

Validation and Psychometric Properties of Mobile Phone Problematic Use Scale (MPPUS) in University Students of Tehran

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Objective: Despite the fact that the mobile phone has become a pervasive technology of our time, little research has been done on mobile dependency. Therefore, a valid and reliable instrument, conforming to Iranian culture seems essential. The aim of our study was to validate the Iranian version of MPPUS (Mobile Phone Problematic Use Scale).

Methods: This was a cross-sectional research, in which data were collected from 600 students studying at Tehran universities. Stratified sampling method was used to collect data. All participants completed Demographic Questionnaire, Cellular Phone Dependency Questionnaire (CPDQ) anonymously. Finally, a clinical interview (based on DSM-IV-TR) was conducted with 100 participants. Data were analyzed using concurrent validity, factor analysis, internal consistency (Cronbach's α), split half, test-retest and ROC Curve by SPSS18 Software.

Results: As a result of reliability analysis and factor analysis by principal component and Varimax rotation, we extracted three factors including preoccupation, withdrawal symptoms and overuse of mobile phones in both males and females. Internal consistency (Cronbach's alpha) of the MPPUS was .91; Cronbach's alpha of the factors was .87, .70, .82 respectively. The test-retest correlation of the MPPUS was .56. The best cut off point for this questionnaire (MPPUS) was 160.

Conclusion: The MPPUS proved to be a reliable questionnaire with adequate factor models to assess the extent of problems caused by the "misuse" of mobile phones in the Iranian society; however, further studies are needed on this topic.

Keywords: *Psychometric Properties, Validatio, MPPUS, Students, Tehran.*

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At the end of the 20th century and the beginning of the 21th century, the rapid pace of change in life can be seen all around us. Some experts believe that we now live in what is called the communication era (1). People are very much attracted to mobile phones, therefore, this device may affect different groups in different ages and cultures specially adolescents (3). According to the International Telecommunication Union, approximately 86% of people have access to cell phones (4) worldwide, and it has been reported that the number of mobile phone users in Iran has reached to 15 million (5).

Though mobile phones can be considered as one of the socio-personal utilities with different performances (uncontrolled, excessive functions), its overuse may entail negative consequences affecting parents' relationships with their children.

Based on evidences including cost and frequency of calls and messages, we expected that the excessive use of cell phones has some effects on the users' health (1). M. Griffiths has defined behavioral dependency and called the machine-people

interaction" technological addiction". However, the overuse of mobile phones is not considered a disorder in neither of the diagnostic manuals such as DSM-IV-TR or ICD-10, as most researchers regard this issue as dependency to the new technology (6-7). Several questionnaires have been designed to assess addiction to mobile phones each of which is based on the criteria expressed by Griffiths. Some of these questionnaires are as follows. SMS Problem Use Questionnaire, Mobile Phone Problematic Use Scale (MPPUS), Cellular Phone Dependency Questionnaire (CPDQ), Toda Mobile Phone Dependency (TMD), Problematic Mobile Phone Use Questionnaire (PMPUQ) and Mobile Phone Dependency (MDS). These questionnaires were designed based on different definitions of mobile phone dependency or behavioral addiction and intended to assess mobile phone problematic use with the criteria of behavioral addiction (8-12).

MPPUS: Bianchi and Phillips (2005) have designed this questionnaire with 27 items based on a 5-point Likert scale; it evaluates many symptoms such as mobile phone addiction, withdrawal symptoms and

destructive effects on health, social, economic and vocational status. Cronbach's alpha was reported to be $\alpha = 0.91$ (8).

Problematic Mobile Phone Use Questionnaire (PMPUQ): Wander Linden et al have published this inventory and it includes 30 items with 5 dimensions about cell phones; its subscales are related to mobile phone ownership, duration, frequency of calls every day, time of calls and number of messages during a day. Cronbach's alpha shows acceptable reliability ($\alpha = 0.85-0.90$) (13) for this questionnaire.

Cellular Phone Dependency Questionnaire (CPDQ): Toda et al. have prepared this questionnaire with 20 questions (Likert range from 0 to 3). Phone dependency shows higher scores. This questionnaire has different features in comparison with other inventions. Cronbach's alpha ($\alpha = 0.80 - 0.93$) has been determined by a study and it shows high internal consistency (9). Factor analysis is calculated for validity of the questionnaire and high school level of boys and girls is used for four dimensions (9, 10). Today, the welfare provided by cell phones is undeniable and cellphones play an important role in people's life although this facility has inappropriate impacts particularly from social and cultural points of view. Therefore, interactive and educational experts are conducting more researches on the use of mobile phones. Meanwhile, some researchers have considered psychological effects of overusing mobile phones with appropriate validity and reliability based on Iranian cultural contexts. Since most studies are restricted to normal users, we should consider different characteristics of people and cultural contexts. Whereas, there is no empirical evidence for psychometric aspects and cut-off points of MMPUS in Iran, we assessed these features and based on cut-off point we separated normal users from dependent users. Finally, we suggested a diagnostic instrument for cell phone dependency in Iran. The current study has been conducted to provide a valid and reliable instrument to measure mobile phone dependency in the studied population.

Material and Methods

The research had a cross-sectional design for scale adaptation to measure the reliability and validity of the test of mobile phone problematic use scale based on the Iranian culture. The sample of the research consisted of 600 anonymous participants.

Inclusion criteria were as follows: being a student at Tehran universities during the study, using a mobile phone for a minimum of one hour daily for one year. Exclusion criteria were as follows: participants with severe physical problems or apparent disability, those under medical treatment due to a specific mental disorder during the past year and those who were not able to complete the questionnaire. The sampling method was stratified. The sample group of the present research was selected from different universities in the

city of Tehran (Tehran University, Shahid Beheshti University, University of Medical Sciences and Islamic Azad University). First, the total number of the students of each university was determined separately (through contacting the public relations department of each university or referring to the universities' websites). Then, based on the calculated sample size (600 students) and proportional to each university, samples were selected by stratified sampling, according to the calculated proportion.

Instrument

A demographic questionnaire, Iranian validated version of CPDQ and MPPUS was used to assess the mobile phone dependency level. Also, interviews were performed based on DSM-IV-TR Not Otherwise Specified (ICD) to diagnose impulse control disorder.

The demographic section of the questionnaire consisted of questions on participants' gender, age, field of study, the year in college, marital status, time of mobile using, ownership of cell phone, etc. Cellular Phone Dependency Questionnaire (CPDQ): It is a self-report, 20-item questionnaire based on a 5-point Likert scale). It includes questions that reflect typical behaviors of addiction. This questionnaire was first used by Toda et al; and a higher score indicates a stronger tendency towards cellular phone dependency. This 20-item instrument provides different dimensions of the mobile phone dependency phenomenon. Toda et al. have reported that the internal consistency (Cronbach's alpha) of the CPDQ was .86 and its test-retest reliability was also satisfactory (9).

The Persian version of CPDQ has shown that the Chronbach's alpha was .88. and Cronbach's alpha of the factors were .85, .70 and .76, respectively (14).

The interview program itself consists of items that allow a set of criteria for diagnosing mobile phone addiction. The first step of this research was translating MPPUS into Persian by two experts who were fluent in English and Persian. Then, the Persian and English versions were compared by two translators. On the next step, content validity of this tool was confirmed by five psychiatrists and psychologists. They compared the content of the questionnaire with the criteria of behavioral addiction, according to scientific texts and confirmed the content of the questionnaire.

The collected data were analyzed with SPSS18 for factor analysis. Chronbach's alpha technique was used to evaluate internal reliability. Also, the test-retest reliability was applied to assess external reliability, split half was used to evaluate internal reliability, and the ROC curve was utilized to determine the cut off points.

Results

The participants of this study were randomly selected from four universities in the city of Tehran including Tehran University of Medical Sciences (36%), Shahid Beheshti University (27%), Islamic Azad University (15%) and Tehran University (22%). The participants

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aged between 20 and 30 (mean = 21.51, SD = 2.1) and had used mobile phones at least one hour per day in the past year. After analyzing all the questionnaires, we found that the response rate was 20.6% for males and 79.4 for females. 51.3% Of the participants were freshmen and 43.8% were studying at other levels; only, 24% of the subjects were married.

Analysis of Internal Consistency of the MPPUS: On the basis of the reliability Analysis, Cronbach's α was between .89 and .91 for the 27 items. Items with correlations below 0.30 did not sufficiently contribute to the total score; those with correlations above 0.7 indicated item redundancy. Since the first, third and fourth items did not have appropriate Intra Class Correlation (ICC) with other items, they were omitted from the reliability analysis (A way to evaluate reliability, apart from surveying each item, is assessing ICC of items and eliminating the score of below 0.3 for each item). Then, we recalculated reliability of the questionnaire, and the results showed a high level of internal consistency for 24 items .

suggesting that they were homogenous and none of the 24 items had to be deleted to improve α .

Analysis of External Consistency of the MPPUS: Test-retest reliability of the questionnaire was checked by Pearson correlation. Fifty university students participated in the study and filled out the questionnaire again after one month.

For the main scale, the correlations of the subscales were found to be 0.56($p = .0001$ in all cases). Also, the split-half reliability of the questionnaire was ascertained with the correlation coefficient between sets I and II. The correlation was 0.80, which was statistically significant at the 0.05 level.

Validity of the MPPUS

a) Concurrent Validity

To evaluate concurrent validity of this questionnaire, its relationship to other measures of mobile phone use was assessed by applying the Pearson's correlation coefficient. There was a significant and positive relationship between the total score of the questionnaire and the CPDQ ($r = .70, p < 0.001$).

b) Factor Analysis

Exploratory factor analysis with varimax rotation was carried out for the 24 items to check the robustness of the Cell Phone Dependency Questionnaire. (Varimax rotation was used as it is the most widely used rotation in social sciences and this rotation can yield orthogonal factors (15-16) We extracted three factors, which explained 50% of the variance (Table 1). To evaluate the factor-analysis of MPPUS.

Initially the measures of sampling adequacy were carried out on the 24-item MPPUS to find whether it was suitable for factor-analysis. Bartlett's test of sphericity indicated a chi-square value of 6093.49 ($df = 276, p < 0.0001$). Also the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy indicated a value of 0.94. When a basic screen-test and eigenvalue > 1.0 criteria were used, the three factors were extracted

from the MPPUS. Also, the normality of the data (with the use of Kolmogorov-Smirnov, p -value $> .05$) was evaluated as one of the assumptions of factor analysis. These three factors, which were rotated to the position of maximum orthogonality in 6 iterations, explained 50% of the variance. Also, the scree plot curve showed the factors above eigenvalue > 1.0 (curve 1) Factor 1 (including fifteen items) accounted for 25.46% of the variance and was called "over use of mobile phone" (e.g., "I find myself engaged on the mobile phone for longer periods of time than intended.", "I have been told that I spend too much time on my mobile phone," etc.). The second factor included 12 items, which accounted for 18.09 % of the variance and measured "withdrawal symptoms" (e.g., "I feel anxious if I don't check my cell phone for messages or if I switch it off for some time.", "I become irritable if I have to switch off my mobile phone for meetings, dinner engagements or at the movies." etc). Factor 3 (contained three items), which accounted for 6.32% of the variance and was named the "preoccupation" (e.g., "When I am out of range for some time, I become preoccupied with the thought of missing a call.", "Sometimes, when I am on the mobile phone and I am doing other things, I get carried away with the conversation and I don't pay attention to what I am doing" etc.).

In order to measure internal consistency within the items in each factor.

Cronbach's alphas were calculated and all were moderately to highly reliable (0.73-0.93) . In addition, the factor analysis provided support for the construct validity of the questionnaire (Table 2).

Determination of Cut-off points

By the systemic diagnostic interview, based on DSM-IV-TR, which was conducted to diagnose behavioral addiction especially mobile phone addiction , we found that almost a quarter of 600 participants (23.4%) were identified as having mobile phone dependency.

In this study, the 'gold standard' chosen was the psychiatrist interview. Generally, clinician-administered schedules based on DSM-IV-TR (17) are often considered as the gold standard in epidemiologic research. ROC analysis for the MPPUS gave an area under the curve of 95%, indicating that the MPPUS had good diagnostic efficiency. The sensitivity, specificity and cut-off point (160) were best for discriminating cases of mobile dependency from those of non-dependency , with a high diagnostic accuracy (95%) and specificity (83%). High sensitivity (80%) showed that this was an optimal cut-off point (160) screening for the possible cases of mobile dependency (Table 3).

Discussion and Conclusion

The main objective of this study was to validate the Persian version of Mobile Phone Problematic Use Scale (MPPUS) in university students of Tehran. The

samples were selected based on inclusion and exclusion criteria and the tests were administered to the samples, and at last the two groups of cell phone dependent and non- dependent (based on experts diagnosis) were compared in order to determine the cut-off point. In this study, reliability was calculated by Cronbach's alpha (0.91), split-half method (0.80) and

test -retest (0.56) after one month and it was statistically significant. It is noteworthy to mention that these methods are the most common means to assess reliability for questionnaires, tests and scales. The results indicated desirable reliability of the test and were consistent with those of previous studies (8).

Table1: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.287	38.698	38.698	6.112	25.467	25.467
2	1.617	6.738	45.436	4.344	18.098	43.565
3	1.070	4.458	49.893	1.519	6.328	49.893

Table 2: Results of Factor Analysis with Varimax Rotation on 24 Items of MPPUS

Items	Component		
	1	2	3
I have used my mobile phone to make myself feel better when I was feeling down.		.526	
I have tried to hide from others how much time I spend on my mobile phone.	.582		
I lose sleep due to the time I spend on my mobile phone.	.689		
I have received mobile phone bills I could not afford to pay.	.530		
When out of range for some time, I become preoccupied with the thought of missing a call.		.589	.444
Sometimes, when I am on the mobile phone and I am doing other things, I get carried away with the conversation and I don't pay attention to what I am doing.			.702
The time I spend on the mobile phone has increased over the last 12 months.		.607	
I have used my mobile phone to talk to others when I was feeling isolated		.566	
I have attempted to spend less time on my mobile phone but am unable to.	.616		
I find it difficult to switch off my mobile phone.		.701	
I feel anxious if I have not checked for messages or switched on my mobile phone for some time.		.721	
I have frequent dreams about the mobile phone.	.568		
My friends and family complain about my use of the mobile phone.	.646	.453	
If I don't have a mobile phone, my friends would find it hard to get in touch with me.		.519	
My productivity has decreased as a direct result of the time I spend on the mobile phone.	.756		
I have aches and pains that are associated with my mobile phone use.	.663		
I find myself engaged on the mobile phone for longer periods of time than intended.	.673	.448	
There are times when I would rather use the mobile phone than deal with other more pressing issues.	.528	.512	
I am often late for appointments because I'm engaged on the mobile phone when I shouldn't be.	.739		
I become irritable if I have to switch off my mobile phone for meetings, dinner engagements, or at the movies.	.440	.514	
I have been told that I spend too much time on my mobile phone.	.597	.453	
More than once I have been in trouble because my mobile phone has gone off during a meeting, lecture, or in a theatre.	.643		
My friends don't like it when my mobile phone is switched off.			.412
I feel lost without my mobile phone.	.522		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table3: Sensitivity and Specificity of Total Scores of MMPUS

Cut off point	Sensitivity	1 - Specificity
92.5000	1.000	.073
93.5000	1.000	.065
94.5000	1.000	.055
95.5000	1.000	.043
96.5000	1.000	.038
97.5000	1.000	.033
98.5000	1.000	.010
129.5000	1.000	.000
160.5000	.950	.000
162.0000	.925	.000
163.5000	.875	.000
165.5000	.850	.000
168.0000	.825	.000
169.5000	.775	.000
170.5000	.750	.000
171.5000	.700	.000
172.5000	.625	.000
174.0000	.600	.000
175.5000	.575	.000
177.0000	.525	.000
179.0000	.475	.000
182.0000	.450	.000
185.0000	.425	.000
186.5000	.400	.000
187.5000	.375	.000
188.5000	.325	.000
190.0000	.300	.000
192.5000	.275	.000
194.5000	.250	.000
198.5000	.175	.000
202.5000	.150	.000
208.0000	.125	.000

In another research, Takao et al. has reported that the Japanese translation of Mobile Phone Problem Usage Scale had good internal reliability (Cronbach’s alpha =.89), showing a high level of internal consistency and suggesting that items were homogenous (18). For the Turkish version, confirmatory factor analysis was used, and the Cronbach’s alpha internal coefficient was found to be 0.94(19).

Thus, the Cronbach’s alpha obtained for the Persian and the original versions were desirable. Consequently, internal reliability was appropriate for the questionnaire. It should be noted that the partial difference of Cronbach’s α in various studies implies the difference between numbers of translated items (three items were omitted), cultural differences and statistical population.

When the primary form was evaluated, there were some problems needed to be removed (three items of the questionnaire did not conform to the Iranian culture and did not correlate with other items). After consulting a psychiatrist, an analyst and a clinical

psychologist who were expert in this subject prepared the second form of the test and, we reviewed it again.

To assess the validity of the MMPUS, we had to consider the relationship between this questionnaire and other scales of mobile phone dependency. One measure of mobile phone use is self-reported questionnaire called CPDQ. There was a strong positive correlation between the scores on the MMPUS and the CPDQ, ($r = 0.70, p < 0.01$). Also, there was a significant and positive relationship between the total score of the questionnaire and the time spent on the mobile phone ($r = .40, p < 0.001$). Takado et al. have reported a significant and positive correlation between the score and the reported time, $r = 0.30, p < 0.001$ (18). Therefore, strong correlations with other measures of mobile phone use and the established scale (CPDQ) for measuring addiction supported the concurrent validity of the MMPUS and provided evidence for the construct of problematic mobile phone use. The results of factor analyses showed that the MMPUS could be characterized as exploring three dimensions of mobile dependency: overuse of mobile phone (Salient),

withdrawal symptoms and preoccupation. These three factors were the same factors which were mostly obtained by the experts who did researches on behavioral addictions. For example, a number of experts, including Brown have argued that the concept of addiction was meaningful and could not be restricted to the ingestion of substances. The six criteria of Brown can be summarized as follows: Saliency: Domination of a person's life by the activity, Euphoria: A 'buzz' or a 'high' is derived from the activity; Tolerance: The activity has to be undertaken to a progressively greater extent to achieve the same 'buzz'; Withdrawal Symptoms: Cessation of the activity leads to the occurrence of unpleasant emotions or physical effects; Conflict: The activity leads to conflict with others or self-conflict; Relapse and Reinstatement: Resumption of the activity with the same vigor subsequent to attempts to abstain negative life consequences and negligence of job, educational or career opportunities (20-21).

Also, the analysis showed that the factor and construct validity and reliability of the MPPUS were comparable to those obtained in previous studies (22).

Thus, the Persian version of MPPUS is based on three main factors, developed from the factors forming behavioral addiction, suggesting that the factors are related. The inner relationship of these three factors can be related to the construct of mobile phone problematic use.

To sum up, the MPPUS has high content, construct and discriminative validity; it has also high validity to determine cell phone dependency in various clinical and general populations. According to this tool and the cut-off point (160), cell phone dependency and non-dependency could be distinguished with sensitivity (0.83) and specificity (0.80). As such, the sensitivity of the screening questionnaires should be greater than the specificity.

Most of the reported correlation coefficients in this study were the same as those of the original questionnaire (8, 18). Other researchers have reported the same correlation coefficients in other countries. These findings showed that the test phrases were simple and expressive in both the English and Persian versions. Also, the Persian version conformed to the Iranian culture ideally.

Conclusion

The result of this study showed that the MPPUS measures could characterize cell phone dependency in university students and probably in other social groups in Iran satisfactorily. This scale could be used to guide researchers on cell phone dependency problems. Also, the present study demonstrated that the MPPUS was the first self-reported instrument for mobile dependency with reliable cut-off points consolidated by psychiatrists' diagnostic interview in Iranian university students. It also provides a comprehensive diagnostic profile for researchers to evaluate cell phone

dependency. With regards to its psychometric features and contents, the MPPUS proved to be a useful assessment tool for measuring problems connected with mobile use.

The results of this study should be interpreted in the context of its limitations. First, the data in our study were collected from Iranian students, and thus the results could not be generalized to the mobile phone users of other groups and cultures. However, since students represented one of the groups that were vulnerable to both substance and non-substance addictions (23), they might be at high risk for developing problematic mobile use. Second, we recognized that the data used in this study were cross-sectional, with the level of mobile dependency. The development of addictive behavior is an ongoing process whose proper delineation requires a time dimension. Finally, collecting the questionnaires directly from the students might cause the participants' disclosure of some sensitive information. Hence, a social desirability scale may be added to the questionnaire in the future studies to check this aspect of the responses. Future studies of the similar nature can be conducted using different groups of people so that the validity and the reliability of the MPPUS can be assessed. Moreover, the reality-substitute effect of the mobile phone is an area worth further investigation.

Suggestions

The most important suggestion is to screen cell phone dependent and non-dependent people. Nonetheless, the study should be conducted with caution.

2. The validity and reliability of other questionnaires such as TMD, MPAAI and MPS on cell phone dependency should also be studied and compared with results of the MPPUS questionnaire.

3. It is also suggested that this study be conducted considering various factors such as different age ranges and educational levels.

Author Note

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