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RESEARCH ARTICLE **OPEN ACCESS**

The Role of Chronic Stress Level and Resilience in Excessive Mobile Phone use by Students

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Abstract:

Background and Objective: This article examines excessive mobile phone use among students, defined by Billieux as a loss of control that leads to negative physical, psychological, social, or academic consequences. The study explores its relationship with chronic stress and resilience among 174 university students in Kazakhstan (75.9% female, 24.1% male; mean age 18.67 ± 0.648 years). The findings highlight the growing relevance of this issue within the student population.

Methods: The Leipzig Express Test for Chronic Stress (LKCS) was used to diagnose the level of chronic stress, and the Resilience Scale (RS-25) was used to diagnose the level of resilience. Several questionnaires were used to diagnose excessive use of mobile phones: the Test of Mobile Phone Dependence brief (TMD brief), Scale PUMP: Problematic Use of Mobile Phone, 27-item Mobile Phone Problem Use Scale (MPPUS-27).

Results: Higher chronic stress levels were strongly associated with increased excessive mobile phone use, while resilience showed only weak, indirect correlations. Female and humanities students demonstrated higher levels of excessive mobile phone use compared to male and technical students.

Discussion: Findings confirm chronic stress as a major determinant of excessive mobile phone use, highlighting loss of control and emotionally negative themes as key latent factors. Resilience plays only an indirect moderating role, while gender and educational profile shape vulnerability patterns.

Conclusion: Excessive mobile phone use is strongly linked to chronic stress among students, while resilience has a limited protective role. Early preventive strategies and targeted interventions should consider stress level, resilience, gender differences, and educational profile.

Keywords: Excessive use of mobile phone, Nomophobia, Stress, Gender differences, Learning profile, Mental health.

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1. INTRODUCTION

Mobile phones are one of the most preferred digital devices that constantly accompany us. The convenience provided by smartphones is obvious, but it is these devices that lead many people to excessive use [1].

Numerous contemporary studies around the world show that excessive smartphone use has a detrimental effect on many important aspects of life. It is particularly alarming that the prevalence of excessive smartphone use is increasing among students in the Republic of Kazakhstan, with detrimental effects on their physical and psychological health. Students whose attention is constantly focused on the smartphone suffer in academic performance, overall learning productivity, and relationships with others, and may also gain excess weight (suffer from obesity [2]).

There is little disagreement about the existence of excessive mobile phone use. While there is no single recognized appropriate diagnosis in the psychological community, there is active discussion about it. However, the problem of excessive mobile phone use is beyond doubt. It is not just about social networks; it is also about computer games, push notifications, and all other functions of a mobile phone and its behavioral use.

In connection with the above, we considered the problem of studying chronic stress as a pathogenic factor and resilience as a protective factor in students in conditions of excessive mobile phone use, taking into account gender differences and educational profiles, for the early identification of students at risk of excessive use.

2. LITERATURE REVIEW

When talking about excessive use of mobile phones, the negative consequences of mobile phone use are implied. Billieux [3] defines excessive use of mobile phones as "failure to regulate the use of mobile phones, which ultimately leads to negative consequences in daily life." It is suggested that a possible "negative consequence" of mobile phone use is decreased performance at work, school, or family. Correlational studies have already provided evidence for this [4-6]. Due to the permanent attention to the smartphone, its most active users cannot fully learn and work, establish relationships with others, and live a full life, as noted by V.P. Sheinov and A.S. Devitsyn [7].

Another area in which mobile phone use may have negative consequences is driving. A number of experimental studies have shown that mobile phone use negatively affects concentration and coordination while driving and increases the risk of accidents [8-10].

There are also a number of studies on the potentially harmful effects of sleep media use. Especially if media are viewed while lying in bed or shortly before bedtime, a shorter sleep duration [11-14], and a higher incidence of sleep disturbances [11, 14-16] have been reported.

A large number of studies have also found a correlation between heavy or very active mobile phone use and depression or anxiety [17-20]. Excessive mobile phone use can also lead to conflicts with significant others (*e.g.*, parents, friends, partners) and problems at work, university, or school because it can be criticized by others.

Several studies have found that humanities students have higher levels of excessive mobile phone use than physics students (Al-Barashdi, Bouazza, Jabur [21]). The average rate of excessive mobile phone use is higher in women than in men (Tateno, Teo, Ukai *et al*. [22]).

3. METHODOLOGY

3.1. Sampling

The study was conducted in 2024 in classrooms. All participants signed informed consent forms. A total of 174 students participated in the study, of which 132 were female students (75.9%), and 42 were male students (24.1%). The mean age of the subjects in the sample was 18.67 years ± 0.648 months. The mean age of female students was 18.58 years ± 0.567 months and of male students 18.93 years ± 0.808 months. The students were studying the following specialties in different universities in Almaty, Kazakhstan: pedagogy, biology, geography, computer science, television, and directing.

All students in the sample used a mobile phone, most often iPhones and Redmi smartphones (83.2%), while only 29 students (16.8%) had simple Samsung mobile phones. Regarding the students' dependence on mobile phones: 11 students (6.4%) cannot imagine their life without a mobile phone, 45 students (26%) almost cannot imagine life without a mobile phone, 91 students (52.6%) can imagine life without a mobile phone but with difficulties due to its absence, and only 26 students (15%) can calmly imagine their life without a mobile phone.

The sample represents different groups of students with varying ideas about life in the absence of a mobile phone.

3.2. Measures

The following tests and questionnaires were used to diagnose the level of chronic stress, resilience, and excessive mobile phone use:

- To diagnose chronic stress, the Leipzig Express Test for Chronic Stress – The Leipzig Screening Questionnaire on Chronic Stress (LKCS) (K. Reschke & H. Schröder, adapted by A. Garber & L. Karapetyan) was used [23]. The test diagnoses seven indicators of chronic stress and an integral indicator: loss of control, loss of meaning, management of negative emotions and feelings, sleep disorders, inability to rest, emotionally negatively colored themes, and insufficient emotional support from society. A typical question: 'I feel cornered.'
- To diagnose the level of resilience, the Resilience Scale (RS-25) by G. M. Wagnild & H. M. Young was used [24]. It was translated into Russian by A. Garber and validated on a Russian-speaking sample by S. Duanaeva. The scale diagnoses two indicators of resilience and an integral indicator: personal competencies and acceptance of oneself and one's life. A typical question: 'I can rely on others just as much as I can rely on myself.'
- To diagnose excessive mobile phone use, three questionnaires were used:

[1] Test of Mobile Phone Dependence brief (TMD brief), Chóliz *et al*. [25], translated into Russian and validated by A. Garber. It diagnoses four indicators and an integral indicator: withdrawal, abuse, tolerance, and loss of control. A typical question: 'When I don't have my cell phone, I feel uncomfortable.'

[2] Scale PUMP: Problematic Use of Mobile Phone, L. J. Merlo, A. M. Stone & A. Bibbey. Validation on a Russian-speaking sample was performed by V. Kolesnikov, Y. Melnik, and L. Teplova [26]. One integral indicator and ten indicators are diagnosed: tolerance (the need to constantly increase the time of use to obtain satisfaction), withdrawal syndrome (emotional discomfort when deprived of the opportunity to use a smartphone), using the phone for more time than planned, a significant time spent on the phone, irresistible desire (thoughts about the phone), anxiety due to possible calls or messages, negative impact on other activities, use despite having physical or physiological problems, failure to fulfill obligations to others, provoking dangerous situations, and use despite problems in relationships with others. A typical question: 'I have problems at work or with my studies because of my use of my mobile phone.'

[3] 27-item Mobile Phone Problem Use Scale (MPPUS-27), Bianchi & Phillips [27]. This scale was translated into Russian and validated by A. Garber. One integral index is diagnosed. A typical question: 'I catch myself being preoccupied with my cell phone when I should be doing other things, which causes problems.'

3.3. Statistical Analysis

Statistical methods: The statistical software package SPSS 23.0 was used. Descriptive statistics of the data were performed, and the following procedures of statistical analysis were applied: checking the data for normality of distribution, non-parametric Mann-Whitney U-test for comparison of two independent samples, Spearman correlation analysis, and factor analysis using principal component analysis (PCA) with Varimax rotation and Kaiser normalization.

4. RESULTS

4.1. Quantitative and Qualitative Comparative Analysis

We will now address each research hypothesis in sequence.

Posing the first research question and the first hypothesis of the study:

Q_1: What is the effect of chronic stress level in general and its individual indicators on the tendency of excessive mobile phone use among students?

H_1: We hypothesize that the higher the level of chronic stress in general or its individual indicators, the higher the tendency to excessive mobile phone use in students.

To test the correctness of the first hypothesis, we applied Spearman correlation analysis (N=174). SPSS 23.0 statistical software package was used for statistical processing by correlation analysis.

As shown in Table **1**, virtually all indicators of chronic stress are significantly correlated with all indicators of excessive mobile phone use (24 significant correlations at the 5% significance level and 45 significant correlations at the 1% significance level). In addition to *p*-values, effect sizes were also evaluated. In the case of Spearman's correlation, all of them exceeded 0.38, which is considered a good result.

Fifteen out of seventeen indicators of excessive mobile phone use correlate with all indicators of chronic stress at the 1% and 5% significance levels.

Table 1. Correlation matrix of stress indicators and indicators of excessive mobile phone use by students.

Stress Indicators	Control	Meaning	Anger	Sleep	Rest	Theme	Social Support	Sum
Test of Mobile Phone Dependence brief (TMD brief)								
Abstinence	0,215**	0,083	0,209**	0,067	0,108	0,044	-0,057	0,117
Abuse	0,166*	0,216**	0,257**	0,117	0,117	0,221**	0,055	0,276**
Tolerance	0,142	-0,035	0,192*	0,022	0,096	0,142	0,043	0,135
Loss of control	0,216**	0,095	0,220**	0,067	0,097	0,189*	-0,025	0,183*
Sum	0,267**	0,125	0,320**	0,116	0,136	0,193*	0,001	0,247**
Scale PUMP: Problematic Use of Mobile Phone								
p1	0,092	0,156*	0,115	0,102	0,179*	0,188*	0,071	0,185*
p2	0,172*	0,080	0,246**	0,019	0,086	0,158*	0,015	0,162*
p3	0,116	0,152*	0,257**	0,067	0,136	0,278**	0,049	0,222**
p4	0,192*	0,174*	0,295**	0,107	0,181*	0,154*	0,161*	0,293**
p5	0,143	0,045	0,065	0,132	0,106	0,150*	0,159*	0,199**
p6	0,210**	0,110	0,230**	0,024	0,099	0,223**	0,077	0,219**
p7	0,107	0,142	0,215**	0,067	0,133	0,212**	0,109	0,239**

(Table 1) contd.....

Stress Indicators	Control	Meaning	Anger	Sleep	Rest	Theme	Social Support	Sum
p8	0,255**	0,101	0,269**	0,185*	0,056	0,069	0,159*	0,251**
p9	0,301**	0,200**	0,207**	0,142	0,289**	0,140	0,178*	0,333**
p10	0,159*	0,136	0,172*	0,179*	0,138	0,099	0,127	0,221**
PUMP total	0,264**	0,201**	0,331**	0,177*	0,211**	0,262**	0,181*	0,372**
27-item Mobile Phone Problem Use Scale (MPPUS-27)								
MPPUS total	0,371**	0,260**	0,459**	0,221**	0,324**	0,325**	0,228**	0,504**

Note: LETS chronic stress test: Control - loss of control; Meaning - loss of meaning; Anger - negative emotions; Sleep - sleep disturbances; Rest - inability to rest; Topic - emotionally negatively colored topic; Social Support - lack of emotional group support; Sum - total level of chronic stress; PUMP: Problematic Use of Mobile Phone scale: P1 - Tolerance: need to increase constantly the time of use to get satisfaction, P2 - Withdrawal syndrome: Emotional discomfort when deprived of smartphone use, P3 - Using the phone for more time than planned, P4 - Significant time spent on the phone, P5 - Irresistible desire: thoughts about the phone, anxiety about possible calls or messages, P6 - Negative impact on other activities, P7 - Use despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Use despite problems in relationships with others.

The large number of identified significant correlations allowed us to apply factor analysis to identify the most significant factors of chronic stress that are associated with the propensity for excessive mobile phone use (nomophobia). Factor analysis was applied to represent the number of variables obtained in the study by a smaller number of other variables called factors. Factors act as more fundamental variables that characterize the subject under study. In factor analysis, the original variables are grouped into clusters, each of which represents a factor. For statistical processing of factor analysis, we also used the statistical software package SPSS 23.0.

Processing was carried out using the principal component method, with the Varimax rotation procedure and Kaiser normalization. Factors with eigenvalues greater than one were considered. Rotation in the case of 25 variables (8 variables – Express Chronic Stress Test, 5 variables – TMD Test, 11 variables – PUMP Scale, 1 variable – MPPUS Scale) required 9 iterations.

As a result of factor analysis, five new factors were formed, which together explain more than 60.82% of the total variance, which is a fairly good result.

We now move on to the interpretation of the results obtained. When analyzing the data, factor loadings with an absolute value greater than 0.4 were identified. In the course of interpretation, the factor loadings with the largest absolute value are particularly emphasized for each variable (Table **2**).

Table 2. Factor analysis of the PUMP, TMD, and stress assessment questionnaire indicators.

Indicators	Components				
	1	2	3	4	5
PUMP amount	**0,868**				
P8 PUMP	**0,771**				
P6 PUMP	**0,704**				
P4 PUMP	0,663				
P10 PUMP	0,647				
P3 PUMP	0,638				
P7 PUMP	0,628				
MPPUS	0,608				
P9 PUMP	0,586				
TMD Abuse	0,502	0,438			0,442
TMD amount		**0,899**			
Abstinence TMD		**0,746**			
Tolerance TMD		0,705			
Loss of control TMD		0,702			
P2 PUMP		0,553			0,439
Stress_sum			**0,793**	0,556	
Stress_control			**0,691**		
Stress_sleep			0,627		
Stress_rage			0,582		
Stress_rest			0,492	0,422	
Stress_socialsupport			0,423		

(Table 2) contd.....

Indicators	Components				
	1	2	3	4	5
Stress_theme				**0,762**	
Stress_meaning				0,592	
P5 PUMP	0,413				**0,557**
P1 PUMP		0,430			0,448

Note: LETS Chronic Stress Test: Control - loss of control; Meaning - loss of meaning; Anger - negative emotions; Sleep - sleep disturbances; Rest - inability to rest; Topic - emotionally negative topic; Social support - lack of emotional group support; Sum - total level of chronic stress; PUMP: Problematic Use of Mobile Phone Scale: P1 - Tolerance: need to increase usage time continuously to get satisfaction, P2 - Withdrawal Syndrome: Emotional discomfort at being deprived of smartphone use, P3 - Using the phone for more time than planned, P4 – Significant time spent on the phone, P5 - Irresistible desire: thoughts about the phone, anxiety about possible calls or messages, P6 - Negative impact on other activities, P7 - Use despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Use despite problems in relationships with others.

The positive pole of a factor is interpreted based on the positive poles of the variables with the highest positive loadings and the negative poles of the variables with the highest absolute negative loadings. Accordingly, the negative pole of the factor corresponds to the negative poles of the variables with the maximum positive loadings and the positive poles of the variables with the largest absolute negative loadings.

Let us summarize the work done and list the latent factors found as a result of the joint analysis of the methods: PUMP Scale, MPPUS-27 Scale, TMD Test, and the Express Test for Chronic Stress, in order of decreasing significance for determining the relationship between chronic stress and nomophobia in students:

[1] Excessive mobile phone use in students is defined primarily by failure to fulfill obligations to others and negative impact on other activities (factor loading 20.14%).
[2] Excessive mobile phone use is associated in students with the development of withdrawal symptoms (factor loading 14.39%).
[3] Chronic stress in the context of nomophobia is defined primarily by loss of control (factor loading 11.79%).
[4] The presence of a certain strongly negative-emotionally colored theme in chronic stress is characteristic of students prone to nomophobia (factor loading 8.55%).
[5] Irresistible desire—thoughts about the phone and anxiety due to possible calls or messages in students (factor loading 5.95%).

Thus, we identified the latent stress factors that have the greatest impact on the tendency to excessive mobile phone use: loss of control and the presence of a certain theme with strong negative emotional associations.

It is interesting that, in students, excessive mobile phone use has the greatest impact on defaulting to others and the overall negative impact on other activities when overused. That is, there is a loss of control arising from both chronic stress and excessive mobile phone use.

The first hypothesis was confirmed, namely, the higher the level of chronic stress in general, or its individual indicators, the higher the tendency to excessive mobile phone use in students.

Posing the second question and the second hypothesis of the study:

Q_2: What is the effect of the level of resilience in general and its individual indicators on the tendency to excessive mobile phone use in students?

H_2: We hypothesize that the higher the level of students' resilience or its individual indicators, the lower the tendency toward excessive mobile phone use.

To test the validity of the second hypothesis, we also conducted a Spearman correlation analysis (N=174). For statistical processing using correlation analysis, we used the SPSS 23.0 statistical package.

As can be seen from Table **3**, only some of the resilience indicators are significantly correlated with the indicators of excessive mobile phone use (a total of 10 significant correlations at the 5% significance level). Moreover, the indicator “Negative influence on other activities” is negatively correlated with all the indicators of resilience at the 5% significance level.

In addition to *p*-values, effect sizes were also evaluated. In the case of Spearman's correlation, all effect sizes exceeded 0.42, which is considered a good result.

Next, we applied factor analysis using the principal component method, with the Varimax rotation procedure and Kaiser normalization. Rotation required 8 iterations. As a result of factor analysis, five factors were formed, which together explain more than 68.63% of the total variance, which is a good result. The effect size was equal to 0.54.

During the interpretation, the factor loadings with the largest absolute value were particularly emphasized for each variable (Table **4**).

The positive pole of a factor is interpreted based on the positive poles of the variables with the highest positive loadings and the negative poles of the variables with the highest absolute negative loadings. Accordingly, the negative pole of the factor corresponds to the negative poles of the variables with the maximum positive loadings and the positive poles of the variables with the largest absolute negative loadings.

Table 3. Spearman correlation matrix of resilience indicators and indicators of excessive mobile phone use by students.

Indicators	Resilience_1 scale	Resilience_2 scale	Resilience_Sum
Test of Mobile Phone Dependence brief (TMD brief)			
Abstinence	-0,026	-0,048	-0,049
Abuse	-0,057	-0,024	-0,086
Tolerance	-0,043	-0,046	-0,049
Loss of control	-0,067	-0,058	-0,057
Sum	-0,029	-0,038	-0,020
Scale PUMP: Problematic Use of Mobile Phone			
p1	-0,096	-0,038	-0,081
p2	-0,163*	-0,146	-0,140
p3	-0,121	-0,158*	-0,131
p4	-0,051	-0,062	-0,036
p5	-0,091	-0,106	-0,084
p6	-0,157*	-0,179*	-0,163*
p7	-0,058	0,010	-0,051
p8	-0,091	-0,169*	-0,095
p9	-0,089	-0,146	-0,121
p10	-0,080	-0,051	-0,074
PUMP_Sum	-0,152*	-0,159*	-0,149
27-item Mobile Phone Problem Use Scale (MPPUS-27)			
MPPUS_27_Sum	-0,153*	-0,186*	-0,148

Note: Resilience scale: scale 1 - personal competencies; scale 2 - acceptance of self and life; PUMP: Problematic Use of Mobile Phone scale: P1 - Tolerance: the need to increase constantly the time of use to obtain satisfaction, P2 - Withdrawal syndrome: emotional discomfort when deprived of the possibility to use a smartphone, P3 - using the phone more time than planned, P4 - Significant time spent on the phone, P5 - Irresistible desire: Thinking about the phone, worrying about possible calls or messages, P6 - Negative impact on other activities, P7 - Using despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Using despite problems in relationships with others; * - Correlation is significant at 0.05 level (two-sided).

Table 4. Factor analysis of the PUMP, TMD, and resilience indicators.

Indicators	Components				
	1	2	3	4	5
P3	**0,727**				0,401
P4	**0,701**				
PUMP_sum	0,683		0,574		
P7	0,660				
P6	0,621				
TMD_Abuse	0,598	0,545			
MPPUS_27_Amount	0,502		0,479		
TMD_amount		**0,928**			
TMD_abstinence		**0,725**			
TMD loss of control		0,705			
TMD_tolerance		0,685			
P9			**0,806**		
P10			0,638		
P5			0,629		0,451
P8	0,547		0,572		
resilience _ sum				-0,**971**	
resilience _1 scale				-0,911	
resilience_ 2 scale				-0,808	
P1					**0,693**
P2		0,439			0,547

Notes: Resilience scale: scale 1 - personal competencies; scale 2 - acceptance of self and life; PUMP scale: Problematic Use of Mobile Phone: P1 - Tolerance: the need to increase constantly the time of use to obtain satisfaction, P2 - Withdrawal syndrome: emotional discomfort when deprived of the possibility to use a smartphone, P3 - using the phone more time than planned, P4 - Significant time spent on the phone, P5 - Irresistible desire: Thinking about the phone, worrying about possible calls or messages, P6 - Negative impact on other activities, P7 - Using despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Using despite problems in relationships with others.

To summarize, the analysis revealed the following latent factors as a result of the joint analysis of the following methods: PUMP Scale, MPPUS-27 Scale, TMD Test, and Resilience Scale, in descending order of their significance for determining the relationship between resilience and nomophobia in students:

[1] Excessive mobile phone use in students is defined primarily by using the phone more time than planned, or generally spending a significant amount of time on the phone (factor loading 18.17%).
[2] Excessive mobile phone use is associated in students with the development of withdrawal symptoms (factor loading 16.56%).
[3] Using a mobile phone despite having physical or physiological problems (factor loading 13.40%).
[4] Resilience is not correlated with indicators of excessive use in students prone to nomophobia (factor loading 12.66%).
[5] The need to constantly increase the time of use to obtain satisfaction (factor loading 7.88%).

Thus, when isolating the latent factors that have the greatest influence on the propensity for excessive mobile phone use with regard to resilience indicators, it was found that excessive mobile phone use is not directly related to the level of resilience; the obtained latent factor has a unidirectional vector including only resilience characteristics.

Interestingly, the results also indicate that, for students, excessive mobile phone use has the greatest impact on spending more time on the phone than planned, or generally a significant amount of time spent on the phone, in the context of resilience. This result reveals an important aspect of the relationship between resilience and excessive mobile phone use: the relationship is indirect—resilience remains at an average level, while excessive mobile phone use negatively affects other activities, which may suggest the development of higher levels of resilience.

Overall, time spent on mobile phone use is a factor that should be considered for the development of a questionnaire or interview to identify students at risk for excessive mobile phone use.

The second hypothesis received partial confirmation, namely: the higher the level of resilience in general, or its individual indicators, the lower the tendency for excessive use of mobile phones among students. The level of resilience is correlated only with one indicator of excessive mobile phone use, “negative impact on other activities”, and is indirectly correlated with the factor of time spent on excessive mobile phone use. Specifically, at a low level of resilience, students are more likely to use their mobile phone for longer than planned or spend a significant amount of time on it.

To reiterate, the level of resilience has only an indirect effect on excessive mobile phone use, in contrast to chronic stress, whose effect is clear both in terms of loss of control, failure to fulfill obligations to others, and direct negative effects on other activities due to excessive mobile phone use. Withdrawal symptoms are present in students in the context of both chronic stress and resilience, ranking second in terms of factor loadings. This further emphasizes the seriousness of the situation regarding excessive mobile phone use by students, as withdrawal symptoms indicate a new type of behavioral addiction (nomophobia) rather than merely excessive use of mobile phones.

Posing the third research question and the third hypothesis of the study:

Q_3: What is the effect of students' gender and learning profile on the tendency of excessive mobile phone use in students?

H_3: We hypothesize that the gender and learning profile of students have a significant effect on the expression of the tendency to excessive mobile phone use in students. This tendency will likely be higher in female students than in male students, and with the technical learning profile of the student/s, he/she will have less tendency to excessive mobile phone use.

The obtained results are characterized in Tables **5** and **6**. It should be noted that no statistically significant differences were found in either chronic stress or resilience indicators between female and male students, as determined by the Mann-Whitney test.

The following hypotheses were considered:

Null hypothesis (H_0): There are only random differences between male and female students on the selected indicators of propensity for excessive mobile phone use, as measured by various questionnaires, namely the PUMP Scale, the MPPUS-27 Scale, and the TMD Test.

Alternative hypothesis (H_1): There are non-random differences between male and female students on certain indicators of propensity for excessive mobile phone use, as measured using different questionnaires on excessive mobile phone use, namely the PUMP Scale, the MPPUS-27 Scale, and the TMD Test.

The results of testing the hypotheses H_0 and H_1 are shown in Tables **5** and **6**.

Table **5** shows that female students have significantly higher scores on the withdrawal scale and also demonstrate a greater loss of control when using a mobile phone compared to male students. The effect size was equal to 0.28. The obtained result confirms findings from other studies on excessive mobile phone use, which show that female individuals also exhibit a greater tendency to excessive mobile phone use than male individuals.

As shown in Table **6**, the indicator “failure to fulfill obligations to others” is significantly higher among male students than among female students. That is, one of the more frequent manifestations of excessive mobile phone use in male students is failure to fulfill their obligations to others, which is less characteristic of female students. At the same time, the indicator “use despite problems in relationships with others” is significantly higher among male students than among female students. This indicates

that gender has an impact on excessive mobile phone use. In students, this effect is expressed to a greater extent in their relationships with others, without typical clinical manifestations such as withdrawal syndrome and loss of control, in contrast to female students. The effect size was equal to 0.33.

Next, let us consider the differences and similarities in the tendency to excessive mobile phone use among students of different study profiles. In our sample, 130 students had a humanities profile, and 44 students had a technical profile. The results obtained are shown in Tables 7 and 8. It should be noted that no statistically significant differences were found in terms of either chronic stress or resilience between students of different study profiles, according to the Mann-Whitney test.

The following hypotheses were suggested: null hypothesis

H_0: - There are only random differences between humanities and technical students on selected indicators of propensity to excessive mobile phone use as measured by different mobile phone excessive use questionnaires, namely, PUMP scale, MPPUS-27 scale, TMD test, and competing hypothesis

H_1: - There are non-random differences between humanities and technical students on selected indicators of the propensity to excessive mobile phone use, measured using different questionnaires on excessive mobile phone use, namely, the PUMP scale, the MPPUS-27 scale, and the TMD test.

Table 5. Results of statistical analysis of indicators of excessive use of mobile phones by male students and female students.

Indicators	TMD_AZ	TMD_ST	TMD_TZ	TMD_KV	TMD_∑	PUMP_∑	MPPUS_∑
Female Students M±SD	6.52± 3.01	7,60±2,93	3.41± 1.94	7,33±2,68	24,92± 7,40	52,64± 12,28	118.78± 35.63
Male Students M±SD	5,02±3,18	7,93±3,10	3.29± 1.93	6,17±3,50	22.57± 9.19	55,67± 12,46	128.74± 41.78
U-test Mann-Whitney	2050,0	2517,5	2657,0	2165,0	2370,0	2297,0	2418,0
Significance level	0,011*	0,368	0,682	0,032*	0,157	0,095	0,213

Note: TMD test: TMD_AZ - withdrawal, TMD_ST - abuse, TMD_TZ - tolerance, TMD_KV - loss of control, TMD_Σ - sum of TMD; PUMP_Σ - sum of PUMP questionnaire; MPPUS_Σ - sum of MPPUS questionnaire; M= arithmetic mean, SD= standard deviation; * - significance at $p \leq 0,05$; ** - significance at $p \leq 0,01$.

Table 6. Results of statistical analysis of the indicators of excessive mobile phone use of female and male students.

Indicators	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_10
Female students M±SD	5,33±1,66	4,58±1,65	6,70±1,95	5,84±2,14	4,73±2,08	5,52±1,84	6,86±2,04	4,58±1,98	4,64±1,91	3,77±1,78
Male Students M±SD	5,45±1,76	4,50±2,10	6,83±2,02	6,10±1,97	5,00±2,06	5,60±1,64	7,36±1,71	5,52±2,21	4,67±1,90	4,64±1,91
U-test Mann-Whitney	2604,0	2623,0	2637,5	2592,0	2505,5	2768,5	2340,5	2065,0	2735,5	2014,0
Significance level	0,546	0,594	0,632	0,523	0,343	0,990	0,124	0,012*	0,896	0,006**

Note: PUMP: Problematic Use of Mobile Phone scale: P1 - Tolerance: need to increase usage time continuously to get satisfaction, P2 - Withdrawal syndrome: emotional discomfort when deprived of smartphone use, P3 - Using the phone for more time than planned, P4 - Significant time spent on the phone, P5 - Irresistible desire: Thoughts about the phone, anxiety due to possible calls or messages, P6 - Negative impact on other activities, P7 - Use despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Use despite problems in relationships with others; M=arithmetic mean, SD=standard deviation; * - significance at $p \leq 0.05$ level; ** - significance at $p \leq 0.01$ level.

Table 7. Results of the statistical analysis using the Mann–Whitney U test of excessive mobile phone use among students of humanities and technical profiles based on the TMD test, the overall PUMP indicator, and the MPPUS scale.

Indicators	TMD_ AZ	TMD_ ST	TMD_ TZ	TMD_ KV	TMD_ ∑	PUMP_ ∑	MPPUS_ ∑
Humanities M±SD	6,02±3,12	8,39±2,61	3,28±1,96	6,88±2,89	26,20±7,82	53,16±12,23	128,84±38,50
Technical M±SD	6,57±3,07	7.44± 3.05	3.68± 1.85	7,57±3,01	23,72± 7,86	53,98± 12,85	118.59± 36.71
U-test Mann-Whitney	2542,0	2304,0	2506,5	2375,0	2283,0	2739,5	2389,0
Significance level	0,269	**0,053***	0,215	0,091	**0,045***	0,676	0,103

Note: TMD test: TMD_AZ - withdrawal, TMD_ST - abuse, TMD_TZ - tolerance, TMD_KV - loss of control, TMD_Σ - sum of TMD; PUMP_Σ - sum of PUMP questionnaire; MPPUS_Σ - sum of MPPUS questionnaire; M= arithmetic mean, SD= standard deviation; * - significance at $p \leq 0.05$; ** - significance at $p \leq 0.01$.

Table 8. Results of the statistical analysis using the Mann–Whitney U test of excessive mobile phone use among humanities and technical students based on the individual indicators of the PUMP scale.

Indicators	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_10
Humanities M±SD	5,42±1,63	4,52±1,83	6,85±1,90	5,81±2,08	5,34±2,11	5,59±1,86	6,92±2,05	4,83±1,99	4,65±1,97	3,90±1,82
Technical M±SD	5,16±1,82	4,70±1,58	6,39±2,14	6,18±2,17	4,61±2,03	5,39±1,59	7,18±1,72	4,75±2,30	4,66±1,68	4,23±1,74
U-test Mann-Whitney	2681,5	2579,0	2508,0	2570,5	2268,0	2587,5	2721,5	2746,0	2763,0	2583,0
Significance level	0,528	0,323	0,217	0,312	0,038*	0,337	0,627	0,689	0,733	0,326

The results obtained are shown in Tables **7** and **8**.

As shown in Table **7**, the “abuse” score and the sum score on the TMD test are significantly higher among humanities students than among technical students. The effect size was equal to 0.56.

PUMP scale: Problematic Use of Mobile Phone: P1 - Tolerance: need to constantly increase the time of use to obtain satisfaction, P2 - Withdrawal syndrome: emotional discomfort when deprived of the possibility to use a smartphone, P3 - Using the phone for more time than planned, P4 - Significant time spent on the phone, P5 - Irresistible desire: Thinking about the phone, worrying about possible calls or messages, P6 - Negative impact on other activities, P7 - Using despite having physical or physiological problems, P8 - Failure to fulfill obligations to others, P9 - Provoking dangerous situations and P10 - Using despite problems in relationships with others; M=arithmetic mean, SD=standard deviation; * - significance at $p \leq 0.05$ level; ** - significance at $p \leq 0.01$ level.

Let's turn to the results of Table **8**. The indicator “irresistible desire: thoughts about the phone, anxiety because of possible calls or messages” is significantly higher among students of humanities than among students with a technical education profile. This indicator is one of the important indicators of excessive mobile phone use, as nomophobia is most often considered from the perspective of increased anxiety due to possible missed information in the form of calls and messages.

Let us summarize the results of testing the third hypothesis of the study:

- The third hypothesis has found its full confirmation. The tendency to excessive mobile phone use is significantly higher among female students than among male students.
- Students of the humanities profile of education are more inclined to excessive use of mobile phones in comparison with students of the technical profile of education.

5. DISCUSSION

Several studies have found a significant positive correlation between excessive mobile phone use and symptoms of ill health, primarily due to sleep disturbances [28, 29]. In our study, we also found a significant positive correlation between sleep disturbances, as one of the dimensions of chronic stress, and indicators of excessive mobile phone use. That is, our results suggest that, in order to promote students' health and physical well-being, students should be encouraged to limit their use of smartphones, especially before bedtime, as delayed or postponed bedtime is significantly correlated with excessive mobile phone use.

Sheinov's research [30] shows that, in Russian-speaking society, excessive mobile phone use is positively correlated with anxiety, depression, and stress, and negatively correlated with self-control and life satisfaction. This is partially reflected in the results of our study in the indicators of chronic stress: sleep disturbances and the presence of a strongly negative emotionally colored theme. In addition, loss of self-control, as one of the indicators of excessive mobile phone use by students, is present in both the results of the chronic stress test and in the questionnaires for excessive mobile phone use.

We also identified gender differences and the influence of study profile on the propensity for excessive mobile phone use. Gender analysis of excessive mobile phone use has been repeatedly conducted by a number of researchers. For example, factors influencing excessive mobile phone use in male students were impulsivity and depression, while in female students, impulsivity was the determining factor [31].

In terms of Internet use, men were found to be more addicted than women; however, this pattern was reversed for smartphones [32]. The average smartphone dependence rate of women is higher than that of men [22]. In our study, female students were more prone to excessive mobile phone use compared to male students across almost all indicators of mobile phone overuse.

That is, the propensity for excessive mobile phone use is significantly stronger in females than in males. This correlation coincides with similar results obtained in different countries [7, 22, 32].

Several studies have found that humanities students have a higher level of propensity for excessive mobile phone use than physics students [21]. In Russian-speaking society, such correlations between humanities education and excessive propensity for mobile phone use were found only in males [7]. In our study, both male and female students with a humanities education profile had a greater propensity for excessive mobile phone use than students with technical education profiles.

Excessive mobile phone use in women, according to Sheinov [7], is negatively correlated with age, competence, complementarity, provocativeness, presence of family, presence of children, and good mood, and positively correlated with addictive behavior and sleep problems. Excessive mobile phone use by young men and women in

Russian-speaking society is "positively related to procrastination, shyness, and insecurity from cyberbullying, and negatively related to assertiveness and good mood" [33].

Perhaps further research should pay separate attention to gender predictors of excessive mobile phone use in order to develop recommendations and regulations for mobile phone use that take into account gender and cross-cultural differences.

In his study, Sheinov [30] reported that, in Russian-speaking society, a significant positive correlation was found between craving for smoking in men and smartphone addiction, which has not yet been confirmed in the results of other studies.

In our study, the task was to investigate the relationship between resilience and excessive mobile phone use. It was found, unfortunately, that resilience as a protective factor does not affect the propensity for excessive mobile phone use among students in the Republic of Kazakhstan.

It is difficult to determine whether this is related to cross-cultural characteristics. Other studies very rarely include the examination of protective factors. An exception is a study [34] that examines resilience in the context of emotional intelligence and self-efficacy development. Another study examined the relationship between resilience and cognitive flexibility [35]. Most studies focus on pathogenic factors that negatively affect mobile phone use, potentially leading to dependence. All the more valuable, in our opinion, is the attempt we have made to identify protective factors that may serve as safeguards against excessive mobile phone use by students.

6. LIMITATIONS

A limitation of this study is that the research covered only a group of Kazakhstani students, and no control group was included. In future studies, we aim to expand the sample to include students from, for example, Central Asia and Central Europe. Additionally, in our study, only indicators of chronic stress and resilience, gender, and field of study were selected as risk and protective factors. Future studies should supplement these with other possible indicators related to risk and protective factors, including socio-psychological characteristics such as age, place of residence, financial status, social status within the reference group, level of education, personality traits, social attitudes, and interests.

Most current research focuses on excessive mobile phone use rather than phone dependency. Our study similarly addresses excessive mobile phone use rather than phone dependency. We did not sufficiently examine smartphone usage time during the day, which is an important indicator for diagnosing excessive mobile phone use. Furthermore, we did not adequately assess physiological indicators of excessive mobile phone use; that is, objective indicators were not measured, and the focus was on subjective indicators. In future studies, more attention will be paid to the development and measurement of objective indicators of excessive smartphone use.

CONCLUSION

The role of chronic stress and resilience in students under conditions of excessive mobile phone use was determined for the early identification of students at risk for nomophobia. The conducted study shows that excessive mobile phone use has a highly negative impact on many important aspects of students' lives, including self-control, relationships with others, and fulfillment of obligations. Early prevention of students' addictive behavior can contribute to the preservation of their physical and mental health and positively impact academic performance, productivity, and personal development during adolescence.

This research introduces new data into the scientific literature, on the basis of which concepts have been formulated. Together with other new findings, these data have formed the theoretical foundation for the development of complex models for the early diagnosis of nomophobia in students, taking into account chronic stress, level of resilience, gender characteristics, and education profile.

Practical conclusions can be applied by university psychological services and curators of study groups in educational and training work with students to prevent smartphone addiction. Thanks to this empirical study, a foundation has been laid for further research to accumulate information on the prevention of nomophobia in students. In future studies of excessive mobile phone use, these findings can serve as material for cross-cultural research.

The proposed theoretically and practically adapted toolkit for diagnosing excessive mobile phone use by students can be employed both at the stage of university preparation, in the first year of study, and as ongoing monitoring throughout the entire period of study.

The theoretical and empirical findings of this study can serve as a basis for methodological developments aimed at creating a safe digital environment for students and organizing educational work to preserve their physical and psychological health, including the early prevention of smartphone addiction.

THEORETICAL AND PRACTICAL IMPLICATIONS

[1] With the appearance of the first iPhone, released in 2007, the smartphone entered the mass market. Currently, almost every student in the Republic of Kazakhstan has one or two smartphones. One of the most common hypotheses explaining why mobile phones have such high emotional importance is the concept of "FOMO" (Fear of Missing Out)—the fear of missing out on something, usually social information. The mobile phone has become a means of keeping in touch with family, friends, coworkers, and others and is therefore an appropriate tool to prevent this specific type of anxiety.

[2] The question of whether problematic (excessive) mobile phone use should be considered another behavioral addiction cannot yet be sufficiently clarified, given the current state of research, as the methodological quality of the studies varies greatly.

[3] Numerous studies have shown that excessive mobile phone use is positively associated with negative factors such as depression, anxiety, stress, decreased self-esteem and self-control, sleep problems, general health problems, quality of life, life satisfaction, family difficulties, decreased academic performance of pupils and students, decreased work productivity, and an increased risk of being a victim of cyberbullying. Excessive mobile phone use is positively related to impulsivity, neuroticism, internet addiction, social media activity, and smartphone use before bedtime, and negatively related to self-esteem. In addition, significantly higher excessive mobile phone use has been associated with younger users.

[4] Within the framework of this study, we adopted the position that excessive mobile phone use is a phenomenon that implies, in any case, negative consequences for the user. The working definition that we adhered to throughout our research is Billieux's extended definition: problematic mobile phone use is "the failure to regulate mobile phone use, which ultimately leads to negative consequences in everyday life." Billieux emphasizes primarily negative consequences in terms of reduced performance at work, school, or university.

[5] We found that the higher the level of chronic stress in general, or of its individual indicators, the higher the tendency for excessive mobile phone use in students. Latent stressors with the greatest impact on the tendency for excessive mobile phone use were identified: loss of control and the presence of a topic with strong negative emotional associations, often linked to students' experiences of psychological trauma. In students, excessive mobile phone use has the greatest impact on failing to fulfill obligations to others.

[6] We found that the higher the level of resilience in general, or of its individual indicators, the lower the tendency for excessive mobile phone use in students. In this context, excessive mobile phone use has the greatest impact on spending more time on the phone than planned, or generally a significant amount of time on the phone, with respect to resilience.

[7] We found that the tendency for excessive mobile phone use is significantly higher in female students compared to male students. Additionally, students with a humanities education profile are more prone to excessive mobile phone use compared to students with a technical education profile. One of the more frequent manifestations of excessive mobile phone use in students is failure to fulfill obligations to others or using the phone despite problems in relationships with others, which is less typical for female students.

[8] To detect excessive mobile phone use, it is necessary to use not just one, but several relevant psychodiagnostic techniques, taking into account their complementary nature. Additionally, a proposed questionnaire can collect more individualized information aimed at revealing the cognitive, emotional, and behavioral features of students' mobile phone use.

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows: A.N.: was responsible for data curation; A.K.: for data collection; L.L.: for analysis and interpretation of results; G.A.: for validation; S.B.: for methodology; A.G.: for writing the paper. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

LKCS = Leipzig Express Test for Chronic Stress

PCA = Principal Component Analysis

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Ethics Commission of Al-Farabi Kazakh National University, Kazakhstan. Reference number: №676 31.07.2025.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Written informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study is available in the Zenodo Repository at: https://zenodo.org/uploads/17846446 Reference number: 10.5281/zenodo.17846446

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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