Dusunen Adam The Journal of Psychiatry and Neurological Sciences 2016;29:49-59
DOI: 10.5350/DAJPN2016290105

Research / Araştırma

# Development of a Problematic Mobile Phone Use Scale for University Students: Validity and Reliability Study

Mustafa Pamuk[1], Abdullah Atli[2]

*[1]Firat University, Faculty of Education, Department of Educational Sciences, Psychological Counseling and Guidance, Elazig - Turkey*
*[2]Inonu University, Faculty of Education, Department of Educational Sciences, Psychological Counseling and Guidance, Malatya - Turkey*

**ABSTRACT**

Development of a Problematic Mobile Phone Use Scale for university students: validity and reliability study

**Objective:** This study aims to develop a Problematic Mobile Phone Use Scale (PMPUS) to determine the problematic mobile phone use by university students.

**Method:** Study participants for exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were 725 university students, for test-retest 126 university students. The psychometric characteristics of the scale were investigated using test-retest, internal consistency (Cronbach's alpha), item analysis, EFA, CFA, and criterion-related validity methods.

**Results:** According to results obtained from exploratory factor analysis, it was determined that PMPUS had four subdimensions. Confirmatory factor analysis confirmed this four-subdimension structure. Reliability data for the PMPUS found Cronbach's Alpha coefficients of 0.92 for EFA and 0.93 for CFA, respectively. Test-retest coefficient for PMPUS was 0.85. Furthermore, a positive, high correlation (r=0.75) was found between PMPUS and Mobile Phone Problem Use Scale (MPPUS). Subscales of PMPUS also showed the required values for validity and reliability.

**Conclusion:** According to the results, PMPUS is a reliable and valid scale with 26 items in four subdimensions.

**Keywords:** Problematic mobile phone use, reliability, university students, validity

**ÖZET**

Üniversite öğrencileri için Problemli Cep Telefonu Kullanım Ölçeği'nin geliştirilmesi: Geçerlik ve güvenirlik çalışması

**Amaç:** Bu araştırmanın amacı üniversite öğrencilerinin problemli cep telefonu kullanımları belirlemek için Problemli Cep Telefonu Kullanım Ölçeği'ni (PCTKÖ) geliştirmektir.

**Yöntem:** Araştırmanın katılımcılarını açımlayıcı faktör analizi (AFA) ve doğrulayıcı faktör analizi (DFA) için 725; test tekrar test için ise 126 üniversite öğrencisi oluşturmaktadır. Ölçeğin psikometrik özellikleri, test-tekrar test, iç tutarlık (Cronbach'ın alfası), madde analizi, AFA, DFA ve ölçüt bağıntılı geçerlik yöntemleriyle incelenmiştir.

**Bulgular:** Ölçeğin geçerliliğine ilişkin yapılan açımlayıcı faktör analizi sonucunda PCTKÖ'nün dört faktörlü bir yapıya sahip olduğu belirlenmiştir. Ardından yapılan doğrulayıcı faktör analizleri bu dörtlü yapıyı doğrulamıştır. Güvenirliğe ilişkin bulgulara göre PCTKÖ'nün Cronbach'ın Alfa'sı AFA verisi üzerinden 0.92, DFA verisi üzerinden 0.93; test tekrar teste göre 0.85 bulunmuştur. Ayrıca PCTKÖ'nün problemli mobil telefon kullanım ölçeğiyle yüksek düzeyde pozitif yönlü ilişkili olduğu bulunmuştur (r=0.75). PCTKÖ'nün alt ölçeklerinin de gerekli geçerlik ve güvenirlik değerlerine sahip olduğu bulunmuştur.

**Sonuç:** Elde edilen bulgular doğrultusunda PCTKÖ'nün 26 maddeli, dört alt boyutlu bir yapıda, geçerli ve güvenilir bir ölçek olduğu belirlenmiştir.

**Anahtar kelimeler:** Problemli cep telefonu kullanımı, güvenirlik, üniversite öğrencileri, geçerlik

Address reprint requests to / Yazışma adresi:
Mustafa Pamuk,
Firat University, Faculty of Education,
A Blok 316 No'lu Oda, Merkez/Elazig, Turkey

Phone / Telefon: +90-424-237-0000/4927

E-mail address / Elektronik posta adresi:
mustafapamuk@firat.edu.tr

Date of receipt / Geliş tarihi:
January 19, 2015 / 19 Ocak 2015

Date of the first revision letter /
İlk düzeltme öneri tarihi:
January 31, 2015 / 31 Ocak 2015

Date of acceptance / Kabul tarihi:
June 21, 2015 / 21 Haziran 2015

## INTRODUCTION

With the rapidly developing technology worldwide, the communication distance between individuals has begun to shrink. One of the most important developments in the field of communication technology is the mobile phone. Especially the new generation of smart phones offers its users a large number of conveniences: talking, internet connection, sending SMS, connecting to social networks, sending e-mails, taking photos, recording videos, MP3, watching TV, navigation or banking transactions. So broad is the field of conveniences that the mobile phone is no longer a luxury item, but has become a necessity. According to data from the Ministry of Transport, Maritime Affairs, and Communication's Information Technology and Communication Authority for the year 2014 (1), published by the Turkish Statistical Institute (TUIK), the number of mobile phone contracts among Turkey's population of 75 million persons was approaching 72 million, and according to TUIK (2), in 2012 93.2% of all households had at least one mobile phone; the rate was 95.1% in urban and 88.5% in rural areas. Remarkably, according to TUIK (3), the average age at which children began using a mobile phone was ten years. Some studies have found that mobile phone use can lead to problems in some individuals, including excessive, problematic mobile phone use or mobile phone addiction (4-10). According to the literature, problematic mobile phone use is correlated with depression (6,11-13), loneliness (9,14), academic procrastination (5), academic success (13), shyness (15), and quality of sleep (16).

Technological gadgets becoming available in parallel with the development of technology can cause addiction in individuals when using them excessively, beyond necessity. According to Griffith (17), technology addiction is a behavioral, human-machine interaction addiction. Gunuc and Kayri (18) state that in the field of technology addiction, various forms like media, television, mobile phone, computer, and internet addictions can be found. As one form of problematic technology use, problematic mobile phone use has been referred to in the literature variously as mobile phone addiction (19,20), excessive mobile phone use (6), or problematic mobile phone use (4,8). Concerning the naming of problematic technology use, Ceyhan (21) specified negative results of internet use in the general population and indicated that using the term internet addiction in non-clinical studies was not appropriate. As a more adequate expression, he proposed the term problematic internet use. In that sense, we chose the term problematic mobile phone use for our study.

In studies developing scales or surveys for problematic mobile phone use, we can see that some researchers use criteria for certain disorders from the DSM (10,19,22,23). When developing an instrument to measure problematic mobile phone use, first of all we may want to look for standards in studies developing instruments for internet addiction, because many of the opportunities offered by the internet can also be reached by mobile phone. From this viewpoint, studies developing instruments for problematic internet use found in the literature have been reviewed (18,24). Another standard might be the recently published criteria for "internet gaming disorder" in the DSM V (25).

Even though according to the above-mentioned TUIK, mobile telephone use in Turkey is very high, there are only recent and few studies regarding the problematic use of mobile phones (5,9,13-16,26-29). For problematic mobile phone use in Turkey, we can find two adapted instruments (26,28) and one scale developed for adolescents (29). However, there is no study developing (rather than adapting) an instrument for university students. In this context, the primary aim of this paper is to develop an instrument for measuring problematic mobile phone use among young adult university students and to make a contribution to the relevant literature.

## METHOD

This section provides information about study participants, data collection instruments used, applied statistical techniques and performed procedures.

### Participants

Participants for this study were two different groups of students from various faculties of Firat University. Before the applications, a permission was granted from the course instructors. Students were informed about the research before the application and the scales were applied to students who voluntarily accept to participate in the research. In the information process, the purpose of the research was presented to students. Also it was stated to students that there is no need to write their names on the papers and all the data will be analyzed as a whole. Also students' approvals of the research were obtained. In the first group, initially data from 850 students were collected. For various reasons, though (incompletely filled forms, errors in control items), only 725 students from the first group were included in the analysis. Of these 725 students, 376 (51.8%) were male, 349 (48.2%) were female. In the second group, data from 126 students were collected for test-retest analysis. It was determined that all participants had a mobile phone. Mean age of students included in the analysis was 20.7 (SD=0.10).

### Data Collection Instruments

**Preparation of an Item Pool for the Problematic Mobile Phone Use Scale (PMPUS):** Aim of this study was the development of a scale for problematic mobile phone use. To generate an item pool for the instrument to be developed, we first reviewed the relevant literature. Then we asked university students open-ended questions (such as: How do you feel when you don't have your phone with you or if you lost it?), obtaining qualitative data. After this stage, we generated an item pool, considering the qualitative data received from the students, the relevant literature (18,24,26), and criteria for substance use disorder and internet gaming disorder in the DSM V. For each item, the views of four area experts were sought and required modifications made. Prepared a provisional scale with 43 items a provisional scale with 43 items administered to 24 university students as a pilot study, testing the items for understandability and typographic errors and determining the duration of completion. To the resulting 43-item scale, two control items were added (item 14 and item 25: Please tick "Not at all applicable") and copies of the forms were prepared to be administered to the students. The form's five-point Likert-type scale had the options "Not at all appropriate", "Rarely appropriate", "Somewhat appropriate", "Fairly appropriate", and "Completely appropriate". "Completely appropriate" corresponded to 5 points, "Not at all appropriate" to 1 point, with the score rising alongside the increase of the individual's problematic use level.

**Mobile Phone Problem Use Scale (MPPUS):** MPPUS was developed by Bianchi and Phillips (4) and adapted by Sar and Isiklar (26) into Turkish. Between the English and the Turkish form, a correlation of 0.78 was found. In the validity and reliability study in Turkish, the scale was administered to 300 students. Reliability analyses for the scale calculated a Cronbach's alpha coefficient of 0.94 and a reliability coefficient of 0.88. The instrument consists of 27 items with a 5-point Likert-type scale. Scores rise with the increase of problematic mobile phone use.

### Data Analysis

Initially, 850 students participated in the research. While the data obtained were entered in SPSS 21, 125 forms with wrong answers to the control items or missing answer marks were excluded from the analysis. The remaining 725 data sets were divided into two; for 362 of them, exploratory factor analysis (EFA) was performed, for the other 363 sets confirmatory factor analysis (CFA). In order to determine the suitability of the received data for analysis, first the data distribution characteristics were examined. Therefore, in order to detect outliers, 3 and +3 z values were considered (30) and no outliers encountered. In addition, the skewness and kurtosis values for all items were examined and found to be between -1.00 and +1.00 for each item. EFA and CFA were carried out to analyze the construct validity for the study data. For criterion validity, correlation analysis was carried out to determine the relationship of scale and subdimensions obtained from the study with MPPUS. For reliability analyses,

Cronbach's alpha and test-retest method were used, and for the item analysis t test.

## RESULTS

In this section, the exploratory factor analysis used to work out the structure of the PMPUS, the confirmatory factor analysis used to confirm the construct, reliability analyses, and results relating to the item analysis are found.

### Validity Studies

### Exploratory Factor Analysis

For the construct validity of PMPUS, first an EFA was made. To determine the appropriateness of the data for factor analysis, sampling adequacy and Bartlett Sphericity tests were carried out. For data to be appropriate for factor analysis, Kaiser-Meyer-Olkin (KMO) index has to be greater than 0.60 and Bartlett Test needs to have a statistically significant result (31). In this study, a KMO coefficient of 0.94 and a Bartlett Sphericity Text $\chi^2$ value of 7829.379 (SD=903; $p<0.001$) were found. These results show that the data are appropriate for factor analysis. Furthermore, to determine if each item was appropriate for factor analysis, anti-image correlation values were examined. The expected values are above 0.50, and items with a value below 0.50 are eliminated from the analysis (32-34). Our anti-image correlation values ranged between 0.71 and 0.96, meaning that all items were appropriate for factor analysis.

In order to determine the factor structure of PMPUS,

**Table 1: Values for exploratory factor analysis results**

| Item No | Factor 1: D | Factor 2: AO | Factor 3: CP | Factor 4: IA | Common Factor Variance |
|---|---|---|---|---|---|
| i7 | 0.816 | | | | 0.74 |
| i8 | 0.804 | | | | 0.71 |
| i5 | 0.787 | | | | 0.66 |
| i6 | 0.783 | | | | 0.63 |
| i4 | 0.772 | | | | 0.66 |
| i9 | 0.686 | | | | 0.57 |
| i10 | 0.684 | | | | 0.61 |
| i2 | 0.608 | | | | 0.45 |
| i27 | | 0.737 | | | 0.62. |
| i28 | | 0.730 | | | 0.56 |
| i29 | | 0.647 | | | 0.51 |
| i32 | | 0.629 | | | 0.57 |
| i30 | | 0.627 | | | 0.55 |
| i34 | | 0.616 | | | 0.55 |
| i35 | | 0.531 | | | 0.53 |
| i17 | | | 0.686 | | 0.56 |
| i21 | | | 0.660 | | 0.54 |
| i15 | | | 0.627 | | 0.51 |
| i16 | | | 0.617 | | 0.53 |
| i18 | | | 0.614 | | 0.62 |
| i22 | | | 0.512 | | 0.44 |
| i41 | | | | 0.744 | 0.58 |
| i38 | | | | 0.717 | 0.60 |
| i42 | | | | 0.645 | 0.58 |
| i44 | | | | 0.620 | 0.58 |
| i40 | | | | 0.523 | 0.50 |
| **Eigenvalue** | 8.899 | 3.286 | 1.344 | 1.273 | |
| **Explained Variance** | 19.697 | 13.957 | 12.157 | 11.122 | |
| **Total Explained Variance** | 56.933 | | | | |

D: Deprivation, AO: Adverse outcomes, CP: Control problem, IA: Interaction avoidance

EFA was carried out. Principal component analysis was performed with the data. According to Buyukozturk (31), one of the criteria used in factor analysis to sort out items that are not measuring the same construct is a high factor loading. If the factor loading is 0.45 or higher, the item is a good measure. Sipahi et al. (34) maintain that this is not a commonly agreed criterion, and some researchers eliminate questions with a factor loading under 0.50, while some put the barrier as high as 0.70. In our study, we have considered 0.50 as elimination criterion. In our data analysis, we first removed items 37 and 33, which were showing overlap. Next, 15 items with a factor loading below 0.50 (1,3,11, 12,13,19,20,23,24,26,31,36,39,43,45) were eliminated from the scale. As can be seen in Table 1, the result of EFA, using principal component method and Varimax rotation, shows that the resulting scale has a 26-item 4-dimensional structure explaining 56.933% of the total variance; the item factor loadings with regard to this structure ranged between 0.61 and 0.82 in the deprivation (D) subdimension, between 0.53 and 0.74 in the adverse outcomes (AO) subdimension, between 0.51 and 0.69 in the control problem (CP) subdimension, and between 0.52 and 0.74 in the interaction avoidance (IA) subdimension. These data show that the factor loadings for a four-factor structure are at a good level. In addition, it was seen that the values for the scale items' common factor variance were between 0.44 and 0.74.

### Confirmatory Factor Analysis

In order to confirm the four-factor structure that emerged after EFA, a CFA was carried out. The initially obtained fit values were found to be insufficient, and in order to bring these values to the desired level, modifications were made to the model: For items i4-i5, i6-i10, and i38-i41, covariance was inserted into the items' error variances. As can be seen in Table 2, these modifications resulted in adequate fit values. In Figure 1, the $\chi^2$/SD ratio calculated with confirmatory factor analysis for the four-factor model is 1.687, and this value shows that the proposed factor model fits the data (35,36). Values for Goodness of Fit Index (GFI) (0.91), Adjusted Goodness of Fit Index (AGFI) (0.89),

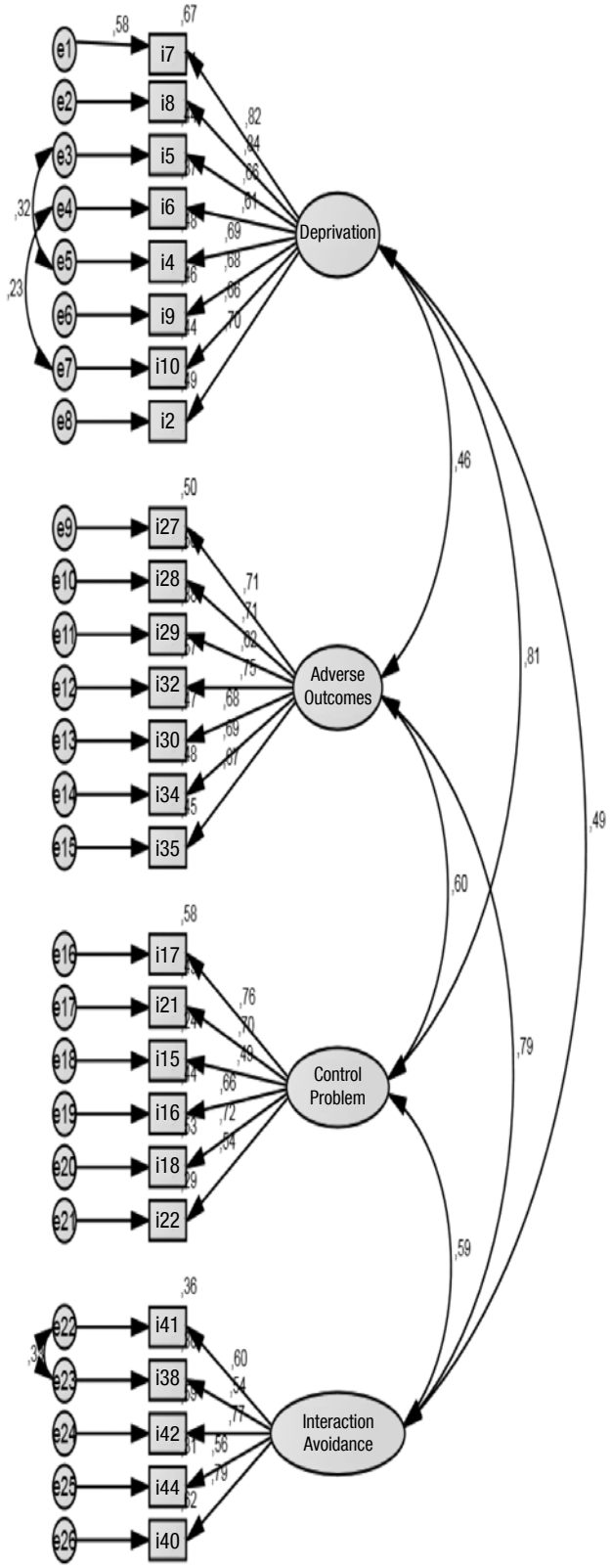


**Figure 1: Four-factor model**

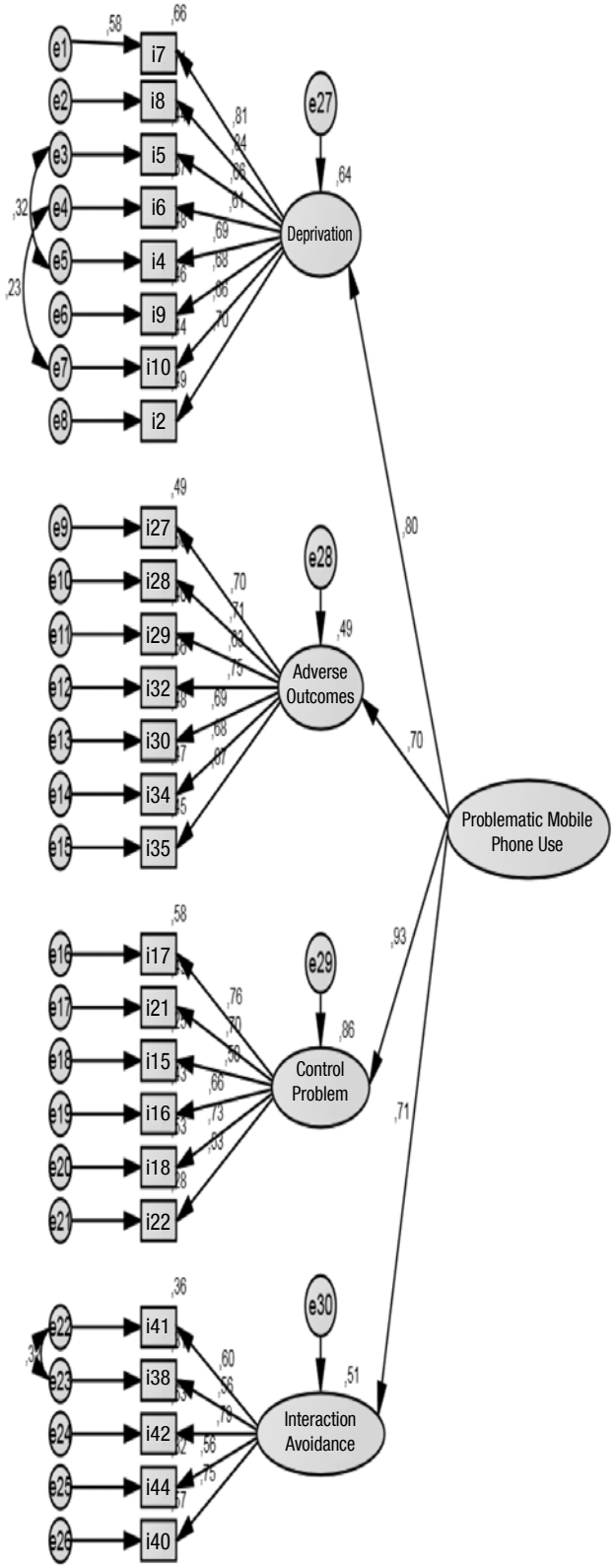


**Figure 2: Second-level four-factor model**

Comparative Fit Index (CFI) (0.96), Tucker & Lewis Index (TLI) (0.95), Root Mean Square Error of Approximation (RMSEA) (0.044), and Standardized Root Mean Square Residual (SRMR) (0.0419) also show that the fit values of the model are appropriate (37-39). In Figure 2, the $\chi^2$/SD ratio calculated with confirmatory factor analysis for the second-level model is 1.997, and this value shows that the proposed factor model fits the data (35,36). Values for GFI (0.90), AGFI (0.88), CFI (0.95), TLI (0.93), RMSEA (0.052), and SRMR (0.0645) also show that the fit values of the model are appropriate (37-39).

### Criterion Validity

To determine the scale criterion validity of PMPUS, MPPUS was used. For this purpose, the scales were printed on the same form and administered to a second group consisting of 126 university students. Total scores for PMPUS and correlations between subdimensions and MPPUS are found in Table 3. Between the total score of PMPUS and MPPUS, a strong positive correlation was found (r=0.75). In addition, there was a strong positive correlation between MPPUS and the PMPUS subdimension deprivation (r=0.72) and correlations of medium strength with the subdimensions control problem (r=0.48), adverse outcomes (r=0.31), and interaction avoidance (r=0.66).

### Reliability Studies

As Table 3 shows, the reliability of PMPUS was calculated using internal consistency and test-retest reliability methods. For PMPUS and its subdimensions, Cronbach's alpha coefficients were calculated both for EFA data and for CFA data. Internal consistency coefficients calculated for EFA data were 0.91 for the deprivation subscale, 0.82 for the control problem subscale, 0.85 for the adverse outcomes subscale, 0.80 for the interaction avoidance subscale, and 0.92 for the instrument overall. Internal consistency coefficients calculated for CFA data were 0.89 for the deprivation subscale, 0.81 for the control problem subscale, 0.86 for the adverse outcomes subscale, 0.81 for the

interaction avoidance subscale, and 0.93 for the instrument overall. All Cronbach's alpha coefficients from both data sets show that PMPUS and its subdimensions have a sufficient internal consistency validity. In addition, to determine the test-retest reliability, the test was administered to 126 twice, with an interval of three weeks. In order to examine the consistency between first and second administration, the correlation between the scores obtained at the two tests was calculated. Test-retest reliability coefficients were 0.73 for the deprivation subscale, 0.71 for the control problem subscale, 0.76 for the adverse outcome subscale, 0.77 for the interaction avoidance subscale, and 0.85 for the scale overall. Reliability coefficients of 0.70 and above for the test scores are considered sufficient (31). In this perspective, the calculated reliability coefficients can be considered sufficient.

## Results for Item Analysis

For the item analysis of PMPUS, item-total correlation values corrected with the t values for the upper and lower 27% groups have been calculated. To compare the item scores of the upper and lower 27% related to the scale, t test was used. As seen in Table 4, for each item there is a significant difference between the mean values for the upper and the lower 27% group. The table shows t values in the range between 13.459 ($p<0.001$) and 4.140 ($p<0.001$) for the item score differences between the upper and lower 27% groups. For the corrected item-total correlation for each item, we found values between 0.35 and 0.65. As these values were not below 0.30, the items are shown to be consistent with the total score (33).

**Table 2: Confirmatory factor analysis, fit values for Problematic Mobile Phone Use Scale**

| | CMIN | DF | CMIN/DF | GFI | AGFI | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|---|---|---|---|
| **Four-factor model** | 489.278 | 290 | 1.687 | 0.91 | 0.89 | 0.96 | 0.95 | 0.044 | 0.0419 |
| **Second-level model** | 583.049 | 292 | 1.997 | 0.90 | 0.88 | 0.95 | 0.93 | 0.052 | 0.0645 |

CMIN: Chi-square, DF: Degrees of Freedom, GFI: Goodness of Fit Index, AGFI: Adjusted Goodness of Fit Index, CFI: Comparative Fit Index, TLI: Tucker & Lewis Index, RMSEA: Root Mean Square Error of Approximation, SRMR: Standardized Root Mean Square Residual

**Table 3: Values for the reliability of PMPUS subdimensions and correlation with MPPUS**

| | Cronbach's Alpha (EFA) | Cronbach's Alpha (CFA) | Test-Retest | MPPUS |
|---|---|---|---|---|
| **Problematic Mobile Phone Use Scale (PMPUS)** | 0.92 | 0.93 | 0.85 | 0.75 |
| **Deprivation (D)** | 0.91 | 0.89 | 0.73 | 0.72 |
| **Adverse outcomes (AO)** | 0.85 | 0.86 | 0.76 | 0.31 |
| **Control problem (CP)** | 0.82 | 0.81 | 0.71 | 0.48 |
| **Interaction avoidance (IA)** | 0.80 | 0.81 | 0.77 | 0.66 |

MPPUS: Mobile Phone Problem Use Scale, EFA: Exploratory Factor Analysis, CFA: Confirmatory Factor Analysis

**Table 4: Results for item analysis**

| Item No | Corrected Item-Total Correlation | t values 27% Lower-Upper Group | Item No | Corrected Item-Total Correlation | t values 27% Lower-Upper Group | Item No | Corrected Item-Total Correlation | t values 27% Lower-Upper Group |
|---|---|---|---|---|---|---|---|---|
| i7 | 0.64 | -12.707* | i28 | 0.41 | -4.422* | i16 | 0.59 | -8.680* |
| i8 | 0.64 | -13.459* | i29 | 0.52 | -8.163* | i18 | 0.65 | -12.577* |
| i5 | 0.58 | -11.171* | i30 | 0.56 | -7.198* | i22 | 0.53 | -8.889* |
| i6 | 0.54 | -8.070* | i32 | 0.58 | -7.699* | i41 | 0.36 | -4.724* |
| i4 | 0.61 | -13.024* | i34 | 0.56 | -7.476* | i38 | 0.38 | -5.117* |
| i9 | 0.63 | -12.095* | i35 | 0.52 | -6.486* | i42 | 0.50 | -6.490* |
| i10 | 0.64 | -10.837* | i17 | 0.53 | -9.121* | i44 | 0.35 | -4.140* |
| i2 | 0.55 | -8.496* | i21 | 0.55 | -9.128* | i40 | 0.40 | -6.028* |
| i27 | 0.51 | -6.220* | i15 | 0.53 | -6.843* | | | |

*$p<0.001$

## DISCUSSION

This study aimed at developing a valid and reliable scale to measure problematic mobile phone use in university students. As a result of our analyses, we obtained a Problematic Mobile Phone Use Scale with 26 items in four subdimensions measured on a 5-point Likert-type scale (1="Not at all appropriate", 2="Rarely appropriate", 3="Somewhat appropriate", 4="Fairly appropriate", and 5="Completely appropriate") (Appendix 1). The subdimensions of the PMPUS we developed are deprivation, adverse outcomes, control problem, and interaction avoidance. The subdimension deprivation measure feelings like tension or unease when the mobile phone is not available or not in a usable state; the subdimension adverse outcomes looks at negative effects of people's mobile phone use on their daily lives; the control problem subdimension deals with people's ability to control their mobile phone use; finally, the interaction avoidance subdimension evaluates the preference to communicate with other people via mobile phone rather than engaging in face-to-face interaction. The possible scores range from 26 to 130 points for the entire scale. With increasing score, the person's level of problematic mobile phone use rises.

To assess the validity of the scale, EFA, CFA, and criterion-validity analysis were carried out. According to EFA results, PMPUS consists of four dimensions that explain 56.933% of the total variance. Tavsancil (40) indicates that for multifactorial scales in social sciences, a total variance ratio of 40-60% is acceptable as sufficient. To test if PMPUS, developed through EFA as a 26-item model with four subdimensions, could be confirmed, CFA was applied. The initial CFA results did not show appropriate fit values. As a subsequent modification, covariance was inserted into the error variances of some items (i4-i5, i6-i10, and i38-i41). With these modifications, sufficient fit values for the four-factor model were obtained. The four-factor confirmatory factor analysis ($\chi^2$/SD=1.687, GFI=0.91, AGFI=0.89, CFI=0.96, TLI=0.95, RMSEA=0.044, SRMR=0.0419) found appropriate fit values (35-39). In order to test if these four dimensions are components of a construct identified as problematic mobile phone use, after the four-factor confirmatory factor analysis a second-level confirmatory factor analysis was carried out. The resulting fit values ($\chi^2$/SD=1.997, GFI=0.90, AGFI=0.88, CFI=0.95, TLI=0.93, RMSEA=0.052, SRMR=0.0645) showed that these four dimensions are indeed components of a construct identified as problematic mobile phone use. Reviewing the literature for instruments developed to measure problematic mobile phone use, we find single-factor scales with 27 items by Bianchi and Phillips (4) or with 20 items by Merlo et al. (23). The instrument developed by Yen et al. (10) to determine problematic mobile phone use in adolescents is a two-factor construct containing a total of 12 items, seven of which are determining problematic mobile phone use and five that are dealing with functional impairment. The problematic mobile phone use scale developed by Guzeller and Cosguner (29) for adolescents is a three-factor construct (negative effects, compulsion/persistence, and withdrawal/tolerance) with 18 items. To determine the scale criterion validity of PMPUS, the Mobile Phone Problem Use Scale was used. A high positive correlation was found between MPPUS and the total score of PMPUS as well as with the deprivation subdimension; for the other subdimensions, a medium-level positive correlation was found.

For reliability analyses, Cronbach's alpha and test-retest results were calculated. Cronbach's alpha values were computed both for EFA and for CFA data. With the EFA data, Cronbach's alpha for PMPUS is 0.92; for the subdimensions of PMPUS, Cronbach's alpha values vary between 0.80 and 0.91. With the CFA data, Cronbach's alpha for PMPUS is 0.93; for the subdimensions of PMPUS, Cronbach's alpha values vary between 0.81 and 0.89. The results of test-retest, another reliability test, found reliability coefficients of 0.85 for PMPUS, 0.73 for the D subdimension, 0.76 for the AO subdimension, 0.71 for CP, and 0.77 for IA. As a result of these reliability tests, PMPUS and its subdimensions can be seen as reliable (31,41).

In the study, it was found that corrected item-total

correlation values were between 0.35 and 0.65. If we consider that in the interpretation of item-total correlation, items with a value of 0.30 and above differentiate individuals by the measured characteristic well (31), we see that the item-total correlations are sufficient. In addition, results of the t test made between scores of the upper and lower 27% groups show a significant difference between all items and subscales.

Our findings demonstrate that the PMPUS, from the perspective of its psychometric characteristics, is a valid and reliable instrument. This scale can be applied to different university student groups. In addition, while this instrument has been developed for university students, after renewed construct validity and reliability analyses it can be converted into an adolescent version. In future studies, researchers can examine problematic mobile phone use not only under variables such as solitude, depression, self-esteem, wellbeing, and academic success, but also with different demographic variables. With various studies on the problematic use of mobile phones, researchers will not only make a contribution to the literature but may in future also support committees determining DSM criteria, especially concerning technology addiction.

| Contribution Categories | Name of Author |
|---|---|
| Development of study idea | M.P., A.A. |
| Methodological design of the study | M.P., A.A. |
| Data acquisition and process | M.P., A.A. |
| Data analysis and interpretation | M.P., A.A. |
| Literature review | M.P., A.A. |
| Manuscript writing | M.P., A.A. |
| Manuscript review and revisation | M.P., A.A. |

**Conflict of Interest:** Authors declared no conflict of Interest.

**Financial Disclosure:** Authors declared no financial support.

## REFERENCES

1. Turkish Statistical Institute. Number of fixed telephone, mobile telephone and internet subscribers. http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1580 (2014) Accessed January 11, 2015. (Turkish)

2. Turkish Statistical Institute. The family and its statistics. News Bulletin 13662 (May 13, 2013). http://www.tuik.gov.tr/PreHaberBultenleri.do?id=13662 (2013) Accessed October 29, 2013. (Turkish)

3. Turkish Statistical Institute. Communication technology use and media among children in the age group 6-15. News Bulletin 15866 (Aug. 22, 2013). http://www.tuik.gov.tr/PreHaberBultenleri.do?id=15866 (2013). Accessed October 29, 2013. (Turkish)

4. Bianchi A, Phillips JG. Psychological predictors of problem mobile phone use. Cyberpsychol Behav 2005; 8:39-51. **[CrossRef]**

5. Erdogan U, Pamuk M, Eren-Yuruk S, Pamuk K. Academic procrastination and mobile phone. International Academic Conference on Education, Teaching and E-learning, 2013.

6. Ha JH, Chin B, Park DH, Ryu SH, Yu J. Characteristics of excessive cellular phone use in Korean adolescents. Cyberpsychol Behav 2008; 11:783-784. **[CrossRef]**

7. Hong FY, Chiu SI, Huang DH. A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students. Comput Human Behav 2012; 28:2152-2159. **[CrossRef]**

8. Takao M, Takahashi S, Kitamura M. Addictive personality and problematic mobile phone use. Cyberpsychol Behav 2009; 12:501-507. **[CrossRef]**

9. Tan C, Pamuk M, Donder A. Loneliness and mobile phone. Procedia Soc Behav Sci 2013; 103:606-611. **[CrossRef]**

10. Yen CF, Tang TC, Yen JY, Lin HC, Huang CF, Liu SC, Ko CH. Symptoms of problematic cellular phone use, functional impairment and its association with depression among adolescents in Southern Taiwan. J Adolesc 2009; 32:863-873. **[CrossRef]**

11. Augner C, Hacker GW. Associations between problematic mobile phone use and psychological parameters in young adults. Int J Public Health 2012; 57:437-441. **[CrossRef]**

12. Sánchez-Martínez M, Otero A. Factors associated with cell phone use in adolescents in the community of Madrid (Spain). Cyberpsychol Behav 2009; 12:131-137. **[CrossRef]**

13. Cagan O, Unsal A, Celik N. Evaluation of college students' the level of addiction to cellular phone and investigation on the relationship between the addiction and the level of depression. Procedia Soc Behav Sci 2014; 114:831-839. **[CrossRef]**

14. Sar AH. Examination of loneliness and mobile phone addiction problem observed in teenagers from the some variables. The Journal of Academic Social Science Studies 2013; 6:1207-1220.

15. Deniz S, Yildirim EA, Cobanyildiz M. The relationship between problematic mobile phone usage and social anxiety, shyness in adolescent. Online Journal of Technology Addiction & Cyberbullying, 2014; 1:1-16.

16. Oz F, Arslantas D, Bugrul N, Koyuncu T, Unsal A. Evaluation of problematic use of mobile phones and quality of sleep among high school students. International Journal of Human Sciences 2015; 12:226-235. **[CrossRef]**

17. Griffiths MD. Technological addictions. Clinical Psychology Forum 1995; 76:14-19.

18. Gunus S, Kayri M. The profile of internet dependency in Turkey and development of internet addiction scale: study of validity and reliability. Hacettepe University Journal of Education 2010; 39:220-232.

19. Chóliz M. Mobile-phone addiction in adolescence: The test of mobile phone dependence (TMD). Prog Health Sci 2012; 2:33-44.

20. Koo HY. Development of a cell phone addiction scale for Korean adolescents. J Korean Acad Nurs 2009; 39:818-828. **[CrossRef]**

21. Ceyhan AA. Comment on Kesici and Sahin (2009): measurement of negative consequences of internet use. Psychol Rep 2010; 106:939-940. **[CrossRef]**

22. Leung L. Linking psychological attributes to addiction and improper use of the mobile phone among adolescents in Hong Kong. J Child Media 2008; 2:93-113. **[CrossRef]**

23. Merlo LJ, Stone AM, Bibbey A. Measuring problematic mobile phone use: development and preliminary psychometric properties of the PUMP scale. J Addict 2013; 1-7. **[CrossRef]**

24. Ceyhan E, Ceyhan AA, Gurcan A. The validity and reliability of the Problematic Internet Usage Scale. Educational Sciences: theory & practice 2007; 7:390-410.

25. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Fifth ed, Washington DC: American Psychiatric Association, 2013; 795.

26. Sar AH, Isiklar A. Adaptation of problem mobile phone use scale to Turkish. International Journal of Human Sciences 2012; 9:264-275.

27. Sahin S, Ozdemir K, Unsal A, Temiz N. Evaluation of mobile phone addiction level and sleep quality in university students. Pak J Med Sci 2013; 29:913-918. **[CrossRef]**

28. Tekin C. Adaptation of problematic mobile phone use scale to Turkish: a validity and reliability study. Unpublished Master Thesis. Inonu University, Health Sciences Institute, Malatya, 2012.

29. Guzeller CO, Cosguner T. Development of a problematic mobile phone use scale for Turkish adolescents. Cyberpsychol Behav Soc Netw 2012; 15:205-211. **[CrossRef]**

30. Anderson D, Sweeney D, Williams T. Essentials of Statistics for Business and Economics. Revised, Cengage Learning, 2011.

31. Buyukozturk S. Veri Analizi El Kitabi. Ankara: Pegem A Yayincilik, 2010. (Turkish)

32. Can A. SPSS ile Bilimsel Arastirma Surecinde Nicel Veri Analizi. Ankara: Pegem A Yayincilik, 2013. (Turkish)

33. Field A. Discovering Statistics Using SPSS. Third ed., London: Sage Publications, 2009.

34. Sipahi B. Yurtkoru ES, Cinko M. Sosyal Bilimlerde SPSS'le Veri Analizi. Istanbul: Beta Basim Yayim Dagitim, 2010. (Turkish)

35. Sumer N. Structural equation modeling: basic concepts and applications. Turkish Psychological Articles 2000; 3:49-74.

36. Schermelleh-Engel K, Moosbrugger H, Muller H. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. Methods of Psychological Research Online 2003; 8:23-74.

37. Byrne BM. Structural Equation Modeling with EQS and EQS/Windows. Thousand Oaks, CA: Sage Publications, 1994.

38. Kline RB. Principles and Practice of Structural Equation Modeling. Third Ed., New York: Guilford Press, 2011.

39. Ullman JB. Structural Equation Modeling. In B. G. Tabachnick & L. S. Fidell (editors) Using Multivariate Statistics. Fourth ed., Needham Heights, MA: Allyn & Bacon, 2001; 653-771.

40. Tavsancil E. Tutumların Olculmesi ve SPSS ile Veri Analizi. Ankara: Nobel Yayincilik, 2005. (Turkish)

41. DeVellis RF. Scale Development: Theory and Applications (Applied Social Research Methods Series, Vol. 26). Newbury Park: Sage Publications, 1991.

Appendix 1

## Problematic Mobile Phone Use Scale**

Read each statement below and then for each sentence mark the option that applies best to you (**"Not at all appropriate", "Rarely appropriate", "Somewhat appropriate", "Fairly appropriate",** or **"Completely appropriate"**) with a **X**. Thank you for your sincere and genuine answers.

| Item No | | Not at all appropriate | Rarely appropriate | Somewhat appropriate | Fairly appropriate | Completely appropriate |
|---|---|---|---|---|---|---|
| 1. | I feel uneasy when my mobile phone is out of network range. | 1 | 2 | 3 | 4 | 5 |
| 2. | I feel uneasy when my mobile phone is out of battery. | 1 | 2 | 3 | 4 | 5 |
| 3. | I feel uneasy when my mobile phone is broken. | 1 | 2 | 3 | 4 | 5 |
| 4. | I don't feel safe without my mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 5. | When my mobile phone is not with me, I am at loose ends. | 1 | 2 | 3 | 4 | 5 |
| 6. | Without my mobile phone by my side, I cannot sleep. | 1 | 2 | 3 | 4 | 5 |
| 7. | When my mobile phone is not with me, I feel lonely. | 1 | 2 | 3 | 4 | 5 |
| 8 | When my mobile phone is not with me, I feel that something is missing. | 1 | 2 | 3 | 4 | 5 |
| 9. | Because of dealing with my mobile phone, my daily routine is hampered. | 1 | 2 | 3 | 4 | 5 |
| 10. | Because of dealing with my mobile phone, I am experiencing eating problems. | 1 | 2 | 3 | 4 | 5 |
| 11. | Because of my mobile phone use, I am experiencing sleeping problems. | 1 | 2 | 3 | 4 | 5 |
| 12. | Because of my mobile phone use, I am experiencing problems with work or career opportunities. | 1 | 2 | 3 | 4 | 5 |
| 13. | Because of my mobile phone use, I am experiencing problems in my education. | 1 | 2 | 3 | 4 | 5 |
| 14. | Because of my mobile phone use, I am spending less time with people in my close environment. | 1 | 2 | 3 | 4 | 5 |
| 15. | Because of my mobile phone use, I am having conflicts with people in my close environment. | 1 | 2 | 3 | 4 | 5 |
| 16. | I cannot control myself when it comes to putting my mobile phone aside. | 1 | 2 | 3 | 4 | 5 |
| 17. | I am using my mobile phone for longer periods than I plan to. | 1 | 2 | 3 | 4 | 5 |
| 18. | I am finding myself permanently checking my mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 19. | When I use my mobile phone, time is going by in a flash. | 1 | 2 | 3 | 4 | 5 |
| 20. | First thing when waking up is to check my mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 21. | When stopping to use my mobile phone, I want to use it again immediately. | 1 | 2 | 3 | 4 | 5 |
| 22. | Rather than with people around me, I prefer dealing with my mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 23. | Rather than talking with friends face-to-face, I talk over the mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 24. | In order to use my mobile phone, rather than being together with people, I prefer to move away from them. | 1 | 2 | 3 | 4 | 5 |
| 25. | Rather than talking with my friends face-to-face, I prefer sending a message from my mobile phone. | 1 | 2 | 3 | 4 | 5 |
| 26. | Rather than continuing my friendships in real life, I prefer carrying on via mobile phone. | 1 | 2 | 3 | 4 | 5 |

*Deprivation: 1-8, Adverse Outcomes: 9-15, Control problem: 16-21, Interaction Avoidance: 22-26,
**For this instrument, validity and reliability analyses have only been carried out in Turkish. The scale has not yet been applied in an English version, for which validity and reliability analyses have not been performed until now.