

ORIGINAL RESEARCH

Adaptation of Smartphone Addiction Inventory-Short Form to Turkish

Zeynep Devran Muharremoğlu , Nüket Paksoy Erbaydar 

Department of Public Health, Hacettepe University School of Medicine, Ankara, Turkey

ORCID iDs of the authors: Z.D.M. 0000-0001-8323-2277; N.P.E. 0000-0001-8004-4342.

Main Points

- Addiction is an important public health problem.
- Behavioral and technological dependencies can be evaluated with valid and reliable measurement tools.
- It is important to save the scales measuring smartphone addiction into the society to take precautions for addiction.

Abstract

In this study, we aimed to determine the validity and reliability of the Smartphone Addiction Inventory-Short Form (SPAI-SF) developed by Lin et al. for Turkish high school students. We analyzed the construct validity by conducting a confirmatory factor analysis (CFA) with the data collected from 578 participants who used smartphones in the past 3 months. Young's Internet Addiction Test-Short Form was used for criterion validity. We calculated the Cronbach's alpha coefficient for the internal consistency of the scale. We conducted the test-retest reliability of the scale with 109 students. We used item analysis based on the correlations method. As a result of CFA, $\chi^2/df=2.25$, root mean square error of approximation=0.047, comparative fit index =0.98, normed fit index=0.96, and incremental fit index=0.98. We found a highly positive and significant relationship between total scores of the two scales ($r=0.57$, $p<0.001$). The Cronbach's alpha value was 0.85 in the internal consistency analysis. First and retest total scores were highly positively correlated ($r=0.68$, $p<0.001$). In the item analysis based on correlations, the Spearman correlation coefficients calculated for each item ranged from 0.47 to 0.70 ($p<0.001$). SPAI-SF can be used as a measurement tool to evaluate the risk of smartphone addiction in Turkish high school students.

Keywords: Smartphone, addictive behavior, adolescence, reliability and validity, codependence

Introduction

Addiction is defined as being unable to stop or control a substance or behavior (Egger & Rauterberg, 1996). The 10th revision of the International Classification of Diseases and Health Problems (ICD-10) treats addiction as a syndrome and defines it as a condition involving many physiological, behavioral, and cognitive variables that arise during the use of a substance or a class of substances (World Health Organization). There has been a change in the concept of addiction owing to technological developments. In recent years, television, internet, and smartphone addiction have emerged along with behavioral addic-

tions, such as gaming and gambling. The common features of behavior-based addictions are defined as the inability to control behavior or action and the continuity of behavior or action despite its negative consequences (Demirci et al., 2014). The spread and overuse of smartphones is an emerging public health problem (United Nations, 2018). The increase is associated with the presence of areas of interest for young people, such as taking pictures and playing games, as well as the use of social media with the widespread use of internet networks (Çakır & Oğuz, 2017).

Excessive use of smartphones can cause physical, mental, and social health problems. Continuous

Corresponding author:

Zeynep Devran
Muharremoğlu

E-mail:
zynpdvrn@gmail.com

Received: February 10, 2021

Accepted: March 28, 2021

©Copyright by 2021 Türkiye
Yeşilay Cemiyeti (Turkish
Green Crescent Society) -
Available online at www.
addicta.com.tr

Cite this article as: Devran, Muharremoğlu, Z., & Paksoy, Erbaydar, N. (2021). Adaptation of Smartphone Addiction Inventory-Short Form to Turkish. *Addicta: The Turkish Journal on Addictions*, 8(1), 58-64.

monitoring of the screen causes health problems such as head, back, and upper extremity pain, neck muscle stiffness, vision problems and sleep disturbances. Undesirable mental and social consequences such as loss of attention because of the desire to constantly control the smartphone and decreased face-to-face communication with the spread of communication through social media applications can be seen. As a result of easy communication in all areas, it may cause withdrawal to unhealthy and illegal environments (Kuyucu, 2017; Statista, 2020). Creating tools that scan smartphone addiction among adolescents and determining the validity and reliability of these tools will contribute to studies on this subject. Therefore, our aim was to adapt the Smartphone Addiction Inventory-Short Form (SPAI-SF), developed by Lin et al. (2017) to Turkish for high school adolescents.

Methods

We conducted this methodological study to evaluate the Turkish validity and reliability of SPAI-SF. We collected the data for the study between May 02 and May 31, 2019. The study sample included students from the 10th grade studying in 23 schools in the Pursaklar District of Ankara (n=1901), of which 52.5% (n=997) were girls.

Considering the opinions in the literature, 578 students in the 10th grade who have used smartphones in the past 3 months were included in the study (Ferguson & Cox, 1993; Comrey & Lee, 2013).

Within the scope of the study, we obtained official permission from Hacettepe University non-clinical research ethics committee (Land No: 2019/11-07), the district national education directorate, and the school administrations. Before participating in the study, we obtained informed consent from the students and their parents.

We collected data by distributing the data collection forms to the students in the classes and getting them filled under observation. We also used the Young's Internet Addiction Test-Short Form (YIBT-SF).

SPAI-SF

The SPAI-SF was developed in 2016 as a short form of the Smartphone Addiction Inventory developed in 2014 by Lin et al. (Lin et al., 2017). The short form of this 26-item scale, whose Turkish validity and reliability study was conducted in 2018 by Arpacı et al., includes 10 items. There are four Likert-type options, such as 1=strongly disagree to 4=strongly agree. The score range of the scale is between 10 and 40. The original, adapted version and item distribution of the scale, which has four subgroups consisting of compulsive behavior, functional impairment, withdrawal, and tolerance as a result of confirmatory factor analysis (CFA), are shown in Appendix Table 1. The Cronbach's alpha internal consistency coefficient of the scale with a cut-off point of 24/25 is 0.84. Item factor loads of the scale are listed in the range of 0.57-0.90 (Lin et al., 2017; Arpacı & Esgı, 2018).

YIBT-SF

The short form of the Young's Internet Addiction Test developed by Young was developed by Pawlikowski et al. (2013). Turkish adaptation was done by Kutlu et al. (2016). YIBT-SF is a 5-point Likert-type scale (1=never to 5=very often) consisting of 12 items. The scale does not have sub-dimensions. There is no re-

verse-scored item on the scale. The scale score ranges between 12 and 60. High scores from the scale indicate a high level of internet addiction. The Cronbach's alpha reliability coefficient of the YIAT-SF was 0.85, and the CFA results showed good agreement (=173.58, $df=53$, comparative fit index=0.95, standardized root mean square=0.064, and root mean square error of approximation=0.079; Kutlu et al., 2016).

Statistical Analysis

We evaluated the data with the Statistical Package for Social Sciences version 23 program (IBM SPSS Corp.; Armonk, NY, USA). To test the compatibility between continuous variables, after evaluating their suitability to the normal distribution, we performed Pearson or Spearman correlation analysis. According to Cohen's classification, "0.10-0.29=low, 0.30-0.49=medium, and 0.50-1.0=high" (Cohen, 1988; Büyükoztürk, 2004). We accepted the statistical significance value as $p<0.05$ at a 95% confidence interval.

We got permission from Yu Hsuan Lin, who developed the scale, after communicating about the use of the scale to be adapted and the necessary regulations, and we created the Turkish form of SPAI-SF and evaluated its language validity. To evaluate the surface validity (understandability) of SPAI-SF, we evaluated the scale, whose translation stages were completed, and the final version of the Turkish form was created by applying it to 12 students in the 10th grade, and we finalized the scale (Appendix Table 1). As CFA is recommended without exploratory factor analysis (EFA) in scale adaptation studies, we performed CFA with the AMOS v.23 program for the structure validity analysis of SPAI-SF (n=578; Seçer, 2018). CFA is used to evaluate whether the determining factors are sufficiently related to each other, which variables are related to which factors, whether the factors are independent of each other, and whether the factors explain the model sufficiently (Schreiber et al., 2006; Erkorkmaz et al., 2013).

As the numerical data were not suitable for normal distribution, we evaluated the relationship between the criterion validity of SPAI-SF, participants' scores of the SPAI-SF, and participants' scores of the YIAT-SF using the Spearman correlation analysis,

Table 1.
CFA Results for SPAI-SF Items (n=578)

Items	Standardized factor loads	
	Original SPAI-SF	Adapted SPAI-SF
Item 1	0.596	0.552
Item 2	0.633	0.402
Item 3	0.710	0.714
Item 4	0.703	0.675
Item 5	0.567	0.658
Item 6	0.649	0.611
Item 7	0.675	0.773
Item 8	0.896	0.769
Item 9	0.764	0.749
Item 10	0.764	0.780

CFA: confirmatory factor analysis; SPAI-SF: Smartphone Addiction Inventory-Short Form

and we calculated the correlation coefficient. We calculated the Cronbach’s alpha coefficient to evaluate the internal consistency of SPAI-SF. The Cronbach’s alpha coefficient was suggested to be ≥ 0.70 . In the test-retest reliability analysis of SPAI-SF, we reached 109 students who were in the same example and whose nicknames were known, with the same data collection form, as suggested in the literature, 2 weeks after data collection (Seçer, 2018). To evaluate the consistency between the first and second application total scores, we performed a Pearson correlation analysis and calculated the correlation coefficient, as the numerical data were suitable for normal distribution. We used the item analysis based on correlations method, one of the item analysis methods suggested by Likert, to determine the measuring power of each item in SPAI-SF. As numerical data were not suitable for normal distribution, we performed the Spearman correlation analysis and calculated the correlation coefficient (Tezbaşaran, 2008).

In the original form of the SPAI-SF, Receiver Operating Characteristic (ROC) analysis was performed using the area under the ROC curve to examine the diagnostic sensitivity of SPAI-SF on smartphone addiction, and the cut-off point was determined as 24/25. In our study, we took the lower cut-off point. Thus, we may have provided a better demonstration of the seriousness of the situation. We accepted the participants who got 24 points and above from SPAI-SF as *high risk* in terms of smartphone addiction and those who scored below 24 as *non-risk*.

Results

We included 578 students who used smartphones in the past 3 months. 59.9% (n=385) of the participants were girls. The average age of first smartphone ownership of users was 12.9 ± 1.7 years, the average duration of smartphone use was 3.4 ± 1.9 years, the total number of smartphones owned was 2.8 ± 2.5 , and the average daily time allocated to the smartphone was 4.7 ± 4.2 hours.

Validity Findings

Language Validity Analysis Results of SPAI-SF

After obtaining the necessary permissions to evaluate the Turkish validity and reliability of SPAI-SF within the scope of this study, we started the translation process of the scale.

Surface Validity (Understandability) Analysis Results of SPAI-SF

To evaluate the surface validity of SPAI-SF, we completed the translation steps, finalized the Turkish form, and applied the scale to 12 students in the 10th grade in a private vocational and technical Anatolian high school in Gölbaşı. We asked if there were any incomprehensible areas on the form during one-on-one interviews with the students and then finalized the scale by considering the answers.

SPAI-SF’s Construct Validity Analysis Results

The original SPAI-SF had four sub-dimensions with 10 items. To verify this structure, the model obtained as a result of the CFA conducted with the responses of 578 participants with full-scale data is shown in Figure 1. The non-standard factor loads of the original scale and the SPAI-SF we adapted are shown in Table 1,

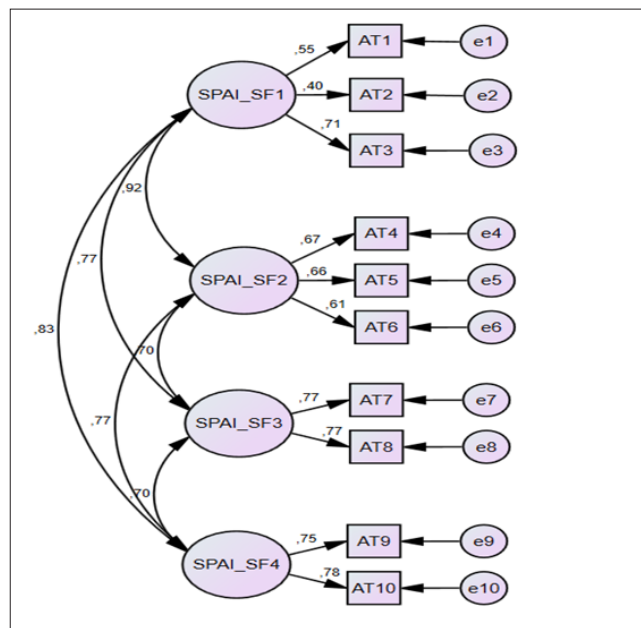


Figure 1. Four Sub-dimensional Confirmatory Factor Analysis (CFA) Model of the Turkish form of Smartphone Addiction Inventory-Short Form (SPAI-SF)
 SPAI_SF1: Compulsive behavior; SPAI_SF2: Impaired functionality; SPAI_SF3: Withdrawal; SPAI_SF4: Tolerance

Table 2. Standard Compliance Measures Used in CFA and SPAI-SF Compliance Values (n=578)

Fit dimensions	Weak fit	Acceptable compliance	PF	Original scale fit values	SPAI-SF compliance values	Compatibility result of SPAI-SF
χ^2/df		≤ 5	≤ 3		2.255	PF
RMSEA	≤ 0.10	≤ 0.08	≤ 0.05	0.061	0.047	PF
RMR	≤ 0.10	≤ 0.08	≤ 0.05		0.023	PF
CFI	$0.85 \leq CFI < 0.90$	$0.90 \leq CFI < 0.95$	$0.95 \leq CFI \leq 1$	0.97	0.979	PF
NFI	$0.85 \leq NFI < 0.90$	$0.90 \leq NFI < 0.95$	$0.95 \leq NFI \leq 1$	0.94	0.964	PF
IFI	$0.85 \leq IFI < 0.90$	$0.90 \leq IFI < 0.95$	$0.95 \leq IFI \leq 1$	0.97	0.979	PF
GFI	$0.85 \leq GFI < 0.90$	$0.90 \leq GFI < 0.95$	$0.95 \leq GFI \leq 1$		0.978	PF
AGFI	$0.80 \leq AGFI < 0.85$	$0.85 \leq AGFI < 0.90$	$0.90 \leq AGFI \leq 1$		0.958	PF

PF: perfect fit; CFA: confirmatory factor analysis; SPAI-SF: Smartphone Addiction Inventory-Short Form; RMSEA: root mean square error of approximation; RMR: root mean square residuals; CFI: comparative fit index; NFI: normed fit index; IFI: incremental fit index; GFI: goodness fit index; AGFI: adjusted goodness fit index

and the standardized factor loads of the scale items we adapted are between 0.402 and 0.773. According to this result, we completed the first step of the analysis required for the validity of the factor structure of the scale.

We looked at the goodness of fit values in the second step for the CFA validity of the four sub-dimensions determined in the CFA analysis we conducted for SPAI-SF. Standard fit measures and the fit values obtained as a result of DFA are shown in Table 2 (Schreiber et al., 2006; Erkorkmaz et al., 2013).

According to the fit values of the CFA result, the SPAI-SF that we adapted perfectly fit the four sub-dimensional structure.

Criterion Validity Analysis Results of SPAI-SF

We performed Spearman correlation analysis to evaluate the relationship between YIAT-SF and SPAI-SF scores, as the total scores of both scales did not match the normal distribution.

Table 3.
Cronbach's Alpha Values Calculated for SPAI-SF and all its Sub-Dimensions (n=578)

Scale and sub-dimensions	Cronbach's alpha value
SPAI-SF	0.85
Compulsive behavior (items 1, 2, and 3)	0.59
Functional impairment (items 4, 5, and 6)	0.68
Withdrawal (items 7 and 8)	0.74
Tolerance (items 9 and 10)	0.73

SPAI-SF: Smartphone Addiction Inventory-Short Form

Table 4.
Item Analysis Results of SPAI-SF Based on Correlations (n=578)

Scale items	Scale point averages when the item is deleted	Scale variance when the item is deleted	Corrected item-total score correlation	Cronbach alpha value when the item is subtracted
1. Compulsive behavior				
Item 1 (n=575)	19.75	31.07	0.51	0.84
Item 2 (n=578)	20.06	33.12	0.36	0.85
Item 3 (n=571)	19.59	29.57	0.63	0.83
2. Functional impairment				
Item 4 (n=578)	19.73	30.03	0.57	0.84
Item 5 (n=574)	19.73	29.92	0.56	0.84
Item 6 (n=581)	19.53	30.44	0.52	0.84
3. Withdrawal				
Item 7 (n=576)	19.65	29.30	0.60	0.84
Item 8 (n=576)	19.73	29.87	0.58	0.84
4. Tolerance				
Item 9 (n=576)	19.75	30.11	0.59	0.84
Item 10 (n=578)	19.92	30.35	0.62	0.83
Total	n=578, item number=10, Cronbach's alpha=0.85, X ⁻ ±SD=21.94±6.07			

SPAI-SF: Smartphone Addiction Inventory-Short Form
X⁻±SD: Mean±Standard Deviation

There was a positive significant correlation between YIBT-KF and SPAI-SF scores (r=0.57, p<0.001). This correlation is at a high level according to Cohen's classification.

Reliability Analysis Results of SPAI-SF

In this study, we performed internal consistency analysis, test-retest reliability analysis, and item analysis for the reliability analysis of SPAI-SF.

Internal Consistency Analysis

The Cronbach's alpha values calculated for all four sub-dimensions of SPAI-SF are shown in Table 3. The Cronbach's alpha values calculated for the whole SPAI-SF is 0.85. According to the sub-dimensions, Cronbach's alpha values are 0.58 for compulsive behavior, 0.68 for impaired functionality, 0.74 for withdrawal, and 0.73 for tolerance. Although there are different opinions about Cronbach's alpha value, the general acceptance is that this value is 0.70 and above (Kılıç, 2016).

Test-Retest Reliability

The first test total scale score average of 109 students was 22.2±5.8, and the average of retest total scale score was 22.2±4.6. According to the result of the Pearson correlation analysis, there was a positive significant relationship between the first and retest total scores (r=0.68, p<0.001). This correlation was at a high level according to Cohen's classification and showed that SPAI-SF gave consistent results over time.

Item Analysis Based on Correlations

For the correlation-based item analysis, we calculated corrected item-total score correlation coefficients. If this coefficient is negative or <0.20 and the Cronbach's alpha coefficient is increased when the item is excluded from the scale, it is accepted as a deter-

minant to remove the relevant item from the scale (Terzi, 2017). The item analysis results of SPAI-SF based on correlation are shown in Table 4. In the item analyses, the results of the second item were different from other items. When the item was deleted, the mean scale scores were similar in nine items of SPAI-SF, whereas the average increased slightly in the second item. Although the corrected item-total score correlation coefficient calculated for any item of SPAI-SF was not below 0.20, the correlation coefficient for the second item was lower than the other items ($r=0.35$). When the item was removed, the Cronbach's alpha value was lower than the Cronbach's alpha value of the scale in all items, whereas the Cronbach's alpha value was minimally higher than the total value when the second item was removed ($\alpha=0.85$).

Therefore, we decided to keep this item in the scale, as the item-total score correlation coefficient calculated for the second item was not below 0.20, and there was a minimal difference in the Cronbach's alpha value of the scale when it was removed from the scale ($\alpha=0.85$). Item analysis results based on the correlations performed for SPAI-SF show that the scale is a reliable measurement tool (Table 4).

The Spearman correlation coefficients calculated for each item in the scale with the item analysis method based on correlations ranged from 0.47 to 0.70, and there was a positive significant relationship between each item and the total score ($p<0.001$). This relationship was mostly at a high level according to Cohen's classification.

Discussion

For a scale to give objective results, it must be standardized, that is, it must have validity and reliability features (Ercan & Kan, 2004). Therefore, in this study, we conducted validity and reliability analyses to evaluate whether the Turkish form of SPAI-SF was a standard measurement tool.

Validity is the extent to which a measurement tool can measure the feature it aims to measure and the degree to which it can be measured without mixing it with other features (Seçer, 2018). In this study, we analyzed language validity, surface validity, construct validity, and criterion validity to evaluate the validity of SPAI-SF.

In language validity and surface validity, the translation process started after obtaining the necessary permissions for the Turkish adaptation of SPAI-SF. The translations of the scale were done with the support of experts. In terms of understandability, it was presented to students for evaluation, and necessary modifications were made. Thus, the problems that could develop later in the scale were noticed and corrected in time. After these steps, it was decided that the scale's language and surface validity were provided and that SPAI-SF was applicable.

Construct validity is related to the extent to which the feature desired to be measured can be accurately measured by the scale (Seçer, 2018). In this study, we used the factor analysis method to evaluate construct validity. Factor analysis is a multivariate statistical method that aims to find factors or sub-dimensions by bringing together multiple related variables (Büyüköztürk, 2007). According to the results of CFA, the original four sub-dimensional structure of SPAI-SF was verified by showing perfect harmony.

The factor load values of nine of the 10 items of SPAI-SF were ≥ 0.55 . Although the second item of SPAI-SF has a lower value than the factor load values of other items, it is critical to question "the duration of using a smartphone and the money spent on it" in measuring smartphone addiction. In addition, this item was kept in the analysis due to the low number of items in the scale (Hoşgör et al., 2017; Özdemir, 2018).

In criterion validity, the researcher collects additional evidence about the scale by comparing the scale with a scale that has previously been proven to be valid and reliable (Seçer, 2018). As internet addiction is similar to smartphone addiction in many aspects, we applied the YIAT-SF, which was validated in Turkish with SPAI-SF (Akaltun & Ayaydın, 2019). According to the data obtained, we correlated the scores of the two scales and found a significant positive correlation between the two scales ($r=0.57$, $p<0.001$). This correlation was high according to Cohen's classification (Cohen, 1988). To verify the criterion validity, the significant correlation value must be above 0.30 (Şencan, 2005). Therefore, the criterion validity of SPAI-SF was verified.

Reliability implies that the test applied does not differ significantly during applications and is consistent, that is, the fact that the test has the least errors shows its reliability. As the reliability of the test increases, the risk of error decreases (Seçer, 2018). In this study, we performed internal consistency analysis, test-retest reliability, and item analysis to evaluate reliability.

Cronbach's alpha reliability coefficient is widely used to measure psychological characteristics (Kılıç, 2016). The Cronbach's alpha reliability coefficient is the reliability value that makes mathematical calculations over variances (Ercan & Kan, 2004). If the answers given to the scale are in the form of dichotomous or ordinal scoring such as true or false, it is appropriate to use the Cronbach's alpha reliability coefficient (Kılıç, 2016). As the answers of SPAI-SF are in the form of sequential scoring, we used the Cronbach's alpha reliability coefficient in the internal consistency analysis of the scale in this study. The total Cronbach's alpha reliability coefficient of SPAI-SF was 0.85. Cronbach's alpha coefficient values of the four sub-dimensions ranged between 0.59 and 0.74. The lowest Cronbach's alpha value belonged to compulsive behavior, and the highest Cronbach alpha value belonged to the withdrawal sub-dimension. In the original SPAI-SF, this value for the total scale was 0.84 (Lin et al., 2017). Although there are different opinions regarding Cronbach's alpha value, the general acceptance is that this value is acceptable if it is between $0.60 \leq \alpha < 0.80$ and highly reliable if it is between $0.80 \leq \alpha < 1.00$ (Kılıç, 2016; Altuntaş & Baykal, 2010). In line with these results, the SPAI-SF sum and Cronbach's alpha coefficient value calculated for the sub-dimensions show that the scale was quite reliable.

We conducted a test-retest reliability analysis to test the ability of SPAI-SF to provide consistent results over time. In the test-retest reliability analysis of SPAI-SF, we reached 109 students who were included in the same sample with the same data collection form 2 weeks after data collection, as suggested in the literature. The high correlation values obtained in test-retest reliability shows that test-retest reliability is ensured (Seçer, 2018). This correlation was statistically significant and high according to Cohen's classification (Cohen, 1988). These results were the first to show that SPAI-SF is a consistent measurement tool against time.

To evaluate the items of SPAI-SF, we calculated the scores the participants got from the scale and performed item analysis based on correlations. There was no reverse item on the scale. The cut-off point in the original scale was 24 (Lin et al., 2017). For the correlation-based item analysis, we calculated corrected item-total score correlation coefficients. If the corrected item-total score correlation coefficient for the items in the scale is negative or less than 0.20 and the Cronbach alpha coefficient is increased when the item is removed from the scale, it is accepted as determinant for the removal of the related item (Terzi, 2017). In the whole item analysis of SPAI-SF, the results of the second item were different from other items. When the item was deleted, the mean scale scores were similar in the nine items of SPAI-SF, whereas the average increased slightly in the second item. Although the corrected item-total score correlation coefficient calculated for any item of SPAI-SF was not below 0.20, the correlation coefficient in the second item was lower than the other items ($r=0.357$). When the item was removed, the Cronbach's alpha value was lower than the Cronbach's alpha values of all the items, whereas the Cronbach's alpha value was minimally higher than the total value when the second item was removed ($\alpha=0.85$). Therefore, we decided to keep this item in the scale, as the item-total score correlation coefficient calculated for the second item was not below 0.20, and there was a minimal difference in the Cronbach's alpha value of the scale when it was removed from the scale ($\alpha=0.85$). The item analysis results based on correlation for SPAI-SF showed that the scale was a reliable measurement tool.

Strengths

Both these scales are useful to determine the level of smartphone use among adolescents and determine whether this increasingly widespread behavior has turned into addiction, to reveal the situation, and to take precautions.

Limitations and Directions/Suggestions for Future Research

The fact that the scale items of absenteeism and refusal to attend school were blank more than the acceptable limit during the study caused data loss. Despite the evaluation of surface validity (understandability) and the settings we made, during the data collection, some students responded, "My sleep quality decreased but my sleep time did not." Regarding the fifth question of the scale, "My sleep quality and total sleep time decreased because I made it a habit of using a smartphone," it will be useful to write "and/or" instead of "and" in this question when the scale is used in future studies.

We were unable to include the data collection form on a standard scale that would function as a gold test to measure smartphone addiction. Hence, we could not determine the cut-off point of our sample and used the cut-off point of the original scale. For researchers who will adapt a cut-off point of the scale in future studies, this may be worth considering.

SPAI-SF is a valid and reliable measurement tool that can be used to measure the smartphone addiction status of Turkish high school students, and there is a significant correlation between SPAI-SF and internet addiction among students. In addition, the scale has a single-factor structure.

Ethics Committee Approval: Ethics committee approval was received for this study from the Non-Clinical Research Ethics Committee of Hacettepe University (Land No: 2019/11-07).

Informed Consent: Informed consent was obtained from the students and their parents.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - N.P.E.; Design - Z.D.M., N.P.E.; Supervision - N.P.E.; Materials - Z.D.M., N.P.E.; Data Collection and/or Processing - Z.D.M.; Analysis and/or Interpretation - Z.D.M.; Literature Review - Z.D.M.; Writing - Z.D.M.; Critical Review - N.P.E.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

References

- Akaltun, İ., & Ayaydın, H. (2019). Çocuk psikiyatrisi polikliniğine çeşitli nedenlerle başvurmuş, akıllı telefon bağımlılığı olan ergenlerin aldığı psikiyatrik tanıları. *Harran Üniversitesi Tıp Fakültesi Dergisi*, 16(2), 193-196.
- Altuntaş, S., & Baykal, Ü. (2010). Örgütsel Vatandaşlık Düzeyi Ölçeğinin hemşirelikte geçerlik-güvenirliliği/Reliability and validity of Organizational Citizenship Level Scale in nursing. *Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi*, 13(3).
- Arpaci, I., & Esgü, N. (2018). Psychometric properties of the Turkish version of the smartphone addiction inventory (SPAI). *Current Psychology*, 1-6.
- Büyükoztürk, Ş. (2007). Sosyal Bilimler İçin Veri El Kitabı, İstatistik, Araştırma Deseni, SPSS Uygulamaları ve Yorum. 14. Baskı. Ankara: Pegem A Yayıncılık, 133-140.
- Cohen J (1988). Statistical power analysis for the behavioral sciences Lawrence Erlbaum Associates Publishers.
- Comrey, A. L., & Lee, H. B. (2013). *A first course in factor analysis: Psychology press*.
- Çakır, Ö., & Oğuz, E. (2017). Lise öğrencilerinin yalnızlık düzeyleri ile akıllı telefon bağımlılığı arasındaki ilişki. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 13(1), 418-429.
- Demirci, K., Orhan, H., Demirdas, A., Akpınar, A., & Sert, H. (2014). Validity and reliability of the Turkish Version of the Smartphone Addiction Scale in a younger population. *Klinik Psikiyatri Farmakoloji Bülteni-Bulletin of Clinical Psychopharmacology*, 24(3), 226-234.
- egger, O., & Rauterberg, M. (1996). Internet behaviour and addiction. *Semester thesis (Swiss Federal Institute of Technology, Zurich, 1996)*.
- Ercan, İ., & Kan, İ. (2004). Ölçeklerde güvenilirlik ve geçerlik. *Uludağ Üniversitesi Tıp Fakültesi Dergisi*, 30(3), 211-216.
- Erkorkmaz, Ü., Etikan, İ., Demir, O., Özdamar, K., & Sanisoğlu, S. Y. (2013). Doğrulayıcı faktör analizi ve uyum indeksleri. *Türkiye Klinikleri Journal of Medical Sciences*, 33(1), 210-223.
- Ferguson, E., & Cox, T. (1993). Exploratory factor analysis: A users' guide. *International journal of selection and assessment*, 1(2), 84-94.
- Hoşgör, H., Tandoğan, Ö., & Hoşgör, D. G. (2017). Nomofobinin günlük akıllı telefon kullanım süresi ve okul başarısı üzerindeki etkisi: sağlık personeli adayları örneği. *Akademik Sosyal Araştırmalar Dergisi*, (46), 573-595.
- Kılıç, S. (2016). Cronbach'in alfa güvenilirlik katsayısı. *Journal of Mood Disorders*, 6(1), 47-48.
- Kutlu, M., Savcı, M., Demir, Y., & Aysan, F. (2016). Young İnternet Bağımlılığı Testi Kısa Formunun Türkçe uyarlaması: Üniversite öğrencileri ve ergenlerde geçerlilik ve güvenilirlik çalışması. *Anadolu Psikiyatri Dergisi*, 17(1), 69-76.

Devran Muharremođlu and Paksoy Erbaydar. Adaptation of SPAI-SF to Turkish

- Kuyucu, M. (2017). Gençlerde akıllı telefon kullanımı ve akıllı telefon bağımlılığı sorunsalı: "Akıllı telefon (kolik)" üniversite gençliği. *Global Media Journal TR Edition*, 7(14), 328-359.
- Lin, Y.-H., Chang, L.-R., Lee, Y.-H., Tseng, H.-W., Kuo, T. B., & Chen, S.-H. (2014). Development and validation of the Smartphone Addiction Inventory (SPAI). *PloS one*, 9(6), e98312.
- Lin, Y. H., Pan, Y. C., Lin, S. H., & Chen, S. H. (2017). Development of short - form and screening cutoff point of the Smartphone Addiction Inventory (SPAI - SF). *International journal of methods in psychiatric research*, 26(2), e1525.
- Özdemir, Z. (2018). Üniversite öğrencilerinin akıllı telefon oyun tercihleri ile cinsiyet, gelir ve akıllı telefon kullanım alışkanlıkları arasındaki ilişkiler üzerine inceleme. *İletişim Çalışmaları Dergisi*, 4(2), 79-107.
- Pawlikowski, M., et al. (2013). "Validation and psychometric properties of a short version of Young's Internet Addiction Test." *Computers in Human Behavior*, 29(3), 1212-1223.
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of educational research*, 99(6), 323-338.
- Seçer, İ. (2018). *Psikolojik Test Geliştirme ve Uyarlama Süreci SPSS ve Lisrel Uygulamaları* (2. Baskı ed.). Ankara: Anı Yayıncılık
- Statista Number of smartphone users worldwide from 2014 to 2020 (in billions). <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/2019>
- Şencan, H. (2005). Sosyal ve davranışsal ölçümlerde güvenilirlik ve geçerlilik [Reliability and validity in social and behavioral assessments]. Ankara: Seçkin. Özlem Diken and James E. Gilliam.
- Terzi, Y. (2017), Güvenirlik analizi. p. 337.
- Tezbaşaran, A. A. (2008). Likert Tipi Ölçek Hazırlama Klavuzu. Mersin.
- United Nations (UN). World Drug Report 2018. Office on Drugs and Crime (UNODC).
- World Health Organization (WHO) Management of substance abuse, Dependence syndrome. https://www.who.int/substance_abuse/terminology/definition1/en/.

Appendix Table 1.
Smartphone Addiction Inventory-Short Form (SPAI-SF)

SPAI - SF

Factor 1- Compulsive behavior

1. Although using smartphone has impacted my interpersonal relationships negatively, the amount of time I spend on the internet remains unchanged.
 2. I use the smartphone for a longer period and spend more money than I intended.
 3. I try to spend less time on smartphone, but the efforts are in vain.
-

Factor 2- Functional impairment

4. I feel aches and soreness in the back or eye discomfort because of excessive smartphone use.
 5. I make it a habit to use the smartphone, and my sleep quality and total sleep time have decreased.
 6. Smartphone use has resulted in certain negative effects on my schoolwork or job performance.
-

Factor 3- Withdrawal

7. I feel restless and irritable when the smartphone is unavailable.
 8. I feel uneasy once I stop using the smartphone for a certain period.
-

Factor 4- Tolerance

9. I find that I have been hooked on the smartphone longer and longer.
 10. I have increased the amount of time using smartphone per week in the recent 3 months.
-

SPAI-SF: Smartphone Addiction Inventory-Short Form
