, attitude and intentions of the individuals who are to use technology (Horzum & Canan Güngören, 2012). In this sense, acceptance of technology that includes the belief, attitude and intentions of the individuals towards technology is a crucial dimension.

Technology Acceptance Model (TAM) & Tablet PC

Technology acceptance is a concept associated with information and communication technologies into our lives. To accept a technology is to be willing to use the technology (Teo, 2011). Under this definition, different models which examined and revealed variables that make individuals be willing to use the technology have been developed about technology acceptance. With these models the variables that affect individuals' technology acceptance and technology acceptance are being investigated.

Among the models associated with technology acceptance, Technology Acceptance Model is one of the most frequently used and developed models (Pynoo et al., 2011). Technology Acceptance Model were associated the use of technology with beliefs, attitudes and intentions starting from the Theory of Reasoned Behaviour developed by Fishbein and Ajzen (1975) and the Theory of Planned Behaviour developed by Ajzen (1991). In the Technology Acceptance Model, individual's use of technology was affected by the intention to use; intention was affected by attitudes towards the use, perceived ease of use and perceived usefulness; perceived ease of use and perceived usefulness were affected by the external variables were determined (Davis, 1993).

Technology Acceptance Model have been used in studies that investigate the acceptance of the use of many technologies such as computers (Yuen & Ma, 2002), the World Wide Web (Moon & Kim, 2001; Riemenschneider, Harrison & Mykytyn JR., 2003), websites (van Schaik, 2011), learning management systems (Adjin-Tettey, 2014; Baleghi-Zadeh et al., 2014), web-based training system (Pynoo et al., 2011) e-learning (Ong & Lai, 2006; Pan et al., 2005; MA & Yeung, 2011). Especially in recent years, at a time that the increasing prevalence of computers and mobile devices, with the importance of tablet computers and frequent use of tablet computers in the field of education (MEB, 2012) within the scope of the FATIH Project implemented in Turkey, acceptance of the use of tablet computers also has become one of the subjects to be explored.

TPC is a portable computer that allows the user to use the screen via a special pen and allows mouse and keyboard input. TPC has a capacity to represent a perfect platform for drawing and writing, and can be used to teach. When compared to other media, it is easier to write and erase in TPC, and students can save all content in the tablet when they want a copy (Gill, 2007).

TPC and other mobile technologies have been becoming common in the whole education area (Pegrum, Howitt & Striepe, 2013). One of the main reasons for this is that using TPC helps students a lot. It is foreseen that TPC will take its place among the standard equipment in the classroom by following a similar route because its users benefit from it a lot (Mock, 2004). The acceptance of these tools that are thought to be an important component in classrooms is a factor that affects their use. In this sense, it would be useful to examine the studies related to TPC acceptance.

In the researches related to TPC acceptance, the effect of using TPC at the classroom on students' views was examined. It was found that students being able to follow the lesson without taking notes and afterwards to get the lesson notes from TPC make them more concentrated and motivated. Participants remember what they forget better and it is advantageous to repeat the notes whenever they want in this way. TPC helps student learning again, and it was emphasized that this is difficult in other media (Biswas, 2007).

Studies related to secondary school students' use of TPC are more limited. Among those, the study of Crossland et al. (2000) carried out a research that provides students with TPCs having a special distant learning system for mathematics. Kravcik et al. (2004) was about students' using a TPC having a system that provides "virtual subject area tours". Elyazgi et al. (2014) researched the 8th grade students' acceptance of TPC in Malaysia with using mixed research methods. Also, Sahadani and Salleh (2014) has been the subject for the acceptance of TPC in science education.

The researches show that there are limited studies related to secondary school students' acceptance of TPC. Another important variable in students' acceptance of technology is readiness.

Readiness and TPC Readiness

Readiness means to have the preconditions, qualifications and pre-experiences in order to perform an event, issue or situation (Şişman, 2001). Readiness is valid for many situations in daily life, e.g. driving car, swimming, literacy, skills to do a task. Readiness concept is a situation that is emphasized in many applications related to education. One of the most important variable associated with readiness in education is readiness to learn. Readiness to learn means all elements that an individual has to make the learning happen. Jonson (1973) considered readiness to learn as the capacity of the child to benefit or gain from teaching.

Readiness to learn means that students have pre-information, pre-conditions and experiences about the topic they are to learn. This situation differs in learning by technological tools, and so two different readiness comes forth. The first one is readiness for using the tool to learn. In the literature, there are some examples of readiness for technology (Parasuman, 2000), computer and internet (Parnell & Carreher, 2003), ICT (Tang, Yin & Sheu, 2011), online portals (Chiou, Ayub & Luan, 2010). The second one is readiness for learning through technological tools, e.g. online learning (Hung et al., 2010), distance learning (Horzum & Çakır, 2012), e-learning (Darab & Montazer, 2011), web-based learning (Davis, 2006), CMC (Gunawardena & Duphorne, 2001), mobile learning (Cheon et al., 2012).

TPC readiness has been gaining importance with TPC's spreading and being using in education today. When the literature is examined, it is seen that studies about TPC are associated with TPC acceptance as a learning tool, and there are limited studies about readiness. Readiness is a variable that affects students' satisfaction (Gunawardena & Duphorne, 2001), increasing their success, enhancing their potential of life-long learning (Davis, 2006), motivation to learn (Hung et al., 2010). Readiness is also an important variable in acceptance of tools and their use in educational context (Demir Kaymak & Horzum, 2011).

Research Hypothesis

For a significant integration of a computer or TPC, it is very important to understand individuals' willingness and intentions of use (Smarkola, 2011). Despite, there have been various studies about self-efficacy, anxiety, technology acceptance and readiness, no study has investigated the relationships between all of them all in one and for TPC. From this point, to examine the relationships between high school students' self-efficacy, anxiety, technology acceptance and readiness for TPC occurs the present study's purpose. The following research hypothesis provided the framework for the study:

1. Secondary school students' self-efficacy perception about TPC would be associated positively with perceived usefulness perception about TPC.
2. Secondary school students' anxiety levels towards TPC would be associated negatively with perceived ease of using TPC.
3. Secondary school students' perceived ease of use and perceived usefulness perception about TPC would be associated positively with attitude toward using TPC.
4. Secondary school students' attitude toward using TPC would be associated positively with behavioural intention to using TPC.
5. Secondary school students' behavioural intention to using TPC would be associated positively with readiness for educational usage of TPC.

Method

Participants

Participants were consisted of 1130 secondary school students from a province located in the Marmara Region. At research, questionnaires were distributed by hand, so random convenient sampling method was used for the selection of the participant. Volunteer students filled the questionnaires. 532 of the participants (47.1%) were females and 598 of them (52.9%) were males. 318 of the participants (28.1%) were ninth grade, 284 of the participants (25.1%) were tenth grade, 261 of the participants (23.1%) were eleventh grade and 267 of the participants (23.7%) were twelfth grade students. 792 of the participants (70.1%) said that they used a TPC and 338 of them (29.9%) said that they didn't use a TPC yet. 1111 of the participants (98.3%) state that they want to use TPC in education and 19 of them (1.7%) state that they don't want to use TPC in education.

Instruments

Four different scales used in the study and three of them have been developed by researchers, the scope of the research. Scales used in this study are presented in the Appendix.

Self-Efficacy for TPC Usage Scale (SETPUS)

The SETPUS was developed by the researchers. Preliminary scale was prepared by considering the literature. In exploratory factor analysis (EFA) , it was found that scale consisted of a single factor and items' factor loads were varied from .668 to .812. The confirmatory factor analysis (CFA) of the scale revealed that 8 items consisted one dimension. The Cronbach's alpha reliability coefficient of the scale was 0.886. The results of reliability coefficients and goodness of fit indexes of confirmatory factor analyze about scale is located in Table 1.

Anxiety for TPC Usage Scale (ATPUS)

The ATPUS was developed by the researchers. Preliminary scale was prepared by considering the literature. In EFA, it was found that scale consisted of a single factor and items' factor loads were varied from .694 to 847.The CFA of ATPUS revealed that 8 items consisted of one dimension. The Cronbach's alpha reliability coefficient of the scale was 0.917. The results of reliability coefficients and goodness of fit indexes of confirmatory factor analyze about scale is located in Table 1.

Acceptence of TPC Scale (ATPS)

The ATPS was developed by Canan Güngören, Bektaş, Öztürk and Horzum (2014). Scale was prepared by considering the literature in line with the Technology Acceptance Model developed by Davis (1993). The CFA of the ATPS revealed that 17 items consisted of four sub-dimensions: Perceived Ease of Use (PEU), Perceived Usefulness (PUF), Attitude toward Use (ATU) and Behavioral Intention to Use (BIU). With the structure of 17 items and four sub-dimensions, the acceptance of TPC scales' explained total variance is 64.12%. At the end of the development study, The Cronbach's alpha reliability coefficient of the scale was.90. The results of reliability coefficients and goodness of fit indexes of confirmatory factor analyze about scale is located in Table 1.

Readiness for TPC Scale (RTPS)

The RTPS was developed by the researchers. Scale was prepared by considering the literature. In EFA, it was found that scale consisted of a single factor and items' factor loads were varied from .624 to .785. The CFA of RTPS revealed that 7 items consisted of one dimension The Cronbach's alpha reliability coefficient of the scale was 0.836. The results of reliability coefficients and goodness of fit indexes of confirmatory factor analyze about scale is located in Table 1.

Table 1. Reliability coefficients and goodness of fit indexes of confirmatory factor analyze.

Scale	Reliability	Fit measure	Model value	Scale	Reliability	Fit measure	Model value
Self-Efficacy for Tablet PC Usage	0.87	χ^2/df	3.02	Anxiety for Tablet PC Usage	0.92	χ^2/df	3.28
		RMSEA	0.042			RMSEA	0.065
		SRMR	0.016			SRMR	0.021
		CFI	0.99			CFI	0.99
		NFI	0.99			NFI	0.99
		NNFI	0.99			NNFI	0.99
		GFI	0.99			GFI	0.98
		AGFI	0.98			AGFI	0.95
Readiness for Tablet PC	0.84	χ^2/df	3.17	Acceptance of Tablet PC	0.84	χ^2/df	3.48
		RMSEA	0.061			RMSEA	0.047
		SRMR	0.030			SRMR	0.032
		CFI	0.99			CFI	0.99
		NFI	0.98			NFI	0.99
		NNFI	0.98			NNFI	0.99
		GFI	0.98			GFI	0.96
		AGFI	0.96			AGFI	0.95

When fit indexes in Table1 were examined, it can be concluded that all values satisfied the criterion values or very close to them according to Schermelleh-Engel, Moosbrugger and Müller (2003).

Data Collection & Analyze

In the study, after receiving the necessary permission, the data from secondary school students in the class has been obtained by distributing and collecting manually. In the data obtained, descriptive analysis and structural equation modeling analysis was conducted. In the study, ready packages for data analysis programs were used and the significance level is based on the .05.

Results

Firstly, each scale and descriptive statistics of their factors was examined in the study. Analysis results are given in Table2.

Table 2. Descriptive Statistic

Variable	Mean	Standard Dev.	Standard Error
Self-Efficacy	4.71	0.49	0.02
Anxiety	1.59	0.87	0.03
PEU	4.56	0.60	0.02
PUF	4.68	0.56	0.02
ATU	4.74	0.51	0.02
BIU	4.74	0.54	0.02
Tablet PC Use Readiness	4.67	0.49	0.02

When Table 2 is analyzed, it is seen that self-efficacy of secondary school students towards TPC are above the average. Nevertheless anxiety levels of secondary school students towards TPC are below the average. When the TPC acceptance levels of secondary school students are analyzed, it is pointed out that attitude toward use, behavioral intention to use, perceived ease of use, and perceived usefulness are above the average. When TPC usage readiness is analyzed, it is seen that secondary school students' readiness are above the average. It is understood that self-efficacy, acceptance and readiness for TPC use of secondary school students' are high, in contrast anxiety levels are low.

A model for high school student's readiness for educational usage of TPC

During configuration of the structural equation model to explain secondary school student's readiness for educational usage of TPC, six variables, namely, self-efficacy, anxiety, attitude towards use, behavioral intention, perceived usefulness (PUF) and perceived ease of use (PEU) were examined. This model was developed based on observed variables comprised of all items and latent variables comprised of self-efficacy, anxiety, attitude towards use, behavioral intention, perceived usefulness (PUF) and perceived ease of use (PEU). For showing the goodness-of-fit of the model's suitability, RMR, GFI, SRMR, RMSEA, CFI, NNFI, AGFI, IFI, NFI and the $\chi 2/df$ were used. Table3 indicates the model's goodness-of-fit values.

Table 3. Model için Uyum İndeksleri (Schermelleh-Engel, Moosbrugger, ve Müller, 2003).

Fit indexes	Perfect fit	Model results
χ^2/df	$\chi 2/df<3$	2.97
RMSEA	0 < RMSEA < 0.05	0.042
SRMR	SRMR <0.05	0.049
CFI	0.97 < CFI < 1	0.99
NFI	0.95 < NFI < 1	0.99
NNFI	0.97 < NNFI < 1	0.99
GFI	0.95 < GFI < 1	0.92
AGFI	0.90 < AGFI < 1	0.90

Table 3 demonstrates that all of the indexes except for GFI are perfect compatibility, so it means that the measurement model displayed a good compatibility.

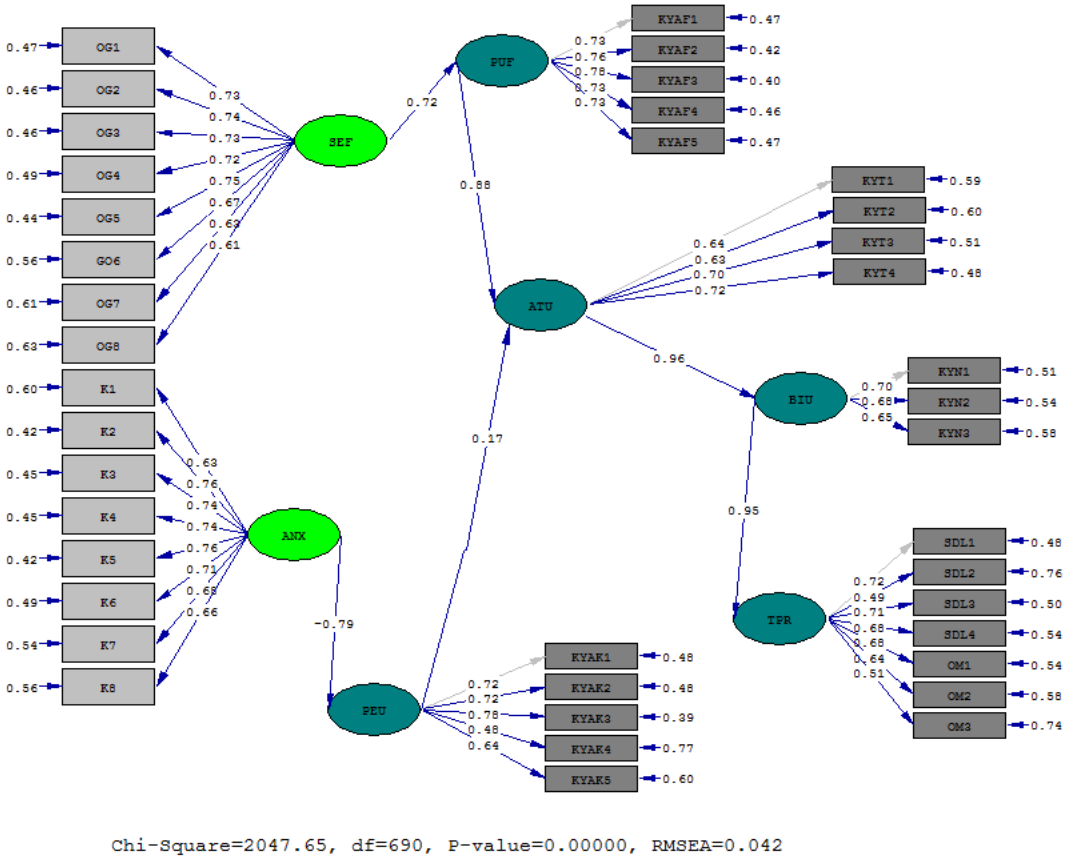

Figure 1. The result of readiness for educational usage of TPC Model (standardized coefficients)

t values and path coefficients of the readiness for educational usage of TPC Model on the basis of Technology Acceptance Model developed by Davis (1993) schematized as the Figure 1 presented in Table 4.

Table 4. Path coefficients and T-values.

Variable 1	Variable 2	Path coefficients	T-value
Perceived Ease of Use (PEU)	Anxiety (ANX)	-0.79**	-21.05
		0.72**	20.58
Perceived Usefulness (PUF)	Self-efficacy (SEF)	0.17**	6.74
Attitude Toward Using (ATU)	Perceived Ease of Use (PEU)	0. 88**	19.14
	Perceived Usefulness (PUF)	0.96**	19.68
Behavioral Intention to Use (BIU)	Attitude Toward Using (ATU)	0.95**	21.39

** p<.01.

It is found that all the coefficients between variables are significant. Anxiety and self-efficacy towards TPC have significant effect on PEU TPC. Furthermore the PU and PEU variables have positive significant effect on attitude towards using TPC. In addition attitude towards using TPC has significant positive effect on behavioral intention to use TPC. Then behavioral intention to use has significant positive influence on readiness for TPC.

When the effect of self-efficacy and anxiety on the PEU is examined, self-efficacy has a significant positive. Moreover anxiety has a significant negative influence on PEU TPC ($p < .05$). In addition, it is found that self-efficacy and anxiety with its determinant variables accounted for approximately 78% (R2) of the variance of PEU TPC.

When the effect of PEU and PU on the attitude toward using is examined, PEU and PU have a significant positive effect on attitude toward using TPC ($p < .05$). In addition, it is found that PEU and PU with its determinant variables accounted for approximately 97% (R2) of the variance of attitude toward using TPC.

Similarly, it is found attitude toward using TPC has a significant positive effect on behavioral intention to use TPC ($p < .05$). In addition, it is found that attitude toward using TPC with its determinants accounted for approximately 86% (R2) of the variance of behavioral intention to use.

When the effect of behavioral intention to use TPC on the readiness for TPC is examined, behavioral intention to use TPC has a significant positive effect on readiness for TPC ($p < .05$). In addition, it is found that behavioral intention to use TPC with its determinant variables accounted for approximately 97% (R2) of the variance of readiness for TPC.

Table 5. Estimated structural equation between variables.

Relation between variables	**Estimated structural equation**
PEU – ANX	PEU = -0.77*ANX $R^2 = 0.62$
PUF – SEF	PUF = 0.70*SEF, $R^2 = 0.52$
ATU – PEU + PUF	ATU = 0.092*PEU + 0.48*PUF, $R^2 = 0.96$
BIU – ATU	BIU = 0.92*ATU, $R^2 = 0.92$
TPR –BIU	TPR = 0.94*BIU, $R^2 = 0.90$

Discussion, Conclusion and Suggestions

TPCs are one of the latest technologies have taken their places in education and started to be used. Now that TPCs started to be used in education, there are benefits like student performance (Connelly Stockton & Gregory, 2012), interactivity and student communication (Galligan, Hobohm & Loch, 2012), student learning, teaching effectiveness, classroom dynamics (El-Gayar & Moran, 2007). Although TPCs have several benefits, students should prefer TPCs as a learning tool so that TPCs are used by students. TPCs should be accepted by students and students should be ready to learn with TPCs so that students prefer TPC as a learning tool.

In researches, students' acceptance of TPC was examined but students' self-efficacy, anxiety and readiness for TPC was not taken into consideration. This study is important with regards to the fact that it examines the variables of the secondary school students' self-efficacy, anxiety, technology acceptance and readiness for TPC together, and considers the relation between these four variables.

In the scope of this study, two important findings were obtained. First one of these is obtaining valid and reliable tools that will show the secondary school students' self-efficacy, anxiety, readiness and acceptance levels for using TPC. The second important finding is that a model defined the acceptance of TPC and based on the model of TAM was developed. These two results are considered to be important with regards that they represent measuring tools and acceptance model for TPC, and they were discussed separately.

First, measuring tools came along to determine the secondary school students' use, acceptance, self-efficacy, anxiety and readiness for TPCs. These tools can be used both individually and together with different variables. Besides that, these tools can be used for primary and higher education after its psychometric properties are examined.

In the research, descriptive results of the scores obtained from the scales were examined first. According to descriptive statistics, anxiety levels of high school students towards TPC are found very low. On the other hand, students have high self-efficacy, acceptance levels and readiness for TPC.

In scope of the research, a model for secondary school student’s readiness for TPC which was structured with six variables -self efficacy, anxiety, attitude towards use, behavioural intention to use, PU and PEU- was formed and analysed. As a result of these analyses, self-efficacy has a positive and anxiety has a negative influence on PEU TPC significantly. PEU and PU have a positive effect on attitude towards using TPC significantly. Attitude towards using TPC has a positive effect on behavioural intention to use TPC significantly. Behavioural intention to use has significant positive influence on readiness for TPC significantly. The model shows secondary school students' acceptance of TPC. The most original aspect of this model is that it shows that intention to use affects readiness to use TPC.

In the study in which Moran (2006) used models of UTUAT and TAM, he addressed the relation between variables of self-efficacy, attitude towards using technology, and anxiety and university students' acceptance of TPCs. In another research about students' acceptance of TPC, it was found that attitude and intention are significantly determined by perceived usefulness, also usefulness and attitude are significantly determined by perceived ease of use. Intention to use the TPC was found that the 40% of it is determined by attitude and the 50 % of it is determined by attitude and perceived ease of use (El-Gayar & Moran, 2007). In a similar study done with students, attitude is found a more significant variable for behavioural intention to use TPC (El-Gayar, Moran & Hawkes, 2011). The results of these studies are consistent with the results obtained from the study and are supportive of the study.

In a another study, computer anxiety and computer literacy is addressed together with computer acceptance, and although computer anxiety has a weak effect on using computer, it is considered as a compound in using computer (Beaudry & Pinsonneault, 2010). Liu (2012) said that there is an inverse proportion between technology anxiety and technology trust, satisfaction and use intentions.

All these studies show that external variables of anxiety and self-efficacy affect Perceived Ease of Use, and relations between the variables in TAM model. And theoretical frame in the TAM emphasized by Davis (1998) and studies related to different technologies about this (see in introduction) show consistency with the findings of the research. Moreover, study about different technologies shows that readiness added into TAM model in the research is an important variable from the point of model.

Cheung, Yuen and Tsang (2011) studied the readiness of mobile learning in open and distance education. In the study it was found that students accept, adopt and like to use the mobile devices for learning. Three critical components, namely pedagogical benefits of mobile learning, meeting students' needs in flexible and ubiquitous learning, and the technological feasibility of mobile learning were found for this acceptance and readiness process. In another study TPC readiness is discussed in term of hardware, cost, software, digital content, infrastructure and security. In this study, it is emphasized that these potential issues affect the readiness of TPC usage in classroom environment (Shabli & Yaacob, 2012).

When the studies are examined, it is seen that mobile technologies will be preferred in education more in the future. In fact, mobile learning architecture will change and improve together with developing technology (Mac Callum & Jeffrey, 2013). Along with these developments, the research can be carried out again by adding some variables such as students' perceptions towards learning with TPCs, students' needs, challenges while using TPC at the classroom, teachers' experiences into the model and even be extended to cover teachers and schools.

In this research, variables considered to be important in using technology such as age, gender, location, being a digital native or not were not examined in the scope of the research. Studies about these variables can be carried out in the next researches. In this research, secondary school students' situations were examined. However, when teachers' roles as a guide for learning media are considered, it is thought that similar studies can be carried out with teachers and teacher candidates. Studies can also be carried out to compare the acceptance levels of teachers and students.

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