DEVELOPMENT OF PROBLEMATIC SMARTPHONE USAGE SCALE (PSUS)

PROBLEMLİ AKILLI TELEFON KULLANIM ÖLÇEĞİNİN GELİŞTİRİLMESİ

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Öz

Amaç: Çalışmanın amacı, kullanım yoğunluğunu dikkate alarak, problemli akıllı telefon kullanımını belirlemek için kullanılabilecek bir ölçek geliştirmekti. Önerilen ölçeğin güvenilirliği ve geçerliliği de değerlendirilerek, ileri epidemiyolojik çalışmalarda kullanılabilmesi amaçlandı.

Materyal ve Metot: Çalışmaya katılanlar 2016 yılında Eskişehir Osmangazi Üniversitesi'nde öğrenim gören 1492 öğrenciden oluşmuştur. Anket formu katılımcıların sosyodemografik özellikleri, akıllı telefon bağımlılığının öznel değerlendirmesi, akıllı telefon kullanım yoğunluğu ile ilgili sorular ve Akıllı Telefon Bağımlılığı Ölçeği Kısa Formu'nu içermektedir.

Bulgular: Araştırmaya katılanlar 18-24 yaş grubunda %48,26'sı (n = 720) kadın, %51,74'ü (n = 772) erkek olmak üzere 1492 öğrenciden, oluşmaktadır. Ölçeğin geliştirilmesi için Akıllı Telefon Bağımlılığı Ölçeği - Kısa Formu adlı ölçekte bulunan tüm sorular ve akıllı telefon kullanım yoğunluğu ile ilgili sorular açımlayıcı faktör analizine alınmıştır. Sonuç olarak, 10 maddelik Problemli Akıllı Telefon Kullanım Ölçeği geliştirilmiştir. Açımlayıcı faktör analizi sonucunda ölçeğin kullanım yoğunluğu, günlük yaşamda bozulma ve çekilme olmak üzere üç faktörlü bir yapıda olduğu ortaya çıkmıştır. Üç faktör toplam varyansın %63,36 'sını açıkladı. Güvenirlik analizi sonucunda, ölçeğin Cronbach alfa katsayısı 0.81'dir. Ayrıca doğrulayıcı faktör analizi ölçeğin üç faktörlü yapısını doğrulamıştır.

Sonuç: Sonuç olarak Problemli Akıllı Telefon Kullanım Ölçeğinin, problemli akıllı telefon kullanımını değerlendirmek için geçerli, güvenilir ve etkili bir ölçek olduğu bulundu.

Anahtar Kelimeler: Problemli akıllı telefon kullanımı, üniversite öğrencileri, kullanım yoğunluğu, güvenirlik, geçerlilik.

Abstract

Objectives: The aim of the study was to develop a scale that, by taking intensity of use into account, can be used to identify problematic smartphone usage. The reliability and validity of the proposed scale were also evaluated and it may be used in further epidemiological studies.

Materials and Methods: Participants of the study consisted of 1492 students at Eskisehir Osmangazi University, Turkey in 2016. The questionnaire included questions about the sociodemographic characteristics of the participants, the self-evaluation of smartphone addiction, and smartphone usage intensities and Smartphone Addiction Scale-Short Version.

Results: Participants of the study consisted of 1492 students aged 18-24, 48.26 % (n = 720) female, 51.74 % (n = 772) male. In order to develop the scale, all questions that are present in the current scale, named Smartphone Addiction Scale-Short Version, and questions about the intensity of smartphone usage were taken into exploratory factor analysis. As a result, the 10-item Problematic Smartphone Usage Scale was developed. The result of the exploratory factor analysis revealed that the scale had a three-factor structure consisting of usage intensity, daily life disturbance and withdrawal. The three factors explained 63.36 % of the total variance. As a result of the reliability analysis, Cronbach's alpha coefficient of the scale was 0.81. Confirmatory factor analysis also confirmed the three-factor structure of the scale.

Conclusion: As a result, the Problematic Smartphone Usage Scale is seen as a valid, reliable and effective scale for assessing problematic smartphone usage.

Keywords: Problematic smartphone usage, university students, intensity of usage, reliability, validity.

Introduction

Nowadays, besides being used for communication, smartphones have come to be a common and indispensable possession in daily life with access to the internet in addition to many types of mobile applications, including games, information, social networks, and entertainment. With ever-increasing features and addictive applications, smartphones are becoming more popular than computers and their usage is increasing day by day. It was reported that the number of smartphone users worldwide surpassed three billion and is estimated to grow in the next years.[1] According to the Turkish Statistical Institute (TUIK), as of 2018, in 98.7 % of Turkish households there are mobile phones or smartphones.[2] The fact that smartphones are portable, easy to access and constantly connected to the internet makes them more dangerous than other technological addictions; smartphones are becoming objects that individuals cannot easily separate themselves from.[3,4]

With the inclusion of internet gaming disorders in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), there has been increased interest in non-substance addictions, and especially in technological addictions that have become more prevalent.[5] There are a few scales present in the literature that were developed to evaluate smartphone addiction.[6-9] The items of one of these scales, known as the Smartphone Addiction Scale-Short Version (SAS-SV), contains many features related to addiction, but does not include items that assess smartphone usage intensity with numerical variables.[7] However, it has been shown that the daily smartphone usage frequency, duration of smartphone use, and time taken to first look at a smartphone in the morning are all related to smartphone addiction.[8,10-13]

The aim of this study is thus to address this shortcoming by developing a scale to determine problematic smartphone usage that, by taking the intensity of smartphone use into account, can be used in epidemiological studies; the reliability and validity of this scale should also be evaluated.

Materials and Methods

Participants

Participants of the study consisted of 1492 students at Eskisehir Osmangazi University, Turkey in 2016. The sample size taken from each faculty was determined according to the quota weight of the faculties in the university, and the classes which the data collection process is going to be done were determined by random selection. From the selected students, 48.26 % (n=720) were female and and 51.74 % (n = 772) were male. Their ages ranged from 18 to 24, with a mean of 20.38 ± 1.66 years. A breakdown of the number of students per faculty was as follows: 5.23 % (n=78) faculty of theology; 20.58 % (n=307) faculty of education; 36.86 %

(n = 550) faculty of engineering; 17.09 % (n = 255) science and arts; 5.70 % (n = 85) faculty of economics and administrative sciences; and 14.54 % (n = 217) faculty of medicine.

Based on the year of study, 779 (52.21 %) of students were in the first year class, and 713 (47.79 %) were in the third year class.

The approval dated 15.12.2016 and number 101471 has been obtained from the ethics committee of Anadolu University for the study. After obtaining administrative permission for the study to be conducted, data collection was completed. The purpose of the questionnaire was explained to the students in the class. Questionnaires were given to those who wanted to participate in the survey. The response time of the questionnaire was approximately 15 minutes.

Data collection tool

The questionnaire, compiled from appropriate literature for the purpose of the study, was broken up into two parts. The first part included questions about the sociodemographic characteristics of the participants, the self-evaluation of smartphone addiction, and smartphone usage intensities.[8,10,14] The second part comprised the Smartphone Addiction Scale Short Version (SAS-SV).

Smartphone Addiction Scale Short Version (SAS-SV): SAS-SV was developed by Kwon, et al..[7] The Turkish validity and reliability study was conducted by Noyan et al., in 2015.[14] This scale consists of 10, sestet Likert-type items, with each item scoring from 1 to 6. The answers given to the items are scored as I strongly disagree 1, I do not agree 2, partly disagree 3, partly agree 4, I agree 5, I absolutely agree 6. Scores that can be obtained from the scale may range from 10 to 60. It is accepted that as the score obtained from the scale increases, the risk of addiction increases. The scale has one factor and no subscales.[14]

The questions that measure the smartphone usage intensity in the study were coded similar to the SAS-SV. The responses to these questions were scored as less than 10 minutes 1, 11-60 minutes 2, 1-2 hours 3, 3-4 hours 4, 5-6 hours 5, over hours 6. The responses to the frequency of controlling a smartphone in a day were scored as less than 5 times 1, 6-10 times 2, 11-20 times 3, 21-50 times 4, 51-100 times 5, and more than 100 times 6. Since this question is a contrary item, after waking up in the morning, the time to first look at the smartphone was scored as less than 5 minutes 4, 6-30 minutes 3, 31-60 minutes 2, more than 60 minutes 1.

Statistical Analysis

The data obtained in the study was transferred to the computer and evaluated using the IBM SPSS (version 15.0) package program. To develop the scale, all items of the SAS-SV and questions about the intensity of

smartphone usage were analyzed using Exploratory Factor Analysis (EFA). In order to obtain a robust scale by factor analysis, the eigenvalue had to be at least 1, the factor loading values of the scale items had to be at least 0.40, and the load values of items which loaded on more than one factor had to be more than 0.20 between the load values.[15] Internal consistency of the scale was calculated by total item score correlation and Cronbach's alpha. Reliability levels expressed by the Cronbach's alpha coefficient range were accepted as 0.40 and less is no reliability, 0.40-0.60 is low reliability, 0.60-0.80 is fairly reliable, 0.80-1.00 is high reliability.[16] In the study, items with a total item correlation greater than 0.20 were considered reliable.[17] Confirmatory Factor Analysis (CFA) was performed on 497 individuals selected with a systematic sampling from the study group, using the Lisrel (8.8 Student Edition) program to assess how well the three-factor structure of the scale fit. The Problematic Smartphone Usage Scale (PSUS) was created after the CFA.

For the test-retest reliability of the PSUS, the scale was applied to a group of 18 participants and after 10 days the scale was reapplied to the same group. Spearman correlation analysis was conducted for the test-retest correlation of the total score of the participants from the PSUS.

Mann Whitney U and Kruskall Wallis tests were conducted to determine the status of the medians that students got from the PSUS according to socio-demographic characteristics.

To determine the cut-off value of PSUS, scores obtained from the scale were transferred to the Minitab 18 program (trial version). In accordance with the data of a dummy variable with a normal distribution and with a mean of 0.0001, a standard deviation of 0.00001 was derived. Using this variable, participants were divided into two clusters by K-Means clustering analysis according to their scores. ROC analysis was performed on the MedCalc 16 program (trial version) of the scores obtained with reference to these cluster properties for the purpose of determining the cut-off value. The highest sensitivity and specificity score in the ROC analysis was considered to be the cut-off value.

Results

Exploratory Factor Analysis

As a first step, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test were performed in order to find out whether the PSUS is appropriate for EFA. As a result of the analysis, it was found that the dataset was suitable for EFA (KMO = 0.872, $\chi 2$ = 7266.40; P <0.001). Factor analysis was performed using Principle Components Analysis (PCA) with Varimax rotation. As a result of the analysis, 'Item 7: I will never give up using my smartphone even when my daily life is already greatly affected by it.', 'Item 8: Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook.' and 'Item 10: The

people around me tell me that I use my smartphone too much.' are not included in the new scale due to the fact that the factor loadings in the dimensions are close to each other. In the analysis it was found that the items were collected in 3 subscales. It has been observed that the usage intensity subscale consisted of 3 items, the daily life disturbance subscale consisted of 4 items, and the withdrawal subscale consisted of 3 items.

Three subscales explained 63.36 % of the total variance (usage intensity 17.91 %, daily life disturbance 23.11 %, withdrawal 22.34 %).

As a result of the reliability analysis, the Chronbach's alpha coefficient of the scale and subscales were evaluated as reliable (PSUS 0.81, usage intensity 0.62, daily life disturbance 0.74, withdrawal 0.83). The total item correlations of the scale items ranged from 0.25 to 0.66. The correlation coefficients of the subscales ranged from 0.31 to 0.46 (p <0.001). The validity and reliability coefficients of the PSUS are given in Table 1.

Confirmatory Factor Analysis

After identifying factors with EFA, CFA was performed on 497 individuals selected by systematic sampling from the study group to confirm the three-factor structure of the scale. The characteristics of the selected persons according to age, gender, the faculty they were educating, the class they were attending, and self-evaluation of smartphone addiction were similar to the study group (p> 0.05). The standardized path diagram scores of the three-factor structure of PSUS are given in Figure 1. When the fit indices of the factors obtained with CFA are examined; $\chi2 = 116.63$ and p <0.001, $\chi2/df = 116.63/32 = 3.64$, root mean square error of approximation (RMSEA) = 0.07, goodness of fit index (GFI) = 0.96, adjusted goodness of fit index (NFI) = 0.96, non-normed fit index (NNFI) = 0.96, and comparative fit index (CFI) = 0.97. It is acceptable that $\chi2 / df$ is below 5.[18] Below 0.08 of RMSEA fit indices indicates good harmony.[19] Between 0.90 and 0.95 of CFI and AGFI fit indices are considered acceptable.[18] Up to 0.08 of SRMR can be considered acceptable, and NFI and NNFI greater than 0.95 is considered to be in perfect harmony.[20] All these results show that the three-factor model fits well and the dimensional structure obtained through EFA is confirmed.

For the test-retest reliability of the PSUS, the scale was applied to a group of 18 participants and after 10 days the scale was reapplied to the same group. As a result of the correlation analysis performed, the test-retest scale scores of the study group showed a strong positive correlation (r=0.74; p<0.001).

At the final state of the scale, the total score that can be obtained from the scale ranged from 10 to 58, the usage intensity subscale score ranged from 3 to 16, the daily life disturbance subscale score ranged from 4 to 24, and the withdrawal subscale score ranged from 3 to 18. The study group had a total median score of 30 (10-57) obtained from the PSUS, the usage intensity subscale median score was 11 (3-16), the daily life disturbance subscale median score was 11 (4-24), and the withdrawal subscale median score was 8 (3-18).

Table 1. Validity and reliability coefficients of the Problematic Smartphone Usage Scale

Factor name	Item	Factor load	Cronbach's alpha (subscales)	Cronbach's alpha (scale)
Usage intensity	Daily smartphone usage time	0.82	0.62	0.81
	The frequency of controlling smartphone in a day	0.86		
	The time to first look at the smartphone after waking up in the morning	0.45		
Daily life disturbance	Missing planned work due to smartphone use	0.87	0.74	
	Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use	0.85		
	Feeling pain in the wrists or at the back of the neck while using a smartphone	0.55		
	Using my smartphone longer than I had intended.	0.61		
Withdrawal	Won't be able to stand not having a smartphone	0.86	0.83	
	Feeling impatient and fretful when I am not holding my smartphone	0.85		
	Having my smartphone in my mind even when I am not using it	0.76		

Table 2. Comparison of students PSUS scores according to their sociodemographic characteristics

Variables		PSUS Median (min-max)	Statistical analysis z/KW; p
Age	18-20	30 (11-57)	2.264; 0.024
	21-24	29 (10-56)	
Sex	Female	32 (10-55)	8.747; <0.001
	Male	28 (10-57)	
Faculty	Theology	30 (14-50)	23.949; <0.001
	Education	31 (12-57)	
	Engineering	29 (10-56)	
	Science and Arts	31 (12-55)	
	Economics and Administrative Sciences	32 (14-49)	
	Medicine	29 (10-55)	
Grade	1. year class	30 (11-57)	2.311; 0.021
	3. year class	29 (10-56)	
Self evaluation of smartphone addiction	Addiction	34 (11-57)	418.587; <0.001
	Non-addiction	25 (10-54)	
	Don't know	31.50 (15-52)	

From the students in the study group who were 18-20 years of age, those who were female and attending their first year class had higher median scores on the PSUS. From the students in the study group, those who were at the faculty of engineering had a lower median score on the PSUS. According to self-evaluation of smartphone addiction; those who think they are addicted and those who did not know the PSUS median score was higher than those who think they are not addicted. The comparison of the PSUS scores of the students, according to their sociodemographic characteristics is given in Table 2.

Different PSUS cut-off values for gender groups were calculated similarly to the Korean version of the SAS-SV.[7] The results of the ROC analysis according to the cluster characteristics were determined using the Dummy variable, PSUS cut-off values were found to be 32 for females and 28 for males. According to this, it was determined that 49.86 % (n = 359) of females, 46.50 % (n = 359) of males and 48.12 % (n = 718) of the total students participating in the study were displaying problematic usage of smartphones.
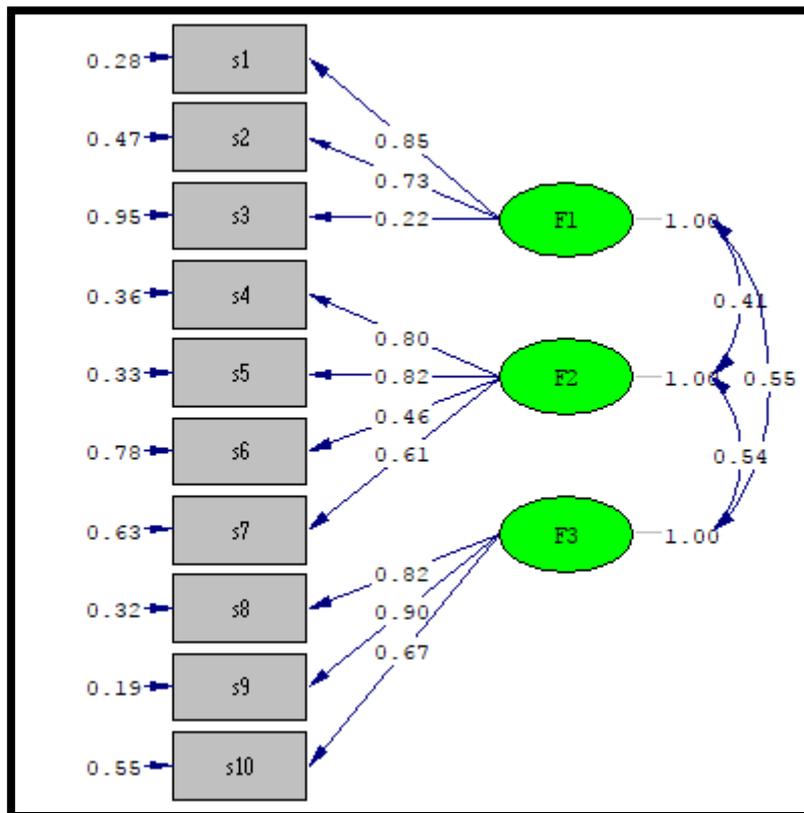

Figure 1. Standardized scores of the three-factor structure of the Problematic Smartphone Usage Scale (F1: Usage intensity, F2: Daily life disturbance, F3: Withdrawal)

Discussion

Reasons such as increasing individuals' social communication, providing easy access to information, fun games and applications make smartphone addiction a current issue, especially for young people. When individuals are eating, walking on the road, or even crossing the street, the inability to take their eyes off from their phones reveals the importance of measuring existing addiction. Appropriate screening scales need to be developed in order to meet the DSM criteria, to determine the size of the problem and associated factors, and to perform interventions.

In the study, a scale consisting of a total of 10 items was developed as a result of the EFA for questions that measured the intensities of smartphone usage and SAS-SV items. The result of the factor analysis revealed that the PSUS has a three-factor structure consisting of usage intensity, daily life disturbance and withdrawal. As a result of the CFA of the scale, it was also seen that the three-factor structure obtained from EFA was strongly confirmed.

The usage intensity subscale was exploring, by rating the individual's frequency of smartphone use, its duration and the time to first look at the smartphone after waking up in the morning. In the Fagerström test for nicotine dependence, which is a common measurement tool for assessing nicotine dependency, the frequency of smoking and the time to first cigarette after waking up are questioned.[21] Such that, in a study conducted by Fagerström in 2003, it was reported that the number of cigarettes smoked daily and time to first cigarette were key determinants of tobacco dependence.[22] It has been shown that the daily frequency and the duration of smartphone use, and time to first look at the smartphone after waking up in the morning are related to smartphone addiction.[8,10-13] In scales developed to evaluate smartphone addiction, overuse is based on perception of the person and is not evaluated by numerical variables.[6,8,9] When evaluated in this context, the PSUS brings a more standardized perspective to measure the intensity of usage.

The daily life disturbance subscale assessed missing planned work, decreased concentration due to smartphone use, using smartphones longer than intended, and wrist and neck pain depending on the overuse of the smartphone. Causing clinically significant distress or impairment in social, occupational, or other important areas of functioning is one of the main elements that should be seen in almost all psychiatric disorders' in the DSM-5.[5] When assessed in this context, the PSUS includes questions of daily life disturbance from the core components in assessing addiction, as in all other psychiatric disorders.

The withdrawal subscale consists of questions that include intolerance, impatience when not holding a smartphone, and inability to think when the smartphone is not being used. Behavioral addictions are reported to have signs of withdrawal with psychological symptoms that are similar to substance addiction withdrawals.

However, in behavioral addictions, unlike substance withdrawal, there are no physiological withdrawal symptoms reported.[23] Withdrawal also has an important place in smartphone addiction, and it is reported that nomophobia (the anxiety experienced from loss of a smart-phone) is a significant symptom of withdrawal.[24] The PSUS does not ignore this, and includes questions that assess withdrawal.

In the reliability analysis of the study, the Cronbach's alpha coefficient of the scale was 0.81, and was sufficient. The item total correlations of PSUS ranged from 0.25 to 0.66 and were sufficient. Correlation analysis showed that test-retest correlation of PSUS was high (r = 0.74, p <0.001). This showed that scale did not change with time related with scale.

In the study group, the PSUS median score was found to be higher in the younger age group and in the lower class. Adolescents show more risky behaviors, so addictions can be seen more often among adolescents.[25] One explanation for adolescents having more problematic smartphone usage in our study could be their being closer to the adolescent age group and the desire to establish new groups of friends using socialization needs.

In the study, according to self-evaluation of smartphone addiction, those who think of themselves as addicted and those who did not know, the PSUS median score was higher than those who do not think of themselves as addicted. A similar finding has been reported in the study of Demirci et al..[26] Kwon et al., also reported that smartphone addiction was more likely in those who considered themselves a smartphone addict, and this result was attributed to the awareness of the seriousness of smartphone addiction.[7]

Females in the study had a higher PSUS median score than males. In the study that was conducted by Demirci et al., it was reported that the scale scores used in that study were also higher for females.[26] In the SAS-SV, developed by Kwon et al., higher scores for females has likewise been linked to the greater awareness of females to their own problems and their greater ability to express themselves.[7] In the same study, different cut-off values for females and males were calculated for these reasons.[7] While calculating the PSUS cut-off points, different cut-off values for females and males are calculated considering this phenomenon.

As a result, we may conclude that the PSUS is a valid, reliable and effective measure in evaluating the problematic usage of smartphones. It is necessary to apply the scale to different risk groups and to make clinical psychological evaluation to test the cut-off value.

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