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TURKISH ADAPTATION OF MOBILE LEARNING READINESS SCALE IN THE FRAMEWORK OF THEORY OF PLANNED BEHAVIOR

Research article

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Abstract

The aim of the study is to conduct the validity-reliability study of mobile learning readiness scale (MLRS) developed by Cheon, Lee, Crooks, and Song (2012) in the framework of the theory of planned behavior by adapting it to Turkish. The participants determined using convenience sampling method consist of 344 pre-service science teachers studying at two different faculties of education (Nevşehir Hacı Bektaş Veli University and Kırşehir Ahi Evran University) in the spring semester of 2018-2019 in Turkey. The construct validity of the scale adapted to Turkish was carried out via the Confirmatory Factor Analysis (CFA) method. The reliability of the scale was tested by computing Cronbach's alpha (α) as internal consistency levels. It was found that the level of internal consistency value was 0.93 and sub-factors of MLRS were at a good level. In conclusion, the Turkish version of the MLRS in the framework of the theory of planned behavior consists of four main factors including attitude, subjective norm, perceived behavioral control, and intention and three external beliefs including Attitudinal Beliefs (Perceived Ease of Use, Perceived Usefulness), Normative beliefs (Instructor Readiness, Student Readiness), and Control beliefs (Perceived Self-efficacy, Learning Autonomy) as in the original model.

Keywords: mobile learning readiness, the theory of planned behavior, pre-service science teachers, validity and reliability study, the adaptation of the scale

1. Introduction

Recent advances in communications technologies have made mobile devices more common, more convenient, and cheaper. In addition, each new version has brought about new features and applications such as music player and audio/video recording, productivity software, e-mail, and Wi-Fi (Wu et al., 2012). As all areas, the changes that took place in every field of technology have undoubtedly brought new dimensions to the field of education. Researchers and educators have especially attempted to develop mobile applications so as to enhance the education quality in their courses (Kukulska-Hulme & Traxler, 2007). Developments in mobile technology have great importance within formal education and are rapidly expanding the scope of formal education (e.g., informal learning) by allowing immediate and flexible access to digital resources. Using mobile learning in education provides ease of use through location-based services, study aids, and cost savings (Cheon et al., 2012). Contrary to limited classroom environments, mobile learning can also provide learning environments independent of time and space (Valk et al., 2010). This provides a wide range of benefits for students who cannot attend school due to environmental and infrastructure challenges in rural areas (İlçi, 2014). Mobile learning can provide efficient ways of transferring instructional programs to larger communities (Valk et al., 2010) and supplies students with assessment-centered education by evaluating them

in the learning process, providing continuous feedback for them, and providing formative guidance on what students learn in the learning process (Geddes, 2004).

Since many undergraduates have their own mobile devices, it can be said that especially university students among different age groups are more inclined to adopt mobile learning (Traxler, 2007). Thus, learning with the help of mobile technologies became an increasing trend in the expertise of education in digital environments (Jeng et al., 2010). This is because education on mobile can bring about new promising opportunities and improve the learning process (Kalinic, Arsovski, Stefanovic, Arsovski, & Rankovic, 2011). Also, using mobile devices for educational purposes can ensure achieving educational objectives when appropriate education strategies are used (Jeng et al., 2010). However, despite some efforts, mobile learning at universities has not completely developed yet (Park, 2011) since their contents don't sufficiently include instruction. For this reason, to integrate mobile learning into the instruction effectively, firstly, instructors or teachers who are the most important part of an education system should be provided with necessary training (Olpak & Ateş, 2018). However, training prospective teachers studying at university can yield more successful results than giving in-service training to working teachers. Previous studies indicated that using mobile learning environments can provide successful results in training pre-service teachers (Baran, 2014). Baran (2014) presented some motivating factors for pre-service teachers. These factors include helping the construction of collaborative information (Järvelä, Näykki, Laru, & Luokkanen, 2007), providing alternative evaluation and assessment methods (Chen, 2010), developing social interaction (McCaughtry & Dillon, 2008), meeting pre-service teachers' requirements for personalized learning experiences (Kommers, 2009), providing pre-service teachers with the opportunity to connect with a larger group of people (Kearney & Maher, 2013), increasing pre-service teachers' mobility (Husbye & Elsener, 2013), exploring the content areas more deeply (Mahruf, Shohel, & Power, 2010), understanding and developing new literacies for pre-service teachers (Husbye & Elsener, 2013), and carrying out scientific investigations (Gado, Ferguson, & van 't Hooft, 2006).

As in all education fields, mobile learning has an important place in science classrooms and in the training of pre-service science teachers, as well. Mobile learning has the potential to revolutionize science learning and teaching (Metz, 2014) due to some viewpoints that make it unique and suitable for the suitability of mobile technology. Using technology in educational settings helps both students and teachers improve their learning of scientific concepts, understand better the nature of science and scientific methods, develop critical thinking skills, and increase their interest in science education (Basey, Sackett, & Robinsons, 2008). Meanwhile, in conjunction with the growing demand, earlier studies demonstrated the potential to include mobile learning in science education and presented innovative strategies (Rivera, 2016). Students receiving distance education can get in contact with science teachers through learning environments, social networking devices, learning management systems, and other educational environments (Mawn, Carrico, Charuk, Stote, & Lawrence, 2011). Considering previous studies related to science education, according to Crompton, Burke, Gregory, and Grabe (2016), these studies were conducted with the purpose of planning a learning system, assessing its impacts, and examining the affective domain, and evaluating the effects of mobile learning effects (e.g., Wu et al., 2012). Studies in science education indicated that life sciences (e.g., Hung et al., 2012), earth sciences (e.g., Kamarainen et al., 2013), physical sciences (e.g., Lin et al., 2013), and multidisciplinary (e.g., Looi et al., 2014) are major science concepts determined by National Science Teachers Association (2014) and mainly emphasized in elementary schools (Crompton et al., 2016). In addition, although previous studies were carried out with regard to informal learning, formal education context and combination of both formal and informal settings are among educational environments, as well (Crompton et al., 2016).

Among mobile learning devices, cell phones and personal digital assistants (Hsu & Ching, 2013; Wu et al., 2012) are mainly used, while digital cameras, iPad tablets (e.g., McClain & Zimmerman, 2016), handhelds, tablets, and iTouches are also preferred by science teachers and instructors (Crompton et al., 2016).

In addition to the benefits of mobile learning for the training of pre-service science teachers, to be successful in higher education in terms of using and generalizing mobile learning, factors to which people attach importance in the adoption of mobile learning should be determined (Cheon et al., 2012). Considering the relevant literature, it can be seen that several studies were conducted to investigate how and why university students adopt mobile learning (e.g., Wang Wu, & Wang, 2009). In these studies, researchers dealt with university students' levels of acceptance of mobile learning. For example, by using the Technology Acceptance Model (TAM), Liu et al. (2010) found that perceived usefulness and personal innovation affect the adoption of mobile learning. In addition, in the study of Wang et al. (2009), it was revealed that there are five significant factors including social influence, self-management, performance expectancy, perceived playfulness, and effort expectancy in the adoption of mobile learning.

However, even though there have been some attempts to determine the factors affecting mobile learning readiness (e.g., Alkiş & Coşkunçay, 2018), the effects of some psychological factors, such as attitude, belief, norms, and perceived behavioral control (PBC), on mobile learning readiness have yet to be measured (Cheon et al., 2012). One of the best ways to measure these factors is to make use of the in-depth analysis provided by the Theory of Planned Behavior (TPB).

1.1. Theoretical Framework of the Theory of Planned Behavior

TPB, which is an extension of the theory of reasoned action developed by Ajzen and Fishbein (1980), can predict a variety of particular behaviors. In this theory, the most important factor is the intention of the individual to act (Ajzen, 2002). In addition, attitude, subjective norm, and PBC influence the intention to act (Tonglet et al., 2004). Consequently, the theory deals with the constructs which are premises that predict intentions and account for human behaviors (Ajzen, 1991). It is assumed that intention is determined by three kinds of thoughts or beliefs (Ajzen, 2002, 2015). The first is called "behavioral beliefs" referring to the perceived positive or negative results of performing the behavior and the subjective values or evaluations of these results (Ajzen, 2015). These beliefs are considered positive or negative attitudes towards behavior and are examined in two parts: behavioral belief strength and outcome evaluation (Ajzen, 1991). The second is concerned with the perceived expectations and behaviors of importantly motivated persons or groups, as well as the motivation of the people to follow the stated directions. The second type of consideration is related to perceived expectations, and these beliefs are called "normative beliefs" and easily accessible normative beliefs are combined to produce a perceived social pressure or subjective norm about a behavior (Ajzen, 2015). These beliefs are divided into two parts: Normative belief strength and motivation to comply. The third consideration type is "control beliefs," the existence of factors that can influence the ability of someone to act. These beliefs are divided into two parts as well: control belief strength and power of control factor. Control beliefs produce PBC at a certain level in relation to behavior (Ajzen, 2015).

The attitude towards behavior is related to how much the individual evaluates the behavior either positively or negatively (Ajzen, 1991). Attitude is a hypothetical construct that must be excluded from answers as it cannot be measured by observing and considering the nature of work. In addition, the answers reflect a positive or negative evaluation of the attitude object (Ajzen, 2005). The theory pointed out that an attitude towards behavior is specified by accessible beliefs about the outcome of the behavior. The evaluation of each salient outcome

contributes to the attitude in proportion to the subjective probability of an individual that the behavior will result in the conclusion of the subject. Subjective norm reflects the views of people in social environments about conducting or not conducting a particular behavior (Ajzen & Fishbein, 1980). The second type of belief used in the theory is the normative belief, which is related to the subjective norm. PBC is the perception of how individuals behave with regard to easiness and difficulty (Ajzen & Madden, 1986). When optimum conditions are presented, individuals' PBC on behavior could be higher (Madden, Ellen, & Ajzen, 1992). In addition, if the PBC on behavior is high, the intention of the individual to perform his/her actions also increases.

1.2. The current study

Building from the above theoretical framework, the purpose of the study is to conduct the validity-reliability study of the mobile learning readiness scale (MLRS) developed by Cheon et al. (2012) in the framework of TPB by adapting it to the Turkish language. To the best of our knowledge, in the Turkish context, no study has been conducted to understand people's mobile learning readiness and no scale has been developed to measure it. Accordingly, the present study is the first attempt to present a valid and reliable Turkish scale to determine the factors affecting pre-service science teachers' mobile learning readiness levels with TPB. Since every community has its own cultural values, a system of educational technology, and mobile learning environments, the study makes a unique contribution to the literature by reflecting the validation of MLRS in the Turkish context. The original scale was developed for university students studying at a public university, while the current study is more focused on pre-service teachers who will educate future generations and use mobile technology in their classes. In addition, the original MLRS was developed several years ago, so the study makes another valuable contribution to the relevant literature by presenting an updated scale since mobile technologies and the way they are used in educational settings constantly change.

2. Method

In this research, MLRS developed by Cheon et al. (2012) in the framework of TPB was adapted to Turkish and validity-reliability analyses were performed. The research was designed with the quantitative method and conducted as a cross-sectional study, which is a type of survey research. A cross-sectional survey collects data from a predetermined population, or a representative subset, at one point in time (Frankel, Wallen, & Hyun, 2012).

2.1. Participants

The respondents of the study determined by convenience sampling are 344 pre-service science teachers (Table 1) studying at two different faculties of education in Turkey (Nevşehir Hacı Bektaş Veli University and Kırşehir Ahi Evran University) in the spring semester of 2018-2019 in Turkey.

Table 1. *Demographic characteristics*

Characteristic	Demographic	Frequency	%
Gender	Male	49	14.41
	Female	295	88.37
Year at university	1 st year	108	31.40
	2 nd year	93	27.03
	3 rd year	87	25.29
	4 th year	56	16.28
Using mobile devices in education	Yes	287	83.43
	No	57	16.57
	Yes	306	88.95

Using mobile devices in daily life	No	38	11.05
The duration of using mobile devices in daily life	Less than 1 hour	17	4.94
	1–4 hours	140	40.70
	5–8 hours	109	31.69
	More than 9 hours	78	22.67

2.2. The Instrument

The English version of the MLRS was obtained from the study by Cheon et al. (2012). The researchers investigated undergraduate students' perceptions toward mobile learning in higher education and tested a conceptual model based on the TPB by explaining how students' beliefs influence their intentions to adopt mobile devices in their coursework. Similarly, in the current study, in line with TPB, the research model included in Figure 1 was presented. Researchers proposed that external beliefs influence attitude, subjective norm, and PBC, and then three constructs affect the intention to adopt m-learning in the model. Therefore, they developed the following external beliefs:

- *Attitudinal beliefs*; Perceived Ease of Use, Perceived Usefulness
- *Normative beliefs*; Instructor Readiness, Student Readiness
- *Control beliefs*; Perceived Self-efficacy, Learning Autonomy

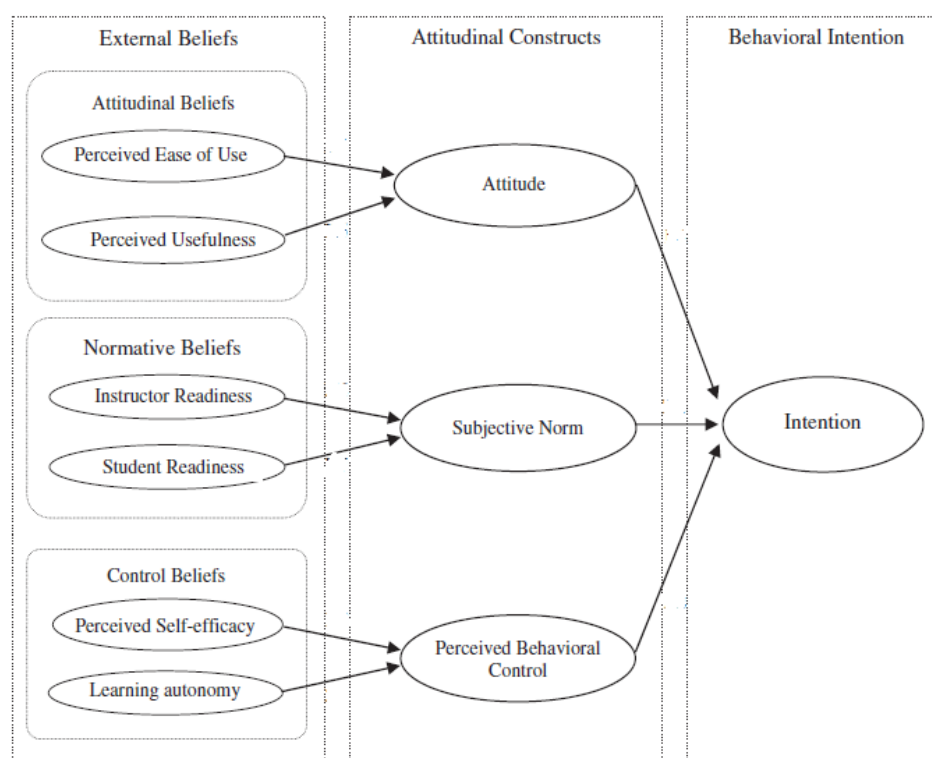


Figure 1. Research model (Cheon et al., 2012)

Variables for attitudinal beliefs were derived from TAM in the research model. As previous studies suggested (Davis, 1989; Teo, 2009), there are causal relationships among perceived ease of use, perceived usefulness, attitude toward a new system, and behavioral intention to use the system in accordance with TAM. Variables for normative beliefs consist of two referent groups in higher education: peer students and instructors (Liu, 2008). And finally, there are causal relationships among Perceived Self-efficacy, Learning Autonomy, Subjective Norm, and Behavioral Intention in the research model. In summary, MLRS based on TPB consists of 30 items (three items for each of the 10 factors); 3 items for Perceived Ease of Use, 3 items for Perceived Usefulness, 3 items for Attitude, 3 items for Instructor Readiness, 3 items for Student Readiness, 3 items for Subjective Norm, 3 items for Perceived Self-efficacy, 3 items for Learning Autonomy, 3 items for Behavioral Control, and finally 3 items for Intention. All of the items on the scale are positively coded. The participants of the scale are required to indicate their responses on a 7-point Likert scale ranging from totally disagree (1) to totally agree (7). Responding to the items on the scale takes about 20 to 25 minutes. As in the original study, all Cronbach values exceeded 0.7 (ranging from 0.88 to 0.95), showing satisfactory reliability for all the ten constructs.

2.3. The Procedure and Data Analysis

First of all, permission for the adaptation of the scale developed by Cheon et al. (2012) was obtained by e-mail from the corresponding author. After obtaining the required permission, the adaptation of the scale into Turkish was initiated. Firstly, the scale was translated into Turkish by three experts independently, one from the department of English Language and Literature and two from the Department of Science Education. The experts' views were then obtained and compared with each other. In the determination of the Turkish equivalents of the items, it was deemed necessary that at least two experts state the same views. After the translation of the scale was completed, the scale was translated back into the original language by one expert from the Department of English Language and Literature and one expert from the Department of Science Education. The re-translated form of the scale was compared with the original form in terms of similarity. After that, the scale was compared with the original scale by two experts from the Department of Science Education. Necessary changes (editing in translation expressions, using appropriate words etc.) were made according to the experts' feedback. The translated scale was controlled by two Turkish language experts in terms of linguistic equivalence and two experts studying in the field of Mobile Learning and Planned Behavior Theory in terms of content. After the necessary adjustments were done, the scale was applied to 10 students in order to check its intelligibility. After all the processes were completed, the scale was applied to pre-service science teachers to do validity and reliability studies of the scale. The construct validity of the Turkish version of the scale was carried out via the Confirmatory Factor Analysis (CFA) method by using Lisrel 8.7 software. The reliability of the scale was tested by computing Cronbach's alpha (α) as internal consistency levels in IBM-SPSS 22.

3. Findings

3.1. Confirmatory Factor Analysis

Prior to CFA, the adequacy of the number of participants, the normal distribution of the data and the missing values which are hypothetical criteria were checked. The skewness and kurtosis values of the research data for all constructs were calculated as ranged from -2 to +2 and it was determined that according the George and Mallery (2010) the data showed normal distribution for the factor analysis. The data set was analyzed to support its fit for factor analysis using Keiser-Meyer-Olkin (KMO) of Sampling Adequacy and Bartlett's test of sphericity (see Table 2).

Table 2. *KMO and Bartlett's test of sphericity results*

Keiser-Meyer-Olkin (KMO) Value		0.92
Bartlett's Test Value	Chi-square	4564.86
	df	435
	Sig.	0.000

The KMO value should be higher than 0.60 and Bartlett's test value should be significant for the data set to be suitable for factor analysis, and (Büyüköztürk, 2017; Pallant, 2013). As can be seen in Table 2, Bartlett's test of sphericity result is significant ($p<.01$), and the KMO value is 0.92. In this case, the data set is suitable for factor analysis. In addition, the suitability of the scale to the model proposed by Cheon et al. (2012) was tested using CFA. In this sense, the factor load of each item should be 0.30 and above (Tabachnick & Fidell, 2007). As seen in Figure 2, the factor loadings of the items, ranging between 0.35 and 0.80, are significant.

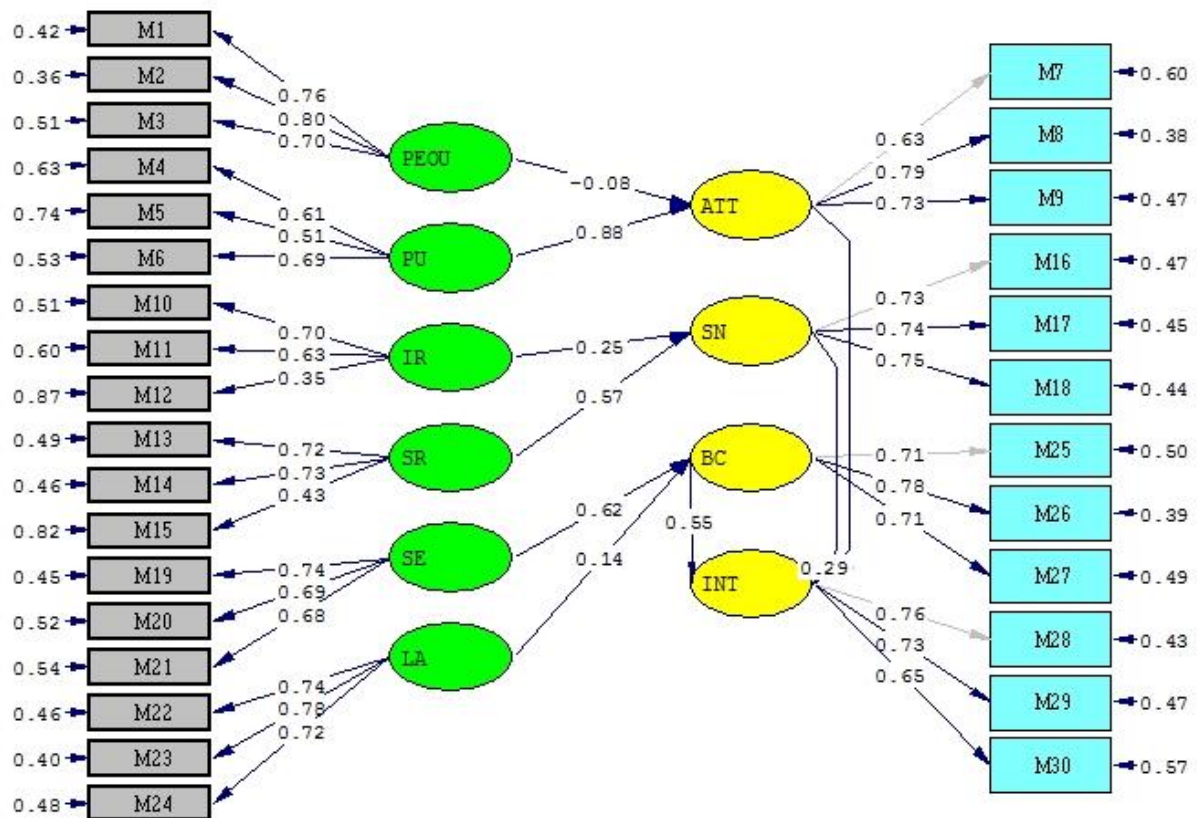


Figure 2. Path diagram (standardized solution) of the MLRS

Note. PEOU: Perceived Ease of Use, PU: Perceived Usefulness, ATT: Attitudinal Beliefs, IR: Instructor Readiness, SR: Student Readiness, SN: Subjective Norm, SE: Perceived Self-Efficacy, LA: Learning Autonomy, BC: Behavioral Control, INT: Intention.”

According to the data obtained from CFA, the model fit indices were ($\chi^2/df = 707.50/381 = 1.86$, $p < 0.001$, CFI=0.98, GFI=0.88, AGFI=0.85, RMSEA=0.05, SRMR=0.05, NFI=0.96, IFI=0.98). Accordingly, the model indicated acceptable goodness of fit indices (Kline, 2005). The model fit indices are shown in Table 3 in detail.

Table 3. *Model fit indices*

Fit indices	Original scale	Turkish scale	Acceptable indices values	Sources
χ^2/df	1.64	1.86	<3	Kline, 2005; Tabachnick & Fidell, 2007
RMSEA	0.06	0.05	<0.05 (good fit) <0.08 (fair fit)	Kline, 2005; McDonald & Ho, 2002
SRMR	0.06	0.05	<0.05 (good fit) <0.08 (fair fit)	Byrne, 1998; Hu & Bentler, 1999; Kline, 2005
GFI	-	0.88	≥ 0.85	Anderson & Gerbing (1984)
AGFI	-	0.85	≥ 0.80	
NFI	-	0.96	≥ 0.90 (good fit) ≥ 0.95 (fair fit)	Schumacher & Lomax (2000)
IFI	-	0.98	≥ 0.90 (good fit) ≥ 0.95 (fair fit)	
CFI	0.95	0.98	≥ 0.90	Hu & Bentler, 1999

Note. “ χ^2/df : chi-square/degrees of freedom CFI: Comparative Fit Indices, GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index, IFI: Incremental Fit Index, NFI: Normed Fit Index, SRMR: Standardized Root Mean Square Residual, RMSEA: Root Mean Squared Error of Approximation”

3.1.1. Testing the Validity and Reliability of the Model

In the current study, two kinds of validity including convergent and divergent validity were tested to assess the measurement structure of the model using CFA. Convergent validity was met since values of composite reliability (CR) were higher than 0.06 (Bagozzi & Yi, 1988), and average variance extracted (AVE) values were above 0.05 (Anderson & Gerbing, 1988). Divergent validity was approved as square roots of the AVE were more than correlation values between constructs. Findings related to convergent and divergent validity are involved in Table 4.

Table 4. *Correlation between constructs, convergent and divergent validity*

No	Constructs	1	2	3	4	5	6	7	8	9	CR	AVE	$\sqrt{AVE}$
1	PEOU	-									0.80	0.57	0.75
2	PU	0.594	-								0.67	0.51	0.71
3	ATT	0.458	0.563	-							0.76	0.52	0.72
4	IR	0.412	0.438	0.402	-						0.60	0.54	0.73
5	SR	0.452	0.397	0.417	0.492	-					0.67	0.51	0.71
6	SN	0.455	0.481	0.421	0.465	0.583	-				0.78	0.55	0.74
7	SE	0.477	0.525	0.546	0.441	0.492	0.544	-			0.75	0.50	0.70
8	LA	0.551	0.567	0.487	0.430	0.464	0.509	0.640	-		0.79	0.56	0.75
9	BC	0.444	0.360	0.347	0.337	0.517	0.422	0.563	0.530	-	0.78	0.54	0.73
10	INT	0.478	0.508	0.516	0.396	0.492	0.578	0.653	0.632	0.653	0.76	0.51	0.71

Note. Correlation is significant at the 0.01 level.

Cronbach's Alpha value used to determine internal consistency for the whole scale is 0.93. Similarly, internal consistency coefficients can be considered acceptable for each sub-dimension of the measurement tool (Nunnally, 1994). It can be also stated that item-total correlations for all items in the sub-dimensions are acceptable (ranging from 0.35 to 0.66), since the values are higher than 0.30 (Büyüköztürk, 2017; Tavşancıl, 2012). Cronbach's Alpha (α) values and item-total correlations measuring the reliability of the scale were indicated in Table 5.

Table 5. *Item-total correlation (r), Means (M), Standard deviation (Sd), and Cronbach's alpha (α) values*

Items	r	M	Sd
Perceived Ease of Use (PEOU) Cronbach's Alpha (α) value = 0.88			
I believe that mobile devices would be easy to use.	0.54	5.51	1.13
I believe it would be easy to access course material with my mobile device.	0.59	5.71	.99
I believe that mobile devices would be easy to operate.	0.55	5.41	1.01
Perceived Usefulness (PU) Cronbach's Alpha (α) value = 0.88			
I believe that using mobile devices would improve my ability to learn.	0.50	5.47	1.14
I believe that mobile devices would allow me to get my work done more quickly.	0.42	5.64	1.07
I believe that mobile devices would be useful for my learning.	0.59	5.65	1.08
Attitude (ATT) Cronbach's Alpha (α) value = 0.89			
I would like my coursework more if I used m-learning.	0.45	4.76	1.42
Using m-learning in my coursework would be a pleasant experience.	0.58	5.17	1.34
Using m-learning in my coursework is a wise idea.	0.57	5.31	1.21
Instructor Readiness(IR) Cronbach's Alpha (α) value = 0.89			
I think instructors would be in favor of utilizing m-learning for their courses.	0.48	5.17	1.26
I think instructors would believe that a mobile device could be a useful educational tool in their courses.	0.44	5.09	1.33
I think instructors would possess adequate technical skills to use a mobile device in their teaching.	0.35	4.78	1.40
Student Readiness (SR) Cronbach's Alpha (α) value = 0.88			
I think other students would be in favor of utilizing m-learning in their coursework.	0.51	5.19	1.29
I think other students would believe that a mobile device could be a useful educational tool in their coursework.	0.56	5.10	1.32
I think other students would possess adequate technical skills to use a mobile device in their coursework.	0.41	4.68	1.37
Subjective Norm (SN) Cronbach's Alpha (α) value = .88			
Most people who are important to me think that it would be fine to use a mobile device for university courses.	0.60	5.10	1.31
I think other students in my classes would be willing to adapt a mobile device for learning.	0.52	5.23	1.24
Most people who are important to me would be in favor of using a mobile device for university courses.	0.54	5.38	1.18
Perceived Self-efficacy (SE) Cronbach's Alpha (α) value = 0.88			

I am confident about using a mobile device for my courses.	0.66	5.25	1.28
Using a mobile device for my courses would not challenge me.	0.59	5.33	1.31
I would be comfortable to use a mobile device in my courses.	0.61	5.22	1.25
Learning Autonomy (LA) Cronbach's Alpha (α) value = 0.88			
I would be able to actively access coursework material with a mobile device.	0.59	5.62	1.06
I would have more opportunities to create knowledge in my coursework with a mobile device.	0.61	5.59	1.10
I would be able to control the pace of learning in my classes with a mobile device.	0.61	5.48	1.14
Behavioral Control (BC) Cronbach's Alpha (α) value = 0.89			
I have a sufficient extent of knowledge to use m-learning.	0.49	5.12	1.41
I have a sufficient extent of control to make a decision to adopt m-learning.	0.54	5.19	1.30
I have a sufficient extent of self-confidence to make a decision to adopt m-learning.	0.55	5.49	1.25
Intention (INT) Cronbach's Alpha (α) value = 0.88			
I predict I would use a mobile device for my courses.	0.66	5.36	1.24
I plan to use a mobile device if a course has mobile learning functions.	0.63	5.46	1.13
I intend to adopt a mobile device for university courses.	0.55	5.29	1.36
Total Cronbach's Alpha (α) value = 0.93			

4. Discussion and Conclusion

The purpose of the study was to conduct a validity-reliability study of MLRS developed by Cheon et al. (2012) in the framework of TPB by adapting it to Turkish. In previous studies, it was indicated that MLRS was a valid and reliable scale that can be used to measure mobile learning readiness levels (e.g., Chu & Chen, 2016; Yeap, Ramayah, & Soto-Acosta, 2016). In addition, since Cheon et al. (2012) suggested applying this scale to a broader sample of university students, the Turkish adaptation of the scale was carried out. Accordingly, the study, which is the first attempt to adapt the scale into Turkish, was carried out with 344 pre-service science teachers.

The results of the model fit showed that the value of χ^2/df (707.50/381) was 1.86. CFI, GFI, AGFI, IFI, and NFI values were founded as 0.98, 0.88, 0.85, 0.98, and 0.96 respectively. In addition, RMSEA was found as 0.05 and SRMR value as 0.05. In the original scale developed by Cheon et al. (2012), similar values were obtained. Considering the proposed model fit indices, χ^2/df should be between 2 and 5 (Byrne, 1989). A CFI value close to 1 indicates a good fit (Hu & Bentler, 1990), and a CFI value higher than 0.90 is considered acceptable (Hair, Black, Babin, & Anderson, 2010). An RMSEA value of less than 0.05 shows a good fit (Browne & Cudeck, 1993). If the value is greater than 0.10, it can be considered a poor fit (MacCallum et al., 1999). Finally, the SRMR value should be less than .08 to provide a good fit model

(Byrne, 1989). Given the model fit values found in the current study, it can be concluded that as all model fit values are in the range of suggested values, the goodness of fit indices of the theoretical model is suitable for our sample group.

In addition, it was found that Cronbach's Alpha internal consistency value was 0.93, and sub-factors of MLRS were at a good level (Pallant, 2013). These results, which were similar to those of the original scale, revealed that pre-service science teachers' mobile learning readiness levels can be explained reliably in the framework of TPB. These results of the study are also in line with the importance of mobile learning in science education such as opening up opportunities for students and teachers to improve their learning of scientific concepts, develop analytical thinking skills, understand better the nature of science and scientific methods, and enhance their interests in science (Ottander & Grelsson, 2006).

In conclusion, the Turkish version of the MLRS in the framework of TPB consists of four main factors (attitude, subjective norm, PBC, and intention) and three external beliefs (Attitudinal Beliefs [Perceived Ease of Use, Perceived Usefulness], Normative Beliefs [Instructor Readiness, Student Readiness] and Control Beliefs [Perceived Self-efficacy, Learning Autonomy]) as the original model. Considering these results, the Turkish version of the MLRS can be used to measure the factors affecting Turkish pre-service science teachers' mobile learning readiness with the TPB.

Several implications can be drawn from the study for curriculum developers, academic staff, and teachers. First of all, the study has provided a valid and reliable scale to measure students' mobile learning readiness levels. Accordingly, the results of the study can be a guide for curriculum developers. For example, the study can help curriculum developers consider the factors affecting mobile learning readiness when designing educational programs. Accordingly, students' needs can be determined and mobile learning programs can be developed in the direction of certain psychological factors. In addition, the study results can help academic staff to arrange their mobile learning education programs to achieve an ideal training program for pre-service science teachers. In addition, academic staff can benefit more from mobile learning-based courses in the training of pre-service science teachers. Doing so will ensure that science teachers have sufficient content knowledge in terms of mobile learning.

Although the study has contributed to the literature by presenting a valid and reliable scale, it also has some limitations. First of all, the study was conducted with pre-service science teachers, who constitute only a part of science education, and can be considered as a first step in determining mobile learning readiness in science education. In Turkey, pre-service science teachers are not obliged to use mobile learning during their training. Therefore, some science teachers can use mobile learning devices quite effectively while others don't use them at all. Hence, professional development attempts should consider pre-service science teachers' competence levels in and frequency of using mobile learning devices. Secondly, although the current study has yielded valuable findings with a sample consisting of pre-service science teachers, further studies can be carried out with different sample groups, such as working science teachers and middle school students, to give more detailed information. Thirdly, only quantitative research methods were used in the study. Therefore, in future studies, researchers can use quantitative and qualitative research methods in combination. Finally, the study results and scale items are prepared for understanding the factors understanding mobile learning readiness, so future studies can be conducted based on longitudinal studies to develop level of mobile learning readiness and antecedents of it.

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Appendix 1.

Mobile Learning Readiness Scale

	Planlanmış Davranış Teorisi Temelli Mobil Öğrenme Ölçeği	Hiç katılmıyorum	Katılmıyordum	Biraz katılmıyorum	Kararsızım	Biraz katılmıyorum	Katılmıyorum	Tamamen katılmıyorum
1	Mobil araçların kullanımının kolay olacağına inanıyorum.							
2	Mobil aracım ile ders materyallerine erişimin kolay olacağına inanıyorum.							
3	Mobil araçları çalıştırmanın kolay olacağına inanıyorum.							
4	Mobil araçları kullanmanın öğrenme becerimi geliştireceğine inanıyorum.							
5	Mobil araçların, çalışmalarımı daha çabuk bitirmemi sağlayacağına inanıyorum							
6	Mobil araçların öğrenmem için faydalı olacağına inanıyorum.							
7	Mobil öğrenme yöntemini kullansaydım ödevlerimi daha çok severdim.							
8	Ödevlerimde mobil öğrenmeyi kullanmak keyifli bir deneyim olacaktır.							
9	Ödevimde mobil öğrenmeyi kullanmak akıllıca bir fikirdir.							
10	Öğretim elemanlarının, derslerinde mobil öğrenme yollarının kullanımından yana olacaklarını düşünüyorum							
11	Öğretim elemanlarının derslerinde bir mobil aracı kullanmanın, faydalı bir öğretim aracı olduğuna inandıklarını düşünüyorum							
12	Öğretim elemanlarının derslerinde bir mobil aracı kullanmak için yeterli teknik beceriye sahip olduklarını düşünüyorum							
13	Diğer öğrencilerin de ödevlerinde mobil öğrenmeyi kullanmaktan yana olacaklarını düşünüyorum.							
14	Diğer öğrencilerin de mobil araçları, kullanışlı bir ders aracı olarak görececeklerini düşünüyorum.							
15	Diğer öğrencilerin, ödevlerinde bir mobil araç kullanmak için yeterli teknik beceriye sahip olduklarını düşünüyorum							
16	Benim için önemli olan çoğu kişi, üniversite derslerinde bir mobil araç kullanmanın iyi olacağını düşünürlər.							
17	Benimle aynı sınıftaki diğer öğrencilerin, öğrenmek için mobil araçları kullanmaya istekli olacaklarını düşünüyorum.							
18	Benim için önemli olan çoğu insan, üniversite dersleri							

	için bir mobil araç kullanmaktan yana olacaktır.							
19	Derslerimde bir mobil araç kullanacağımı düşünüyorum.							
20	Derslerimde mobil araç kullanımı benim için zor olmayacaktır.							
21	Derslerimde mobil araç kullanmak beni rahat hissettirecektir./rahatlatacaktır.							
22	Bir mobil araç vasıtasıyla ders materyallerine aktif olarak erişebilirim.							
23	Bir mobil araçla derslerimde daha fazla bilgi üretme fırsatım olacaktır.							
24	Derslerimdeki öğrenme aşamalarını bir mobil araçla kontrol edebilirim.							
25	Mobil öğrenmeyi kullanmak için yeterli bilgiye sahibim.							
26	Mobil öğrenmeyi kullanmaya karar vermek için yeterli derecede kontrole sahibim.							
27	Mobil öğrenmeyi kullanmaya karar vermek için yeterli özgüvene sahibim.							
28	Derslerim için bir mobil araç kullanacağımı öngörüyorum.							
29	Bir dersin mobil öğrenme işlevleri varsa, mobil araç kullanmayı planlarım.							
30	Üniversite dersleri için bir mobil araç edinme niyetindeyim.							