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A Validity and Reliability Study of the Smartphone Self-Efficacy Scale

Sayim Aktay, sayimaktay@gmail.com, Turkey, https://orcid.org/0000-0002-5301-0099

SUMMARY

The aim of this study is to develop a valid and reliable scale named “Smartphone Self-Efficacy Scale”. The purpose of the scale is to determine the smartphone self-efficacy levels of people. The study was carried out with 520 pre-service teachers in the spring academic term, and 103 pre-service teachers in the academic year of 2018-2019 autumn academic term. The pre-service teachers all were attending the Education Faculty of Mugla Sitki Kocman University. In order to determine the validity and reliability of the scale, exploratory and confirmatory factor analyses were conducted. As a result of the exploratory factor analysis, it was found that the scale is included one factor and 20 items. The Cronbach Alpha internal consistency coefficient of the scale was calculated as 0.97. Confirmatory factor analysis also showed that the goodness of fit indices was at an acceptable level. Therefore, according to the results of the both validity and reliability analyses “Smartphone Self-Efficacy Scale” is reliable.

Keywords: Smartphones, Smartphone self-efficacy, Smartphone self-efficacy scale

INTRODUCTION

Hand-held computers that can slide into one's pant pocket as well as can even be loaded with software have been created thanks to ever progressing technology, and correspondingly have been dubbed mobile devices. While desktops and laptops alike are still necessary in order to run a number of programs, mobile devices too are interactive, and hold a different place in people's everyday lives (Collins, 2015). Mobile devices are handheld, compact, and lightweight (Technopedia, 2019). Today, mobile devices have an important place in people's lives. According to reports by Hootsuite & we are Social, more than 91% of the world's Internet users use mobile devices in order to connect to the Internet. Moreover, the rate of those connecting to the internet via mobile devices increases by 30% each year (Kemp, 2017). Backing this data up, according to Google's own statistics, people appear to do most of their searching via mobile devices rather than computers (Google, 2015).

In addition to apps designed for sending e-mail, surfing websites, taking photos and videos, and playing mp3 clips and the like at already come included on modern smart phones, one also has the ability to install and use various other paid and free apps on them as well (PC Magazine, 2018). Smartphones also include personal digital assistant (PDA) features that help users to communicate through speech and writing. Likewise, in addition to helping people access the up-to-date information that is on their computers, smartphones also allow one to easily check their e-mails and appointments etc. as well (Ilyas and Ahson, 2006).

Apps are another important feature of smartphones (Frith, 2015). One can seamlessly download and install apps designed specially for their smartphone’s operating system via a whole host of app stores. According to data released by Digital Trends, smart phone users are able to download and use a vast range apps from among the some 3.5 million Android and 2.2 million iOS-based apps available on the current market.

A study produced by Ofcom involving participants from a diverse number of countries such as the United Kingdom, France, Germany, the United Sates, Japan, and Spain, revealed that the vast majority used smart phones more over laptops, desktops, and tablets, be it from home or from elsewhere (Ofcom, 2017). As of June 2017, some 75% of American adults are reported to posses a smartphone. Correspondingly, the number of individuals who entrust in smart phones to access the internet also appears to be on the increase (Cook, 2018).

Smartphones seem to make most people's lives significantly easier because they give one the option of being able to complete a multitude of tasks. Easy internet access, sharing the internet with other devices and people via active hot spots, video conferencing, quickly capturing and saving documents with a single camera click, broadcasting one's location, and jotting down notes are just some of the many things that smartphones facilitate for individuals. This study looks at the development process behind the "Smart Phone Self-Efficacy Scale" and applies it various statistical data aimed at understanding how individuals view their own ability to use smart phones effectively.

METHOD

Working Group for Exploratory Factor Analysis

This sample group featured in this study is comprised of two different populations: an exploratory as well as a confirmatory factor analysis group. The first of these two groups was comprised of 520 student teachers studying in different 1st, 2nd, and 3rd year modules at Muğla Sıktı Koçman University's Faculty of Education during the 2017-2018 spring academic term. What is more, their personal characteristics featured were enriched by the

inclusion of students from different years and modules/sections within the faculty. The characteristics of the first study group are summarized in Table 1.

Table 1. The characteristics of the first study group

Characteristics of the First Study Group (Exploratory)	Number (f)	Percentage (%)
Teaching Modules/Sections		
Primary School Education	96	18.8.
Social Studies Education	54	10.6
Early Childhood Education	34	6.7
Science Education	91	17.8
Math Education	40	7.8
Turkish Language Education	45	8.8
English Language Education	71	13.9
German Language Teaching	39	7.6
Music Education	16	3.1
Visual Arts Education	24	4.7
Gender		
Female	351	68.4
Male	162	31.6
Year		
1st Year	198	38.5
2nd Year	174	33.5
3rd Year	142	27.6
Smartphone Usage		
4 Years or Less	148	28.5
5-8 Years	315	60.6
9+ Years	57	11.0
Total	**520**	**100.0**

As one can see Table 1, the study group featured 520 student teachers from ten different teaching modules/branches within the faculty of education. The majority of the participants were students of either primary school or science education, however there nonetheless was relative diversity. Additionally, it was found that the majority of the participants were female. It is worth noting that most of the participants were in same year of university. Similarly, the vast majority of them had been using smart phones for more than 5 years.

Confirmatory Factor Analysis Working Group

The second of two groups was comprised of 103 student teachers studying in different 1st, 2nd, and 3rd year modules at Muğla Sıktı Koçman University's Faculty of Education during the 2018-2019 autumn academic term. What is more, their personal characteristics featured were enriched by the inclusion of students from different years and modules/sections within the faculty. The characteristics of the second study group are summarized in Table 2.

Table 2. The characteristics of the second study group

Characteristics of the First Study Group (Exploratory)	Number (f)	Percentage (%)
Modules		
Primary School Education	51	53.5
Preschool Teaching	18	17.5
Math Education	32	31.1.
Gender		
Female	79	76.7
Male	24	23.3
Year		
1st Year	42	40.8
2nd Year	30	29.1
3rd Year	31	30.1
Smartphone Usage		
4 Years or Less	31	30.1
5-8 Years	56	54.4
9+ Years	16	15.5
Total	**103**	**100.0**

As can be seen in Table 1, the confirmatory factor group was comprised of 103 student teachers from three different teaching modules. This group at the same time was comprised mostly of female students from similar university years; moreover, most had been using smartphones for over 5 years.

Development Process Behind the Scale

In order to develop the scale, first a literature review was needed to be conducted in relation assessing people's competence when it came to their using smart phones. A general framework was then established in light of the information obtained from the review. Subsequently, a pool of 42 items was created by using the information obtained from the literature as well as from field experts. Five-grading options were then placed in order to measure the level of people's competence in relation to the aforementioned items. These options were as follows: "strongly disagree", "disagree", "neither agree nor disagree", "agree", and "strongly agree".

The scale items were then presented in draft form to field experts to be assessed from both linguistic and scientific standpoints. Once all corrections were made, a pilot test was run on fifty 4th year student teachers from the same faculty at the same university, whereupon the scale was fine-tuned for any ambiguities accordingly. Last, the draft scale then administered to the 520 aforementioned student teachers. All of the data obtained was entered into a computer program for the purposes of analyzing the validity and reliability of the statistics, whereupon they were subjected to statistical processing.

FINDINGS

This section provides information about the development process of the scale and the statistical tests conducted for the scale.

Construct Validity

In order to test the construct validity of the scale, first the Kaiser-Meyer-Oklin (KMO) and Bartlett tests were performed on the data, whereby the KMO value = 0.960, whereas the Bartlett test value was x2 = 18933.563; df = 861 (p = 0.000). The KMO value must be either 0.60 or higher, where as the p Bartlett value must be less than or equal to 0.05 (Pallant, 2003). Upon looking at these values, one understands that factor analysis could, in fact, be performed on a 42-item draft scale. Factor analysis is used to reveal whether the items in a scale separate into fewer mutually exclusive factors (Balci, 2009). In this context, it is important to obtain as few factors as possible, as well as to explain the large amount of variance provided that the scale still holds validity. In factor analysis, the most important as well as the most frequently used technique is main component analysis which is supported both by Kaiser criterion and scree plot graphs (Pallant, 2003). It was preferred that the factor load of the scale items be at least 0.50. After the eliminated items were discarded, the KMO value of the remaining 20 items of scale was 0.967, and the Bartlett test value was x2 = 11181.068; df = 190 (p = 0.000). The factor loadings of those 20 items were found to be between 0.512 and 0.789. The Scree plot graph for the scale is shown in Figure 1.

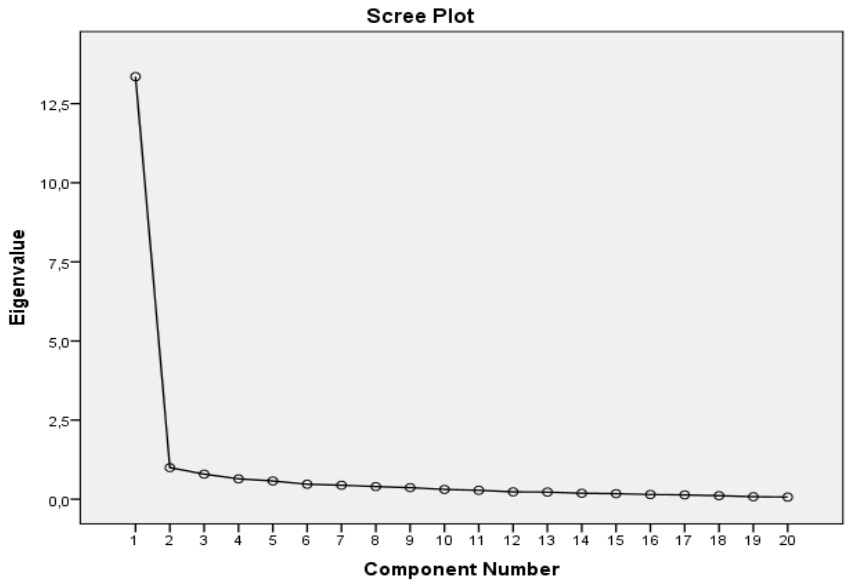

Figure 1. The Scree Plot Graph for the Factors

One sees in Figure 1 that there is a sharp decrease after the initial factor, which then only continues, but in a more leveled off, flattened pattern. Therefore, the contributions to the variance of whatever follows the first factor are close to one another. Table 3 reveals the item loads of the remaining 20 scale items, as well as the eigenvalues of the factors and their respective variance descriptions.

Table 3. The eigenvalues of the factors

Number	Eigenvalue	Number	Eigenvalue	Number	Eigenvalue	Number	Eigenvalue
s7	0.924	s15	0.867	s12	0.823	s28	0.721
s8	0.906	s6	0.856	s23	0.822	s33	0.716
s22	0.892	s21	0.854	s19	0.819	s11	0.699
s3	0.889	s31	0.851	s25	0.811	s4	0.676
s1	0.888	s2	0.849	s24	0.732	s13	0.668

As can be seen in Table 3, the factor loads of the items vary between 668 and 924. The amount of contribution of the factor to the variance is 66.756%. Considering that the variance explained in single factor scales should be 30% or above (Büyüköztürk, 2002), here, one sees the variance explained by the scale was being quite high.

Item Discrimination

This section examines the degree of correlation of the scale items with the points obtained from the whole scale by looking at the total item correlation of the scale. The correlation between the score of each times versus the score of the whole scale indicates how well that item measures the element in question. The correlation data between the item versus total score is shown in Table 4.

Table 4. The correlation data between the item versus total score

Number	Total Item Correlation	Cronbach's Alpha, if the item is removed	Number	Total Item Correlation	Cronbach's Alpha, if the item is removed
s1	0.869	0.968	s1	0.845	0.968
s2	0.827	0.968	s2	0.800	0.969
s3	0.868	0.968	s3	0.835	0.968
s4	0.646	0.971	s4	0.880	0.968
s6	0.825	0.969	s6	0.793	0.969
s7	0.906	0.968	s7	0.709	0.970
s8	0.883	0.968	s8	0.788	0.969
s11	0.677	0.971	s11	0.693	0.970
s12	0.794	0.969	s12	0.830	0.968
s13	0.638	0.971	s13	0.694	0.970

As one can see in Table 4, the total item correlation of the scale items ranged between 0.638 and 0.906. Therefore, it was found that all of the scale items were over 0.30, which was considered as the limit without needing correction.

Additionally, for purposes criterion validity, after separating the extremes in terms of upper and subgroups based on the scale scores, we used item analysis in order to see whether the difference between the averages of these two groups was substantial or not. In this context, the scores of 27% of the upper group and 27% of sub-group were subjected to the t-test for each item as well as factorially for independent samples in order to determine the presence of any difference. The results of the analysis reveal that all of the items alongside the general factor ($p < 0.001$) were significant.

Findings Regarding the Reliability of the Scale

The reliability analysis of the scale was calculated using Cronbach's alpha reliability coefficient, the Sperman-Brown formula, and the Guttmann split-half reliability test. The reliability analysis data for the scale is shown in Table 5.

Table 4. The reliability analysis data for the scale

The Reliability Test	Test Results
Cronbach's Alpha	0.970
The Guttmann Split-Half	0.944
Sperman Brown	0.945

Table 5 shows us that the Cronbach Alpha reliability value for the scale was 0.948, the Guttmann Split-Half value was 0.903, and the Spearman Brown reliability value was 0.904.

Findings Related to Confirmatory Factor Analysis

The results of exploratory factor analysis reveal to us that the scale had a single factor structure. The researchers performed confirmatory factor analysis (CFA) using Lisrel to determine the structural validity of the factor obtained. Confirmatory factor analysis refers to a previously established and constructed structure is tested for validity using a model.

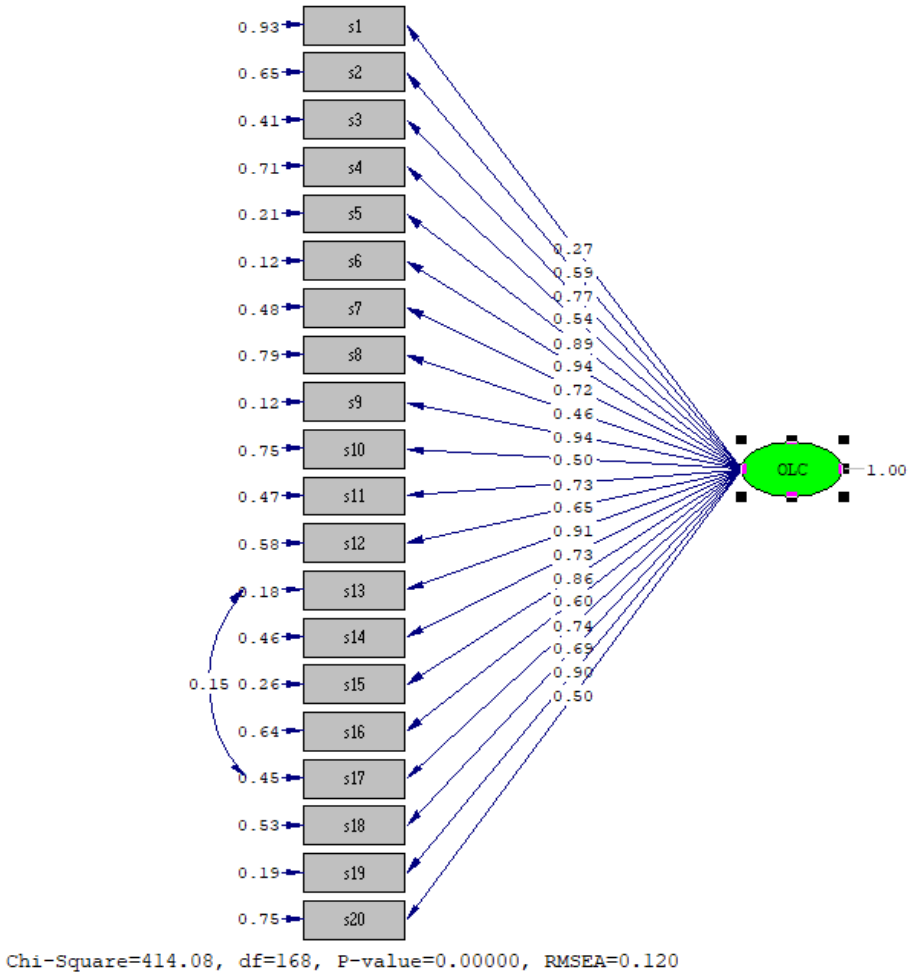

Figure 2. CFA Results

The fit indices of the 20-item model were analyzed using CFA. The results of the CFA concluded the following: SRMR = 0.067, RMSEA = 0.120, RMR = 0.024, AGFI = 0.64, GFI = 0.71, NFI = 0.92, NNFI = 0.95, CFI = 0.95, and IFI = 0.95. Given that the GFI and AGFI values fell below 0.90, one can state that it had a weak fit. However, the RMR value being less than 05 shows us that model-data compatibility was good. The NFI, NNFI, CFI and IFI values also demonstrate good comparative compatibility as well. The RMSEA value being above 0.10 may be misleading given that the sample volume is not large (Kline, 2005; Hooper et al., 2008; Blunch, 2008; Kenny, 2015). The $\chi 2$ sd ratio was obtained as (875.98 / 322 = 2.72). Moreover, given that the $\chi 2$/sd ratio is between 2 and 3, a good fit was found. The fit indices for the scale were deemed acceptable within in the context of the CFA

results (Schermelleh-Engel, Moosbrugger and Müller, 2003; Schumacker and Lomax, 2004; Tabachnick and Fidell, 2001).

CONCLUSION

Correspondingly, the results of the exploratory factor analysis disclosed that the scale had a single factor structure consisting of 20 items, that the factor loads of the items ranged between 0.668 and 0.924, and that it accounted for 40% of the variance. Additionally, the total item correlation of the scale items likewise ranged between 0.454 and 0.716. What we thus see is that all of the scale items were above 0.60, which was considered as the limit without needing any correction. Furthermore, the scores of 27% of the upper group and 27% of sub-group were subjected to the t-test for each item as well as factorially for independent samples in order to determine the presence of any difference between them. The results of the analysis hence reveal that all of the items alongside the general factor ($p < 0.001$) were significant.

The reliability tests of the scale concluded that the Cronbach Alpha reliability value was 0.970, that the Guttmann Split-Half value was 0.944, that the Spearman Brown reliability value was 0.945. Considering the results of the CFA (SRMR = 0.067, RMSEA = 0.120, RMR = 0.024, AGFI = 0.64, GFI = 0.71, NFI = 0.92, NNFI = 0.95, CFI = 0.95, and IFI = 0.95) the fit indices for the scale were deemed acceptable. In conclusion, the results of the validity and reliability analyses demonstrated that the "Smartphone Self-Efficacy Scale" was both valid and reliable.

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Appendix I. The Smartphone Self-Efficacy Scale in English

THE SMARTPHONE SELF-EFFICACY SCALE

This scale is designed to measure your smartphone self-efficacy. Please read each statement carefully and select the option that suits you best.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I can access photos on my smartphone when I need to.					
2. I can install apps onto my smartphone via an app store.					
3. I can surf websites on my smartphone.					
4. I can send emails from my cell phone.					
5. I can take photos/videos with my smartphone.					
6. I can send messages from my smartphone via social networking platforms.					
7. I can make audio recordings with my smartphone.					
8. I can use the navigation apps on my smartphone.					
9. I can conduct internet-based searches on my smartphone.					
10. I can change the name of my file folders on my smartphone.					
11. I can delete files and file folders from my smartphone.					
12. I can share internet-based mobile on my smartphone with other wireless devices.					
13. I can connect to Wi-Fi hotspots from my smartphone.					
14. I can check how much memory space my apps take up on my smartphone.					
15. I can take screen shots on my smartphone.					
16. I can learn how much free disk space is available on my smartphone.					
17. I can copy and paste text fragments on my smartphone.					
18. I can edit the photos on my smartphone (e.g. crop, re-size, etc.)					
19. I can do video conferencing on my smartphone via my social media apps.					
20. I can create calendar-based reminders on my smartphone.					

Appendix 2. The Smartphone Self-Efficacy Scale in original language (Turkish)

AKILLI TELEFON ÖZ-YETERLİK ÖLÇEĞİ

Bu ölçek, akıllı telefon öz-yeterliğinizi ölçmek amacıyla hazırlanmıştır. Lütfen her ifadeyi dikkatle okuduktan sonra size en uygun olan seçeneği işaretleyiniz.	Kesinlikle katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle katılıyorum
1. Akıllı telefonumdaki fotoğraflardan gereksinim duyduğuma ulaşabilirim.					
2. Akıllı telefona uygulama marketindeki uygulamayı yükleyebilirim.					
3. Akıllı telefonumdan bir web sitesini ziyaret edebilirim.					
4. Akıllı telefonumdan e-posta yollayabilirim.					
5. Akıllı telefonum ile fotoğraf ve video çekebilirim.					

6. Akıllı telefonum ile sosyal ağlardan mesaj gönderebilirim.					
7. Akıllı telefonum ile ses kaydı yapabilirim.					
8. Akıllı telefonumdaki navigasyon uygulamalarını kullanabilirim.					
9. Akıllı telefonum ile internette arama yapabilirim.					
10. Akıllı telefonumdaki bir klasörün adını değiştirebilirim.					
11. Akıllı telefonumdaki bir dosyayı ya da klasörü silebilirim.					
12. Akıllı telefonumun mobil veri internetini kablosuz internet olarak diğer cihazlara paylaştırabilirim.					
13. Akıllı telefonumdan kablosuz ağlara bağlanabilirim.					
14. Akıllı telefonumda kurulu olan uygulamaların telefon hafızasında ne kadar yer kapladığına bakabilirim.					
15. Akıllı telefonumun ekran görüntüsünü alabilirim.					
16. Akıllı telefonumda ne kadar disk alanım kaldığını öğrenebilirim.					
17. Akıllı telefonumun ekranındaki bir metni seçip kopyalayabilirim.					
18. Akıllı telefonumdan resimleri kırpma ve yeniden boyutlandırma gibi düzenleme işlemlerini gerçekleştirebilirim.					
19. Akıllı telefonumla sosyal ağ uygulamaları üzerinden görüntülü görüşme yapabilirim.					
20. Akıllı telefonumdan bir görev ya da iş ile ilgili olarak ileri tarihte hatırlatmak üzere takvim girdisi oluşturabilirim.					