



# Adaptation of problematic mobile phone usage scale (PMPUS) among students from countries of the commonwealth of independent states in Russian university

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## ABSTRACT

An aim of this study was to evaluate the precision and reliability of the problematic mobile phone use scale in the context of Russia and to investigate the frequency and associated factors of problematic mobile phone use among university students. The survey included a random sample of 481 university students from Moscow, Russia. The dataset was randomly split into two groups in order to support exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). An EFA helped to build the five-component framework including social dissonance, emotional impact, cognitive impact, psychosomatic impact, and loss of control. The CFA validated this structure by obtaining favorable model fit indices. Both Cronbach's alpha and McDonald's (2013) omega coefficients for all subscales demonstrated a high level of dependability. The application of latent profile analysis revealed three clearly defined user profiles: high-risk users, moderate users with social concerns, and low-risk users. This study presents a reliable and valid instrument for evaluating problematic mobile phone usage in the Russian setting and provides significant insights into the complex and multifaceted nature of this phenomena. The results emphasize the need to implement focused intervention measures, especially for vulnerable populations, and add to the expanding repository of research on problematic cell phone usage in many cultural settings.

**Keywords:** problematic mobile phone use, scale adaptation, university students, latent profile analysis, Russian context

## INTRODUCTION

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The mobile phone, which has become ever more common, is among the most often used and effective tools of communication available in the 21<sup>st</sup> century. Beginning with children and working through old age, Pheeraphuttharakoon (2015) and Mach et al. (2020) claim that the use of mobile phones has considerably increased across all age categories. This trend began in 1983, when the first mobile phone was introduced. Based on statistical data, the global smartphone user base in 2023 is estimated to be 6.92 billion, accounting for 85.95% of the world's population (Mamasolievich & Hayitmirzaevich, 2023). Despite the fact that this broad use has many positive effects, it also raises concerns about the adverse effects that might result from problematic and excessive use.

Bianchi and Phillips (2005) describe problematic mobile phone use as the excessive and uncontrollable use of mobile phones that compromises everyday life, social contacts, and general well-being of individuals. Among the possible effects of this are a variety of psychological and physical ones including distraction, disturbed sleep, migraines, and tiredness (Brautsch et al., 2023; Kim et al., 2015; Pirwani & Szabo, 2024; Thomée et al., 2011). Moreover, it can result in psychological health problems such as anxiety and sadness (Demirci et al., 2015). Additionally, there is strong evidence indicating a correlation between it and negative consequences such as a decrease in academic achievement (Sunday et al., 2021) and a reduction in overall life satisfaction (Jiang et al., 2022).

Various instruments have been developed to evaluate and quantify the dangerous mobile phone consumption. Originally developed by Bianchi and Phillips (2005), among them the mobile phone problematic use scale (MPPUS) is one of the most widely used indicators. Bianchi and Phillips (2005) claim that this measure combines negative repercussions with behavioral addiction criteria including tolerance, avoidance, withdrawal, desire, and negative consequences.

The MPPUS was initially designed for adults; but, over the course of its development, it has been modified to accommodate a variety of age groups and cultural contexts. Versions have been developed in a variety of languages, including Spanish (López-Fernández et al., 2012), German (Foerster et al., 2015), Iranian (Mohammadi Kalhori et al., 2015), Turkish (Şar & Işıklar, 2012), and Polish (Mach et al., 2020). During the course of these modifications, a few variations in the factor structure of the scale arose, which provides evidence that cultural context has a significant impact in the perception and evaluation of problematic mobile phone use.

Considering the ubiquity of problematic mobile phone use as well as the ramifications of such use, it is of utmost relevance to have a deeper understanding of and measure this phenomena. Therefore, adapting valid and reliable measurement tools such as MPPUS to different cultures and examining their psychometric properties will provide valuable information for both researchers and clinicians. The aim of this study was to examine the validity and reliability of the Russian version of the MPPUS and to investigate the prevalence and associated factors of problematic mobile phone use among university students.

## LITERATURE REVIEW

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Problematic cell phone use is defined as a situation in which the user continues to use the cell phone even when it has negative consequences in various areas of his/her life (social, family, work, and financial). These negative consequences may include tolerance, escape from other problems, withdrawal, craving, and negative life outcomes (Foerster et al., 2015; Şar & Işıklar, 2012). Some researchers have noted that problematic cell phone use shares similarities with addictions such as substance use or gambling. These similarities include tolerance, impaired control, withdrawal symptoms and intense cravings (Agus et al., 2022; Foerster et al., 2015). The definition of problematic cell phone use may be influenced by cultural differences. For example, in a study conducted in Poland, it was reported that the item "There were times when I could not pay my phone bills" in the MPPUS-10 scale did not fit the Polish culture and was outdated (Mach et al., 2020). In conclusion, problematic mobile phone use is a behavior model that continues despite negative consequences and may show addiction-like characteristics. Cultural differences should be taken into consideration in the evaluation of this situation.

## Psychological Effects

mobile phone problematic use (MPPU) is closely associated with more emotional pain and anxiety. Those who have high degrees of experiential avoidance—that is, those who typically avoid unpleasant emotions—are more likely to use MPPU as a coping strategy that fuels anxiety (Kwak & Kim, 2023). Furthermore linked to psychological pain including stress, depression, and obsessive-compulsive tendencies is MPPU (Canale et al., 2023; Della Vedova et al., 2022). This has been determined that students who show signs of addictive behaviors related to smartphone use are more prone to negative psychological outcomes, including increased anxiety and depression (Parent et al., 2022).

Research has identified a direct relationship between psychological distress and PMPU. For example, it found that psychological distress, especially depression and anxiety, can predict problematic smartphone use among college students, and meta-cognitions about smartphone use serve as a mediating factor (Chen et al., 2022). Studies have shown that higher levels of smartphone use are linked to increased anxiety, as evidenced by research conducted during the COVID-19 pandemic; these studies noted that students who used more smartphones reported higher levels of anxiety (Wang et al., 2022).

One of the main factors predicting MPPU is lack of self-control. Low impulse control people are more likely to engage in obsessive smartphone use, which can cause emotional burnout or social media tiredness (Świątek et al., 2023). Since people search for fulfilling features of smartphone use and help MPPU, reward sensitivity of the behavioral activation system also becomes crucial (Kwak & Kim, 2023). It shows that high self-control can mitigate the negative effects of low parental supervision on PMPU and that individual differences play an important role in how students manage smartphone use (Hu & Wang, 2022).

MPPU is linked to higher psychopathological symptoms like obsessions and depression as well as other disorders. Those who choose online contacts sometimes show low self-esteem and social anxiety, which fuels emotional turbulence (Canale et al., 2023). Well-documented is the link between PMPU and sleep problems. It discovered that sleep disturbances and daytime dysfunction—which in turn aggravated anxiety and depressed symptoms among university students—positively correlated smartphone addiction scores (Matar Boumosleh & Jaalouk, 2017). Studies showing that excessive smartphone use can cause several psychological health issues, including depression and anxiety, mostly by affecting sleep quality help to support this (Demirci et al., 2015).

## Social Effects

Prolonged and excessive use of social media on mobile devices can lead to social media fatigue, characterized by feelings of being overwhelmed and disconnected from important relationships (Świątek et al., 2023). Given that MPPU replaces face-to-face interactions and strong social bonds, it has the potential to additionally intensify feelings of loneliness. Social dynamics are also affected by mobile phone addiction. The use of mobile phones for social networking can create a paradox where students experience increased feelings of loneliness and social isolation despite feeling more connected (Li et al., 2023b; Zhang et al., 2023). Zhong et al. (2022) found that the positive relationship between mobile phone use and emotional loneliness in Filipino workers in Hong Kong was shown to be mediated only by poor mobile phone experience. The inappropriate use of mobile phones exacerbates feelings of isolation rather than promoting their utility.

According to Mohd Salleh Sahimi et al. (2022), students who use their smartphones for extended periods of time on a regular basis are more likely to experience social anxiety and lower levels of self-esteem, which in turn has an effect on their mental health and their interactions with other people. PMPU has a negative impact on life satisfaction, as evidenced by the fact that students report lower levels of enjoyment as a direct result of excessive phone usage. This phenomenon is ascribed to the amount of time individuals spend on mobile devices, which diverts their attention from significant in-person contacts (Jiang et al., 2022). The fear of missing out is a strong indicator of post-material psychological unease (PMPU), resulting in the compulsive checking of mobile devices and the need to remain constantly connected, therefore exerting pressure on social interactions (Sun et al., 2022). Notwithstanding the adverse consequences, certain students report elevated levels of social support, which can alleviate the impact of PMPU. Nevertheless, the perceived presence of assistance does not automatically result in enhanced life satisfaction (Eichenberg et al., 2021).

It has been emphasized that mobile phone addiction is significantly associated with feelings of loneliness and suicidal thoughts that are exacerbated by lack of social support (He & Lopez, 2023; Hu et al., 2022). A meta-analysis found that university students with PMPU had a higher prevalence of depressive symptoms and suicidal ideation, with these associations becoming stronger post-COVID-19 outbreak (Tang et al., 2024).

### Learning Outcome

Extensive scholarly research has focused on the influence of PMPU on learning outcomes. Multiple studies have established a distinct inverse relationship between excessive use of mobile phones and academic achievement among pupils. For instance, research has shown that excessive use of mobile phones has a detrimental impact on the motivation and academic achievement of university students. Available empirical evidence indicates that excessive usage of mobile phones can result in a propensity to postpone academic assignments and produce below-average academic performance (Tian et al., 2021). Zhou et al. (2022) revealed a detrimental correlation between PMPU and performance on mathematics tests. This correlation was influenced by apprehension about mathematics and decreased motivation in academic pursuits. Hence, academic achievement is negatively affected. In addition, when mobile phones are used correctly and effectively, they positively affect the academic achievement of university students (Lin et al., 2021).

The occurrence of academic burnout, worsened by PMPU, adds complexity to the correlation between mobile phone usage and educational achievements (Wang et al., 2023). It is proposed that the conflict arising from excessive usage of mobile phones, known as technology conflict, acts as a mediator in the connection between mobile phone addiction and academic burnout. Furthermore, the cognitive overload caused by continuous connectivity might result in reduced academic involvement and heightened stress levels (Yang et al., 2024). In addition, mobile phone overuse negatively affects sleep quality and consequently affects academic performance (Cheng & Zhang, 2020; Li et al., 2023a).

In addition to these findings, the role of social media and entertainment applications in promoting PMPA is important. It has been reported that the use of mobile apps for social interaction and entertainment often leads to addiction, which may reduce students' academic responsibilities and performance (Fook et al., 2021). This coincides with observations made by Rozgonjuk et al. (2018) and Shi and Kopcha (2022), who stated that problematic smartphone use is associated with both deep and surface approaches to learning and that excessive phone use can lead to superficial engagement with academic material.

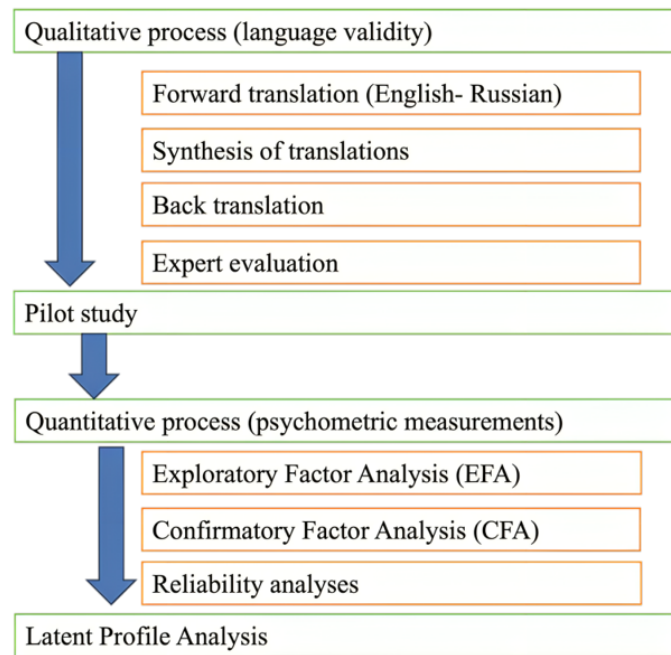
In conclusion, the data strongly endorses the idea that problematic mobile phone use damages learning outcomes by means of several channels, including academic procrastination, burnout, psychological discomfort, and distraction from educational obligations. Improving general student well-being and academic achievement depends on addressing PMPU.

### Dimensions of PMPU Scale

The scale of problematic mobile phone use (MPPUS) has revealed various dimensions in different cultures and versions. The original scale was developed as a unidimensional scale by (Bianchi & Phillips, 2005) and exhibited a structure including tolerance, avoidance, abstinence, excessive desire and negative consequences. However, multidimensional structures emerged in the adaptations of the scale to different languages. For example, in the Spanish version, López-Fernández et al. (2012) found three factors: dependence, withdrawal and negative consequences. In a study conducted in Iran, Mohammadi Kalhori et al. (2015) revealed the dimensions of overuse, withdrawal symptoms and mental preoccupation. In the German short form, Foerster et al. (2015) found a five-factor structure (loss of control, withdrawal, negative life outcomes, craving, and peer dependence). In the Polish version, Mach et al. (2020) found a two-factor structure: withdrawal/social aspects and craving/escape from other problems.

If we briefly touch on the meanings of these dimensions:

1. **Deprivation:** The feeling of restlessness and discomfort experienced when the use of the phone is prevented.
2. **Overuse/loss of control:** Difficulty in limiting phone use and using more than planned.
3. **Negative consequences:** Problems in social, academic or work life due to excessive use of the phone.
4. **Mental preoccupation:** Feeling the need to constantly think about and control the phone.



**Figure 1.** Research process (Source: Authors)

5. **Tolerance:** The need to increase the duration of phone use to achieve the same effect.
6. **Avoidance:** Using the phone to avoid negative emotions.
7. **Peer dependence:** Becoming dependent on the phone to maintain communication with the social environment.

These dimensions reflect different aspects of problematic mobile phone use and may differ in cultural context. In future studies, examining the factor structure of the scale in different cultures and age groups will contribute to a better understanding of the universal and culture-specific aspects of problematic mobile phone use.

## METHOD

For the purpose of addressing the intricate nature of the scale adaptation process, this study utilized a mixed research strategy. According to Creswell and Clark (2017), mixed methods research (as shown in [Figure 1](#)) is a method that blends the capabilities of qualitative and quantitative methodologies in order to create a more thorough knowledge of research topics. According to Tashakkori et al. (2020), the utilization of a mixed methods approach allowed for the scale adaptation process to be carried out in a manner that was both linguistically and statistically sound. Additionally, the employment of this methodology produced more thorough responses to the study questions.

### Sample

The sample consists of university students from Peoples' Friendship University of Russia named after Patrice Lumumba, Moscow, Russia. 74.6 percent of the participants were female. 27 percent of the participants are under the age of 18, 53.2 percent are 18–19, 14.6 percent are 20–21, 3.3 percent are 22–23 and 1.9 percent are 23 and over.

### Data Collection Tools

The mobile phone problem use scale (MPPUS) was used to adapt in Russian context. The scale is a 27-item self-report scale designed to assess problematic mobile phone use in adults. The original scale showed a single-factor structure and high internal consistency (Cronbach's alpha = 0.93).

The MPPUS has been translated into many languages over the years and validity and reliability studies have been conducted in different countries. The scale, which has been translated into languages such as

Spanish, English, Turkish, Japanese, Persian, German, and Polish, has shown structures ranging from 1 to 5 factors in different cultures (Agus et al., 2022; López-Fernández et al., 2012; Mach et al., 2020; Şar & Işıklar, 2012). For example, the Spanish version showed a 3-factor structure (addiction, withdrawal, and negative consequences), the Persian version showed a 3-factor structure (overuse, withdrawal symptoms, and mental preoccupation), and the German version showed a 5-factor structure (loss of control, withdrawal, negative life consequences, craving, and peer dependence). The scale has also been used in various shortened versions over time (e.g., MPPUS-10) (Mach et al., 2020). The MPPUS is an important measurement tool that is widely used in the field of mobile phone addiction and has been validated in different cultures.

## Data Analysis

Several psychometric evaluations of the scale were conducted using statistical methods. Two groups were randomly chosen from the acquired data (N = 481): group 1 (n = 219) was used for Cronbach's alpha and exploratory factor analysis (EFA), whereas group 2 (n = 262) was used for confirmatory factor analysis (CFA) and McDonald's (2013) omega.

Firstly, CFA was performed on group 1 data. 'Maximum likelihood' was used as factor extraction method and 'varimax' as rotation method. Parallel analysis method was used to determine the factor structure (Williams et al., 2010). Items with factor loadings below 0.40 and loading on more than one factor were removed from the scale (Hair et al., 2010). Cronbach's alpha coefficient was calculated to evaluate the internal consistency of the factor structure determined according to the EFA results.

Then, CFA was performed on group 2 data. Various fit indices were used to evaluate the model fit: Chi-square/degree of freedom ratio ( $\chi^2/df$ ), comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized residual root mean square (SRMR). The following criteria were used for acceptable agreement:  $\chi^2/df < 3$ , CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08 (Hu & Bentler, 1999; Kline, 2023). In addition, McDonald's (2013) omega coefficient was calculated to assess the reliability of the factor structure determined according to the CFA results.

Following the validity and reliability analyses of the scale, descriptive statistics were calculated to determine the problematic mobile phone use levels of the participants. Finally, latent profile analysis (LPA) was performed to identify different user profiles. Akaike information criterion (AIC), Bayesian information criterion (BIC), sample size corrected Bayesian information criterion (SABIC), and entropy values were considered in model selection for LPA (Nylund et al., 2007). All statistical analyses were performed using Jamovi (2024).

## FINDINGS

### Exploratory Factor Analysis

First, Bartlett's test of sphericity and the KMO sample adequacy measure were applied for EFA of the sample. The assumption control results are significant with a  $\chi^2$  value of 3726 (df = 210) and a  $p < .001$  in Bartlett's test of sphericity. The KMO sample adequacy measure is generally 0.879, and the MSA values for each item vary between 0.946 and 0.754. As a result, the data is suitable for EFA.

According to the parallel analysis results, 5 factors were obtained. The 'maximum likelihood' extraction method was used in combination with a 'varimax' rotation. Items with factor loadings below 0.4 and items with two or more factors (items 11, 13, 14, 17, 18, and 24) were removed from the scale and reanalyzed. As can be seen in [Table 1](#), a scale with 5 factors and 21 items was obtained. The factors were named by examining the item expressions in each factor. In the first factor, 8 items were collected, and SS loading was calculated as 4.26 and % of variance as 20.29. The items were named "social dissonance" based on the statement. Three items were collected in the second factor. This scale was named as "emotional effect". In this factor, SS loading was calculated as 2.84 and % of Variance as 13.53. In the third factor, 4 items were collected. The SS loading was 2.69 and the % of Variance was calculated as 12.81. It was named "cognitive effect" based on the related items. In the fourth factor, 4 items were collected and named as "psychosomatic effect". In this factor, SS loading was calculated as 2.37 and % of variance as 11.27. The last factor was named



**Table 1.** Factor loadings

Items	Factor					Uniqueness
	1	2	3	4	5	
MP_23	0.768					0.34255
MP_15	0.726					0.37720
MP_22	0.696					0.35420
MP_4	0.694					0.24262
MP_16	0.681					0.40306
MP_25	0.527					0.55297
MP_27	0.526					0.56265
MP_26	0.469					0.75117
MP_1		0.941				0.00498
MP_2		0.857				0.22456
MP_3		0.755				0.19584
MP_7			0.893			0.00498
MP_8			0.729			0.31800
MP_9			0.675			0.26359
MP_10			0.426			0.50529
MP_19				0.923		0.00499
MP_5				0.803		0.22076
MP_6				0.522		0.39021
MP_20					0.683	0.27603
MP_21					0.539	0.36897
MP_12					0.518	0.39684

Note. 'Maximum likelihood' extraction method was used in combination with a 'varimax' rotation

**Table 2.** Model fit indices

Indices	$\chi^2/df$	CFI	TLI	SRMR	RMSEA	RMSEA %90 CI
Criteria	< 3	> .90	> .90	< .08	< .08	
Initial model	711/179 ≈ 3.97	0.860	0.836	0.0981	0.107	0.0984–0.1150
Final model	454/172 ≈ 2.64	0.926	0.909	0.0554	0.079	0.0702–0.0879

Note. CI: Confidence interval

as “loss of control” based on 3 related questions. In this factor, SS loading was calculated as 2.08 and % of Variance as 9.90. Considering the total scale, the % of variance was calculated as 67.8.

### Confirmatory Factor Analysis

Firstly, the model fit indices values were examined without any modifications to the model (Table 2). Since the indices values were below the critical values, covariance adjustments recommended by the software were made. Model index values were recalculated. Model fit index values exceeded the acceptable level.

When the item loadings of the CFA results are analyzed, it is seen that each item has a strong connection with the relevant factor ( $p < 0.001$ ). According to this result, there are no items that need to be removed (Table 3).

**Table 3.** Factor loading based on CFA

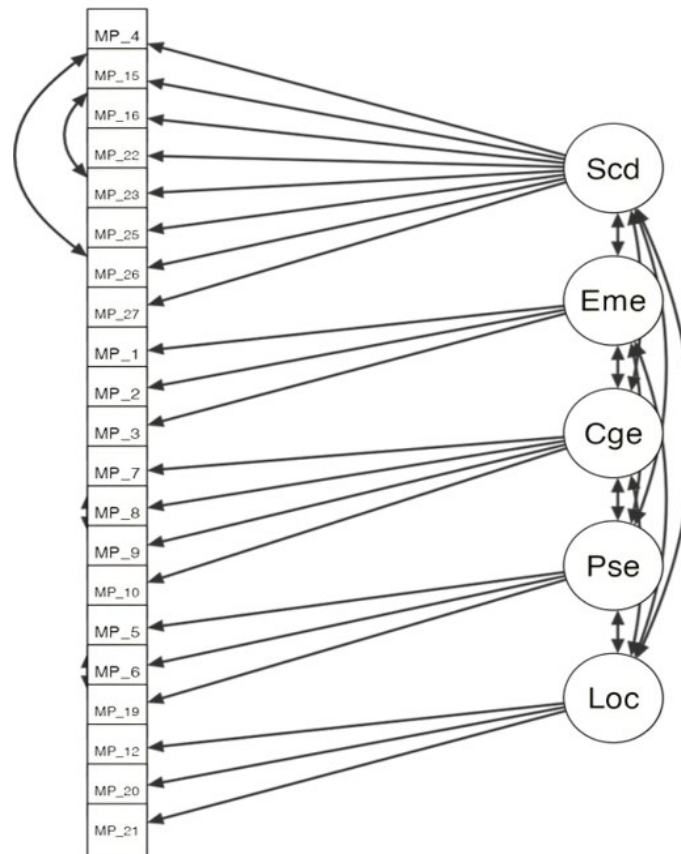
Factor	Indicator	Estimate	SE	Z	p
Social dissonance	MP_4	2.03	0.127	16.01	< .001
	MP_15	1.31	0.114	11.49	< .001
	MP_16	1.57	0.130	12.02	< .001
	MP_22	2.05	0.133	15.37	< .001
	MP_23	1.65	0.126	13.13	< .001
	MP_25	1.74	0.144	12.09	< .001
	MP_26	1.30	0.173	7.52	< .001
	MP_27	1.64	0.172	9.52	< .001
Emotional effect	MP_1	2.37	0.139	17.05	< .001
	MP_2	1.38	0.175	7.90	< .001
	MP_3	2.79	0.136	20.46	< .001

**Table 3. (continued)**

Factor	Indicator	Estimate	SE	Z	p
Cognitive effect	MP_7	1.82	0.143	12.67	< .001
	MP_8	1.53	0.188	8.15	< .001
	MP_9	1.92	0.166	11.58	< .001
	MP_10	2.05	0.173	11.83	< .001
Psychosomatic effect	MP_5	1.69	0.150	11.29	< .001
	MP_6	2.16	0.158	13.71	< .001
	MP_19	1.71	0.118	14.45	< .001
Loss of control	MP_12	1.89	0.152	12.43	< .001
	MP_20	2.42	0.149	16.22	< .001
	MP_21	2.37	0.154	15.38	< .001

**Table 4.** Reliability coefficient for PMPUS

Factors	Cronbach's alpha	McDonald's omega
Social dissonance	0.883	0.877
Emotional effect	0.922	0.874
Cognitive effect	0.878	0.839
Psychosomatic effect	0.864	0.865
Loss of control	0.837	0.829



**Figure 2.** Path diagram of PMPUS (Source: Authors)

**Reliability of PMPUS**

For reliability, both Cronbach's alpha and McDonald's (2013) omega values are expected to be greater than 0.7. As indicated in **Table 4**, it is above 0.8. It can be said to have high reliability values. **Figure 2** shows the path diagram of problematic mobile phone usage scale (PMPUS).

When the EFA, CFA and reliability results were evaluated together, the validity and reliability of the problematic mobile usage scale in the Russian context was ensured. There are 22 items in the final version of the scale.



**Table 5.** Descriptive statistics for dimensions of PMPUS

Dimension	N	Mean	Standard deviation	Skewness		Kurtosis	
				Skewness	Standard error	Kurtosis	Standard error
Social dissonance	481	2.80	1.81	1.510	0.111	2.250	0.222
Emotional effect	481	5.16	2.53	0.203	0.111	-0.902	0.222
Cognitive effect	481	3.57	2.29	0.993	0.111	0.325	0.222
Psychosomatic effect	481	2.93	2.18	1.318	0.111	1.244	0.222
Loss of control	481	4.07	2.45	0.729	0.111	-0.327	0.222

**Table 6.** Model fit indices for latent profile analysis

Model	Classes	LogLik	AIC	AWE	BIC	CAIC	CLC	KIC	SABIC	ICL	Entropy
1	2	-4,882	9,796	10,008	9,863	9,879	9,766	9,815	9,812	-9,897	0.901
1	3	-4,734	9,512	9,804	9,604	9,626	9,470	9,537	9,534	-9,668	0.869
1	4	-4,678	9,411	9,783	9,528	9,556	9,357	9,442	9,439	-9,615	0.864
1	5	-4,629	9,327	9,779	9,469	9,503	9,261	9,364	9,361	-9,580	0.857
2	2	-4,655	9,352	9,630	9,440	9,461	9,312	9,376	9,373	-9,474	0.887
2	3	-4,437	8,939	9,364	9,073	9,105	8,877	8,974	8,971	-9,137	0.863
2	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	2	-4,735	9,522	9,868	9,631	9,657	9,472	9,551	9,548	-9,740	0.680
3	3	-4,594	9,252	9,678	9,386	9,418	9,190	9,287	9,285	-9,427	0.911
3	4	-4,594	9,264	9,770	9,423	9,461	9,190	9,305	9,302	-9,591	0.697
3	5	-4,581	9,250	9,836	9,434	9,478	9,163	9,297	9,294	-9,784	0.606
6	2	-4,441	8,964	9,510	9,135	9,176	8,884	9,008	9,005	-9,176	0.860
6	3	-4,255	8,634	9,460	8,893	8,955	8,512	8,699	8,696	-8,934	0.914
6	4	-4,265	8,696	9,803	9,043	9,126	8,532	8,782	8,779	-9,153	0.824
6	5	-4,187	8,582	9,969	9,016	9,120	8,376	8,689	8,686	-9,131	0.838

### General Level of Participants

When the descriptive statistics of the five factors of the problematic mobile phone use scale are examined, it is seen that each factor exhibits unique characteristics (Table 5). The emotional effect factor has the highest mean (5.16), while the social dissonance factor has the lowest mean (2.80). This suggests that participants are more prone to emotional and social use but have fewer problems in terms of social consequences. The observation of positive skewness in all factors indicates that low scores are more common, and high scores are less common in general. More precisely, the significant skewness (1.318) in the psychosomatic effect component suggests that harmful actions in this domain are rather rare. The variations in kurtosis values among the components suggest that each factor has a distinct distribution pattern. As an illustration, the negative kurtosis of -0.902 in emotional effect suggests that the responses in this area are more broadly distributed, whereas the high positive kurtosis of 2.250 in social dissonance indicates that the responses are more tightly clustered around the mean. Collectively, these statistics indicate that various aspects of problematic mobile phone usage are encountered in society in distinct manners and with varying degrees of severity.

### Latent Profile Analysis

The choice of models 6 and 3 classes stands out as the optimal solution for latent profile analysis. This choice is supported by the combined evaluation of several fit indices (Table 6). First of all, this model has the lowest AIC (8,634), BIC (8,893), and SABIC (8,696) values, indicating an excellent fit of the model to the data. Moreover, a very high entropy value of 0.914 indicates a clear separation of the classes and the reliability of the classification. The 3-class version of model 6 presents a lower LogLik value (-4,255) compared to the other alternatives, indicating that the model explains the data better. This combination provides an optimal balance between complexity and fit, maximizing the explanatory power of the data without falling into over-complexity, while providing a sufficiently detailed classification. In conclusion, the choice of model 6 and model 3 classes offers the most statistically powerful and interpretable solution, allowing you to reliably interpret and present the findings of your research.

According to the results of latent profile analysis, clusters with three classes were analyzed (Figure 3). There are 290 people in the first class. This group has the highest mean scores across all subscales (social

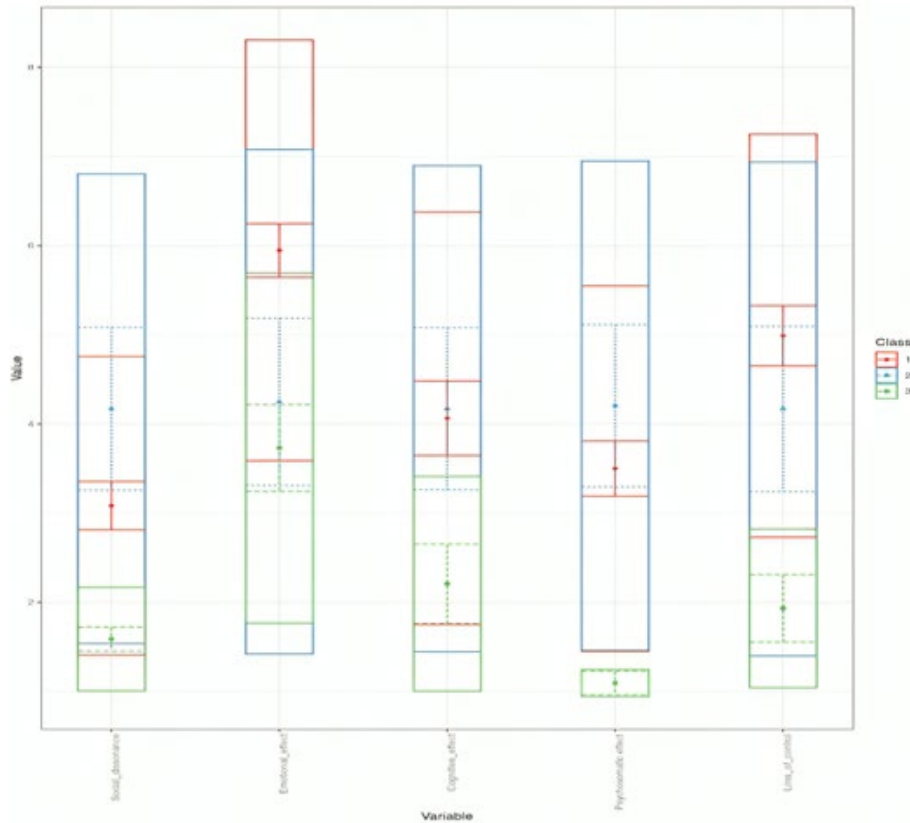


Figure 3. Comparison of the classes (Source: Authors)

Table 7. Descriptive statistics for class

Gender	Age	High-risk users	Moderate users with social concerns	Low-risk users	Grand total
Female	< 18	65	8	26	99
Female	18-19	112	26	44	182
Female	20-21	31	8	18	57
Female	22-23	8	1	4	13
Female	23+	4	1	3	8
Female	Total	220	44	95	359
Male	< 18	19	3	9	31
Male	18-19	43	8	23	74
Male	20-21	5	3	5	13
Male	22-23	2		1	3
Male	23+	1			1
Male	Total	70	14	38	122
Grand total	Total	290	58	133	481

maladjustment, emotional impact, cognitive impact, psychosomatic impact, and loss of control). This represents the group with the most severe problematic mobile phone use. This group is labeled “high-risk users”.

In the second class, there were 58 participants. This group has moderate scores in most sub-dimensions. It is noteworthy that it has the highest average in the social dissonance dimension. This group was labeled as “moderate users with social concerns”. There are 133 participants in the third group. This group had the lowest mean scores across all subscales. It represents the lowest risk group in terms of problematic mobile phone use. Therefore, it is labeled as “low-risk users”. The gender and age of the participants were analyzed in detail (Table 7).

Important demographic patterns in problematic mobile phone use are revealed by this study. Young adults—especially those between the age of 18 and age of 19—show the largest risk of problematic use, according to the statistics. The fact that this age group makes up the biggest subgroup in all three classes could represent the difficulties experienced by a generation raised in the digital age and exposed to

cellphones from a young age. Furthermore, the fact that the under-18 age range is especially important in the high-risk category implies that teenagers are also prone to this issue.

In terms of gender, females are more represented than males in all three classes. This suggests that women may be more vulnerable to problematic mobile phone use or tend to use mobile devices more intensively. The fact that women outnumber men by more than three times, especially in the high-risk group, points to the need to develop gender-based intervention strategies. More in-depth research may be needed to understand the underlying reasons for this difference.

Examining the distribution among classes, it is alarming that high-risk users is much more than the other classes. This implies that a good number of the sample's participants show rather high degrees of problematic use. Conversely, moderate users is smaller than the others, implying that users either lean low-risk or high-risk and have less taste for the "middle ground". This could mean that using a cell phone can either be kept under control or usually spirals out of hand.

## DISCUSSION

The objective of this study was to assess the accuracy and consistency of the PMPU within the Russian setting and to explore the frequency and related aspects of problematic mobile phone use among university students. Our results demonstrated that the scale is a viable and valid instrument for measuring certain aspects of problematic mobile phone use in the Russian setting.

The factor analysis outcomes indicated that the PMPU scale displayed a five-dimensional framework within the Russian setting, including social maladjustment, emotional impact, cognitive impact, psychosomatic impact, and loss of control. The multidimensional structure of this scale (Bianchi & Phillips, 2005) is distinct from the original unidimensional form and shares similarities with multidimensional structures seen in other cultural adaptations (Foerster et al., 2015; López-Fernández et al., 2012; Mohammadi Kalhori et al., 2015). These findings indicate that the manifestation of problematic mobile phone use may vary depending on the cultural environment, and the measurement of such use should be adjusted accordingly.

The five dimensions that emerged in our study reflect the multifaceted nature of problematic mobile phone use. The element of social dissonance emphasizes the negative effects of too high mobile phone usage on social contacts, therefore reflecting the experiences of social isolation and loneliness recorded in other studies (Li et al., 2023b; Zhang et al., 2023). The "emotional impact" component pertains to the influence of mobile phone usage on emotional states, consistent with conclusions from previous research on psychological disorders such as anxiety and depression (Canale et al., 2023; Della Vedova et al., 2022).

The 'cognitive impact' and 'psychosomatic impact' dimensions illustrate the potential effects of problematic mobile phone use on both mental and physical health. These findings are in line with previous research showing that excessive mobile phone use is associated with various health problems such as sleep disorders, headaches and fatigue (Brautsch et al., 2023; Kim et al., 2015; Pirwani & Szabo, 2024; Thomée et al., 2011). The 'loss of control' dimension reflects addiction-like behaviors, which is in line with research suggesting that problematic mobile phone use shows similarities with other addictions such as substance use or gambling (Agus et al., 2022; Foerster et al., 2015).

The results of the latent profile analysis showed that the sample could be categorized into three different user profiles: 'high-risk users', "moderate users with social anxiety", and "low-risk users". These findings suggest that problematic mobile phone use is not a homogeneous phenomenon, exhibiting different levels of risk and patterns of use. In particular, the fact that the high-risk group scored the highest on all subscales suggests that this group may need comprehensive intervention and support strategies.

Demographic analysis revealed that problematic use was more common among those in the 18–19 age range. This finding might point to the challenges faced by a generation growing up in the digital age and raised with mobile gadgets in their hands. Furthermore, women are overrepresented in all risk groups, indicating the need to develop gender-based intervention strategies. This gender difference may be related to the social and emotional dimensions of mobile phone use and deserves further investigation in future research.

The findings of our study also shed light on the potential negative effects of problematic mobile phone use on academic performance. In particular, the dimensions of 'cognitive impact' and 'loss of control' may

affect students' ability to focus on academic tasks and manage their time effectively. This finding is consistent with previous studies showing that excessive mobile phone use is associated with academic procrastination and poor academic performance (Tian et al., 2021; Zhou et al., 2022).

In conclusion, the study's conclusions emphasized the complexity of problematic cell phone use and provided evidence for the validity and reliability of the PMPU scale in the Russian setting. Our results provide a fascinating analysis that can be applied to the process of creating tailored intervention strategies. This is achieved by highlighting the importance of demographic traits and the existence of several risk categories. Future study should primarily concentrate on developing intervention programs that are specific to certain cultures, and these risk factors should be thoroughly examined.

## CONCLUSION

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The aim of this study was to evaluate the validity and dependability of the Problematic Mobile Phone Use Scale (PMPU) in the Russian environment as well as to find the frequency of problematic mobile phone usage and related traits among university students. Our results suggest that for Russian university students the PMPU scale is a reliable and appropriate assessment tool.

Our work highlights the complex characteristic of problematic mobile phone use, therefore contributing significantly to the field. Our results expose in the Russian environment five distinct dimensions (social maladaptation, emotional impact, cognitive impact, psychosomatic impact, and loss of control). This multimodal framework helps us to better grasp and assess the complicated character of problematic mobile phone use.

Moreover, by exposing the existence of three separate user profiles—high-risk, medium-risk, and low-risk users—the latent profile analysis results underlined the varied character of problematic mobile phone use.

This finding points to the need to develop specialized intervention strategies for different risk groups. Another important contribution of our study is the relationship between problematic mobile phone use and demographic characteristics. The identification of young adults and women as being at higher risk is an important guide for future research and intervention studies.

## Recommendations

Subsequent investigations should assess the soundness of the five dimensions delineated in this work under diverse cultural settings. Tailored intervention programs should be created for populations at high risk, and the efficacy of these programs should be assessed. For women and young people, targeted preventive actions are absolutely vital. Longitudinal research should be conducted to look at how problematic mobile phone use affects interpersonal relationships, psychological well-being, and academic performance going forward. Designed and carried out educational campaigns should aim to improve knowledge about mobile phone usage.

## Limitations

Since our study has a cross-sectional design, definitive conclusions about causal relationships cannot be made. Since our sample consisted only of university students, the generalizability of our findings is limited. Since the data collection process was based on self-report measures, factors such as social desirability bias may have influenced the results. Since our study was conducted only in a specific region of Russia, the results may be limited in their representativeness for the entire country. Given the pace of technological advances, the scale may need to be updated in the future.

Finally, our research has made substantial progress in evaluating and comprehending the difficulties associated with the utilization of mobile phones in the Russian context. With the help of our results, professionals and academics now have access to knowledge and tools that can be put into practice to address this significant problem. The results of this study should serve as a reference for future research on the development of effective techniques for the treatment and prevention of problematic mobile phone usage.

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Valentin V. Matvienko, Stanislav E. Martynenko; **Writing – original draft:** Anna E. Bazanova, Evgeny V. Martynenko, Nozima F. Muratova; **Writing – review & editing:** Elena V. Martynenko, Anna E. Bazanova, Stanislav E. Martynenko. All authors approved the final version of the article.

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**Ethics declaration:** The authors declared that this study was conducted in line with the ethical principles stated in the Declaration of Helsinki (1964) and approved by Peoples' Friendship University of Russia named after Patrice Lumumba, Moscow, Russia. The questionnaire application used in the data collection process within the scope of the study was carried out on a completely voluntary basis. No data that could reveal the identity of the participants were collected and the data collected were processed anonymously. During the research process, the participants were informed in detail about the purpose and scope of the study and informed consent was obtained from them. Participants were informed that they had the right to withdraw from the study at any time without any sanction. The data collected were used for scientific purposes only and were not shared with third parties. The confidentiality and privacy of the participants were protected during the reporting of the research results.

**Declaration of interest:** The authors declare no competing interest.

**Data availability:** Data generated or analyzed during this study are available from the authors on request.

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