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Psychometric properties of the Turkish version of the smartphone addiction inventory (SPAI)

Ibrahim Arpaci [1] · Necmi Esgi [1]

Abstract

This study aimed at contributing to the literature by adaptation and validation of the Turkish version of the "Smartphone Addiction Inventory" (SPAI). The psychometric properties of the inventory were evaluated through the data obtained from 330 undergraduate students. A confirmatory factor analysis (CFA) was employed to validate the inventory. The results confirmed the four dimensional structure with a Cronbach's α value of .93 for the inventory as a whole, thus suggested a good internal consistency. Further, the CFA results suggested that correlations between the four constructs and their 26 items were valid. Thus, it is important to note that Turkish version of the SPAI adapted in this study is a valid and reliable instrument for measuring smartphone addiction in Turkey.

Keywords Smartphone addiction · SPAI · Turkish · Validation

Introduction

Addiction is a disorder that involves withdrawal, tolerance, and dependence symptoms accompanied by time management and social problems (O'Brien 2011; Holden 2001). The term involves both chemical dependencies resulting from addiction to drugs or substances of abuse and behavioral addictions such as internet, technology, gambling, and gaming addiction (Young 1998). Similar to the internet addiction, which has been categorized as a "substance related and addictive disorder" in DSM-5, smartphone addiction can be regarded as a form of behavioral addiction (Griffiths 1996).

Bock et al. (2016) developed an instrument to identify key factors associated with mobile phone use. They found that mobile phone addiction and anxious attachment are correlated with impulsivity and depression. In a similar study, Arpaci et al. (2017) investigated the mediating role of mindfulness in the relationships among nomophobia and attachment styles. The results suggested significant and positive relationships between nomophobia and avoidant/anxious attachment styles. In another study, Arpaci (2017) reported a significant correlation between horizontal collectivism and nomophobia. Kim et al. (2014a, b) investigated the effects of impulsivity, resilience, and depression on smartphone addiction. Their results suggested that impulsivity has a significant impact on the smartphone addiction among university students.

Lee et al. (2017) proposed a theoretical model in order to explain effects of anxiety in social interaction and materialism on the self-expressive and utilitarian benefits of smartphones. The study proposed locus of control as a moderator between the smartphone addiction and benefits. The study analyzed the model using structural equation modelling (SEM) based on data collected from Japan, South Korea, China, and Taiwan. The results suggested that the relationships between the proposed constructs differ across the countries. In another study, Chen et al. (2017) investigated the impact of motivations on the smartphone addiction. They found that conformity, mood regulation, perceived enjoyment, and pastime have a positive correlation with the smartphone addiction. Further, gender moderated this relationship. Finally, Lian and You (2017) found that vitality is positively but relationship and conscientiousness virtues are negatively correlated with the smartphone addiction.

Kwon et al. (2013a, b) developed and validated the 10-item "Smartphone Addiction Scale" to investigate the characteristics of the smartphone use in adolescents (mean age =

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Table 1 Demographics of the participants

	Variable	Percent
Gender	Female	65.8
	Male	34.2
Age	18 years or younger	20.6
	19	26.1
	20	16.1
	21	17.0
	Above 21 years	20.2
Study Major	Social Sciences	38.2
	Computer Science	27.9
	Psychology	22.1
	Math	11.8
College Status	Freshmen	44.8
	Sophomore	15.2
	Junior	15.5
	Senior	24.5

14.5). However, Lin et al. (2014) developed the 26-item "Smartphone Addiction Inventory" (SPAI) to identify the predictors of the smartphone use in adults (mean age = 22.9). Therefore, given the fact that population of the study was undergraduate students, the study evaluated the psychometric properties of Turkish version of the SPAI, which could be a promising assessment instrument in clinical and research practice in the field of behavioral addictions. Thereby, this study tested the reliability and construct validity of the Turkish SPAI (Lin et al. 2014), which is specifically designed based on the main components of the "Internet Addiction Scale" (Chen et al. 2003).

Method

Participants and Procedure

A convenience sample of 330 undergraduate students were recruited from various study majors of a public university in

Turkey. Of those, 65.8% were female and 34.2% were male with an average age of 20.38 ± 2.65. In terms of college status, 44.8% were freshmen, 15.2% were sophomore, 15.5% were junior, and 24.5% were senior. All participants reported that they have a smartphone, while 94.8% of the participants reported that they have a mobile Internet connection. Further, 56.7% of them use their smartphones more than 4 h a day and 48.2% of them use their smartphones more than four years. Table 1 presents general characteristics and demographics of the participants.

Upon receiving the permission from the corresponding author of the original scale, items, instructions, and responses were translated by following the standard "forward-backward" translation procedure. Two independent experts who held a PhD degree from an English-medium university in Turkey translated the SPAI into Turkish. Then, the translators met to elaborate and agree on a consensus version of the adapted scale. This version was then evaluated by a third native Turkish-speaking expert in terms of linguistic performance, conceptual equivalence, and clarity. The final form was then back-translated into English by two independent translators and the translators agreed on a common back-translated version. Finally, the translated scale was administered to the sample (See Appendix Table 5 for Turkish items of the SPAI).

Measures

"Smartphone Addiction Inventory" (SPAI) Lin et al. (2014) developed a 26-item five point Likert scale with four subscales including "compulsive behavior," "functional impairment," "withdrawal," and "tolerance" (see Table 3 for sample items). The evidence for the reliability and construct validity of the inventory was provided. Cronbach's α coefficient of the total scale was .94 and it is ranged from .72 to .88 for the subscales.

Statistical Analysis

Preliminary Analysis Statistical tests were carried out by using SPSS version 25.0 (SPSS, Chicago, IL, USA). First,

Table 2 Descriptive statistics, skewness, kurtosis, and reliability coefficients

Subscales	Mean	Standard Deviation	Skewness (SE = .134)	Kurtosis (SE = .268)	Cronbach's α
Tolerance	2.24	.83	−.18	−.16	.71
Withdrawal	2.12	.79	−.14	−.35	.76
Compulsive behavior	2.06	.78	.12	−.05	.84
Functional impairment	1.96	.79	.10	−.42	.80

Table 3 Factor structure of the scales

Items	Total variance explained	Factor load	Communality
Tolerance	51.54		
1. Item 1. "I was told more than once that I spent too much time on smartphone."		.75	.56
2. Item 3		.78	.61
3. Item 9		.61	.37
Withdrawal	45.48		
4. Item 2. "I feel uneasy once I stop smartphone for a certain period of time."		.72	.52
5. Item 4		.77	.59
6. Item 14		.65	.42
7. Item 16		.68	.46
8. Item 19		.73	.54
9. Item 25		.46	.21
Compulsive Behavior	55.96		
10. Item 5. "I feel very vigorous upon smartphone use regardless of the fatigues experienced."		.58	.53
11. Item 6		.59	.51
12. Item 7		.74	.56
13. Item 10		.71	.53
14. Item 11		.75	.56
15. Item 18		.66	.60
16. Item 20		.63	.40
17. Item 21		.68	.72
18. Item 22		.78	.64
Functional Impairment	45.44		
19. Item 8. "I have slept less than four hours due to using smartphone more than once."		.68	.47
20. Item 12		.55	.30
21. Item 13		.70	.49
22. Item 15		.68	.46
23. Item 17		.71	.50
24. Item 23		.69	.48
25. Item 26		.69	.48

Table 4 Regression results with maximum likelihood estimates

Path	Squared Multiple Correlations	Std. Estimate	Std. Error	Critical Ratio	p
Tolerance ← SPAI				14.943	***
	.566	.752	.036		
Withdrawal ← SPAI				17.272	***
	.714	.845	.052		
Compulsive Behavior ← SPAI				19.313	***
	.865	.930	.075		
Functional Impairment ← SPAI				15.865	***
	.642	.801	.055		

*** $p < .001$

psychometric properties of the subscales were examined. The sampling adequacy of each subscale was tested by using Kaiser-Meyer-Olkin, which ranged from .75 to .87. The significance of the Bartlett test was less than .001, suggesting that the factor analysis was appropriate. The results verified the appropriateness of the data set for factorability.

The normality distribution of each scale revealed minimal kurtosis (range − .42 to −.05) and skewness (range − .18 to .12). Cronbach's α coefficients of the "tolerance," "withdrawal," "compulsive behavior," and "functional impairment" were .71, .76, .84, and .80, respectively. Further, a randomized subsample of 217 participants (141 females and 76 males) with a mean age of 20.08 ± 2.43 years was recruited from the original sample to determine test-retest reliability of the scale. The participants completed the instrument twice with a time interval of 10 days between the measurements. Test-retest reliability for the measurement was consistently high (Cronbach's α = .91). Table 2 indicates the descriptive statistics, kurtosis, skewness, and reliability coefficients of the subscales.

Factor Structure An "Exploratory Factor Analysis" (EFA) with "maximum-likelihood estimation" was used to test factor structure. The "total-variance-explained" ranged from 45.44 to 55.96. The factor loadings for each item ranged between .46 to .78 and communality values ranged from .21 to .72. The "inter-construct correlations" were significantly lower than one, thus, satisfying the test of discriminant validity. Table 3 indicates the total variance explained, factor load, and communality values.

In the scale, "time management problems" were classified as "functional impairment" symptoms. On the other hand, the item 24 "I need to spend an increasing amount of time on smartphone to achieve same satisfaction as before" was one of the items of "functional impairment" in the original scale. However, this item is more related to the "tolerance," which was defined as "spending more and more time on smartphone use" (Lin et al. 2014). Thus, based on theoretical considerations, this item was excluded from the main analysis.

Results

A "Confirmatory Factor Analysis" (CFA) by using AMOS (ver. 23) was employed to test the internal structure and the validity of the scale. Given the thresholds for acceptable fit by (Hair et al. 2006; Kline 2005), the CFA suggests that the Turkish version preserved the original factor structure of the SPAI [χ^2 (156) = 328.26, χ^2/DF = 2.10, GFI = .91, AGFI = .87, NFI = .86, TLI = .91, CFI = .92, IFI = .92, RMSEA = .058]. The findings revealed that the scale adapted in this study forms a reasonable measurement model, and thereby, provides support for the construct validity.

Further, the structural equation modeling (SEM) results revealed that "compulsive behavior" (β = .93, t = 19.31, p < .001), "withdrawal" (β = .85; t = 17.27; p < .001), "functional impairment" (β = .80; t = 15.87; p < .001), and "tolerance" (β = .75; t = 14.94; p < .001) are positively associated with the smartphone addiction. Table 4 shows the standardized regression weights along with squared multiple correlations.

Discussion and Conclusion

The present study adapted the SPAI into Turkish by conducting the EFA and CFA. The results revealed that the scale demonstrated high test retest reliability, internal consistency, and construct validity. The SPAI proposed four distinct factors including, "compulsive behavior," "functional impairment," "withdrawal," and "tolerance." The findings suggested that these constructs are prominent components of the smartphone addiction. In conclusion, the adaptation process of the SPAI was successful and the instrument is promising for measuring the smartphone addiction in Turkey. The adapted Turkish version of the SPAI showed adequate psychometric properties of the instrument and confirmed the postulated factor structure.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest Authors declare none.

Appendix

Table 5 Turkish items of the SPAI

Item #	Turkish Items
1	Akıllı telefonda çok fazla zaman geçirdiğim bana birçok kez söylenmiştir.
2	Belli bir süre akıllı telefonu kullanmadığımda kendimi huzursuz hissediyorum.
3	Git gide akıllı telefona daha çok bağlandığımı düşünüyorum.
4	Akıllı telefonu kullanamadığımda kendimi tedirgin ve sinirli hissediyorum.
5	Ne kadar yorgun olsam da akıllı telefonu kullanmak için kendimde enerji buluyorum.
6	Planladığımdan daha uzun süre akıllı telefon kullanıyor ve daha çok harcama yapıyorum.
7	Kişisel ilişkilerime zarar verdiğini bilmeme rağmen, akıllı telefon için harcadığım süreyi azaltamıyorum.
8	Akıllı telefon kullandığım için birçok kez dört saatten az uyuduğum zamanlar olmuştur.
9	Son üç aylık bir sürede haftalık akıllı telefon kullanımımda belirgin bir artış olmuştur.
10	Belli bir süre akıllı telefonu kullanmayı bıraktığımda kendimi stresli ve kötü hissediyorum.
11	Akıllı telefon kullanma arzumu kontrol edemiyorum.
12	Arkadaşlarla dışarı çıkmak yerine akıllı telefonda vakit geçirmeyi yeğliyorum.
13	Aşırı akıllı telefon kullanımından dolayı sırtımda ağrı ve sızı veya gözlerimde rahatsızlık hissediyorum.
14	Her sabah uyandığımda ilk aklıma gelen akıllı telefonu kullanmak oluyor.
15	Akıllı telefon kullanımı okul veya iş performansımı olumsuz etkiliyor.
16	Belli bir süre akıllı telefon kullanmadığımda bir şeyleri kaçırmış gibi hissediyorum.
17	Akıllı telefon kullanımı yüzünden ailemle iletişimim azalmıştır.
18	Akıllı telefon kullanımı yüzünden dinlenme faaliyetlerim azalmıştır.
19	Akıllı telefonu kullanmayı bıraktıktan sonra tekrar hemen kullanma isteği duyuyorum.
20	Akıllı telefon olmasaydı hayatım eğlencesiz olurdu diye düşünüyorum.
21	Akıllı telefon kullanımının fiziksel sağlığım üzerinde negatif etkileri oluyor (akıllı telefona bakarak yürürken ve ya araç kullanırken kaza yapmak gibi).
22	Akıllı telefonda daha az süre harcamaya çabalasam da başaramıyorum.
23	Akıllı telefon kullanımı alışkanlık yapıyor, bu. yüzden uykumun süresi ve kalitesi düşüyor.
24[*]	Aynı hazzı alabilmek için akıllı telefonu geçmişte kullandığımdan daha fazla süre kullanmak zorunda olduğumu düşünüyorum.
25	Akıllı telefon kullanmaksızın yemek yiyemiyorum.
26	Geç saatlere kadar akıllı telefon kullandığım için gün boyu kendimi yorgun hissediyorum.

[*] Excluded from the main analysis. Compulsive behavior: 5, 6, 7, 10, 11, 18, 20, 21, 22; Withdrawal: 2, 4, 14, 16, 19, 25; Tolerance: 1, 3, 9; Functional impairment: 8, 12, 13, 15, 17, 23, 24, 26

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