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A Correlational Study on Mobile Phone Addiction among University Students: Prevalence, Student Characteristics, Mobile Phone Use Purposes, and Situations

Berkan Çelik*
Van Yüzüncü Yıl University, TÜRKİYE

Amine Hatun Ataş
Galatasaray University, TÜRKİYE

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Abstract: Due to the notably increased penetration of smartphone use among university students and the alarming risk it poses to both physical and mental health, this study investigated mobile phone addiction among university students concerning student characteristics, mobile phone usage behaviors, and mobile phone use purposes and situations. The participants of this study were 600 university students, who were selected according to the convenience sampling method from different departments in Türkiye. The data were collected using the student characteristics form and the Mobile Phone Addiction Scale. The correlational research method was followed in the study. The data were analyzed using descriptive and inferential statistics. The results showed that students clustered as addicted and non-addicted had different mobile phone use behaviors on account of daily smartphone use duration, internet use duration on a smartphone, and daily smartphone check frequency. Being a female at a lower grade level and using mobile phones mostly at night made students more vulnerable to mobile phone addiction. Additionally, the results indicated a significant positive moderate correlation between internet use duration, daily smartphone use duration, daily smartphone check frequency, and mobile phone addiction scores. Lastly, checking social media apps, messaging, and editing photos significantly contributed to mobile phone addiction scores. Among the mobile phone use situations, when getting bored, during lessons, when watching TV or movies, and when being alone significantly contributed to mobile phone addiction scores. This study provided a thorough discussion and a set of recommendations.

Keywords: *Mobile phone addiction, problematic mobile phone use, smartphone use and situations, university students.*

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Introduction

Over three billion people are using smartphones all over the world. China (974.69m), India (659m), and the US (276.14m), respectively, are the leading countries in terms of the highest number of smartphone users, according to Statista (2022). In Türkiye, the number of smartphone users was reported as 59.54 million with a 70.0% penetration rate (Newzoo, 2020). Moreover, as provided by the Organisation for Economic Co-operation and Development (OECD), mobile broadband subscriptions per 100 inhabitants for Türkiye were 83.2 in 2021 (OECD, n.d.). In another study, most of the smartphone users were stated as younger and relatively more educated groups (Silver, 2019).

Smartphones, the one-stop center of a variety of digital activities, have become a necessity for all, including the great majority of university students all over the world (Subramaniam et al., 2020), due to their being useful hubs to ease daily activities with their numerous features and functions such as calling, texting, having embedded cameras, GPRS, and having a variety of applications (apps), which have been classified under 26 categories by Apple, one of the most popular technology brands. Popular apps have been classified as photo and video, entertainment, social networking, music, lifestyle, and productivity (App Store, 2021). Statista (2022) also listed the most popular Apple app store categories with different name tags. According to the study, the most popular five have been published as games, business, education, utilities, and lifestyle, which explicitly indicates the popular app preference categories and how the wide spectrum of apps prevails in sections of life.

* **Corresponding author:**
Berkan Çelik, Van Yuzuncu Yil University, Turkey. ✉ berkancx@gmail.com

Even though a smartphone serves numerous functionalities, excessive and compulsive use of it can cause or correlate with directly/indirectly many physical and mental problems such as increasing attention deficit (Kıraç, 2019), having an influence on eating behavior disorders (Tayhan Kartal & Yabancı Ayhan, 2021), being correlated with shyness (Bian & Leung, 2014), loneliness (Bian & Leung, 2014; Sönmez et al., 2021), anxiety (Demirci et al., 2015; Elhai et al., 2017), stress (Gligor & Mozoş, 2019; Samaha & Hawi, 2016), academic performance (Samaha & Hawi, 2016), depression (Demirci et al., 2015), sleep quality (Canan et al., 2013; Demirci et al., 2015), addiction (Gligor & Mozoş, 2019), and the professional identity scale, poor mental health, smartphone use before bed, and perceived study pressure (Liu et al., 2022) Based on a meta-analysis of 24 countries, problematic smartphone use behavior continues to rise across the world (Olson et al., 2022). Yılmaz et al.'s (2022) systematic review of adolescents' smartphone addiction during the COVID-19 era demonstrated that adolescent internet/smartphone addiction rates were higher than they were before the epidemic. This signaled that these addictions were becoming more common overall. Furthermore, these addictions were linked to adolescent mental diseases and issues.

Literature Review

Mobile Phone/Smartphone Addiction

Due to being correlated with health problems and having common indicators with non-substance behavioral addiction, smartphone addiction was proposed to be included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (Lin, Chiang et al., 2016). While stated mostly as smartphone addiction (Aktürk et al., 2018; Gökçearslan et al., 2018; Kaya & Kaya, 2020; Lin, Chiang et al., 2016; Lin, Kuo et al., 2014), it has been conceptualized with different names such as problematic smartphone use (Forster et al., 2021; Takao et al., 2009), mobile phone addiction (MPA) (Hong et al., 2012; Li et al., 2020), and nomophobia (Gezgin et al., 2018; Gurbuz & Ozkan, 2020; Ma & Liu, 2021; Sevim-Cirak & Islim, 2021).

Smartphone addiction stated as a kind of technological addiction (Lin, Kuo et al., 2014), has not been officially defined yet under DSM-5, although it comprises complex physical, social, and psychological factors. However, the risk of addiction has been acknowledged by many authorities due to the misuse and extreme use of smartphones. Moreover, internet gaming disorder has been considered behavioral addiction and included in the DSM-IV manual (Mok et al., 2014). Basic attributes of behavioral addiction are continuously engaging in a particular behavior despite its negative consequences, using this action to avoid reality or create a euphoric feeling, constituting tolerance for the behavior's continuation, detecting withdrawal symptoms when it is missing, having interpersonal issues as a result of the constant action, and relapsing into it (Çoban & Gündoğmuş, 2019; Mok et al., 2014).

Among the technology-related addiction models, internet addiction has mainly contributed to the development of the smartphone addiction concept. The Mobile Phone Addiction Scale (MPAS) (Hong et al., 2012), which was used in this study, was revised based on Young's (1998) study, in which the pathological use of the internet resembled the nature of pathological gambling. Pathological gambling was listed in DSM-IV, and therefore, the criteria of pathological gambling were modified to screen the diagnostic questionnaire of pathological internet use.

Mobile Phone Use over Student Characteristics

Concerning student characteristics, existing studies reveal contradictory findings. Mok et al. (2014) and Varchetta et al. (2020) reported that females' smartphone addiction scores were higher than males' scores. Similarly, in recent studies, Nayak (2018) and Gül et al. (2019) revealed that a higher prevalence of problematic cell phone use was found among females according to gender-based data. On the other hand, Afe et al. (2020) stated that males showed significantly higher mean smartphone addiction scores (31.7 ∓ 9.4) in comparison to females (28.1 ∓ 8.5). However, across all age groups, there were no discernible differences in smartphone addiction. In another study, no statistically significant gender difference was reported regarding smartphone addiction, although females' addiction scores were higher than males' scores (Bavlı et al., 2018). Gurbuz and Ozkan (2020) reported that gender, working position, and level of nomophobia (NoMobilePhone Phobia), which is a similar concept indicating problematic use of mobile phones, did not differ statistically significantly from one another; however, age and educational attainment did differ significantly. The degree of nomophobia experienced by young people lessened as they grew older. During their high school years, they expressed a greater degree of nomophobia. Students' levels of nomophobia were higher than graduates and working youth despite a minor decline during their university years. Similarly, no gender differences were found in mobile addiction and smartphone addiction among college students (B. Chen et al., 2017; Yang et al., 2020). In the study of Van Deursen et al. (2015), it was found that women consequently have a larger likelihood of establishing ingrained or addictive smartphone behavior. Age has a negative impact on the process and social utilization as well as social stress. Self-regulation is positively impacted by age. Therefore, older adults are less likely to acquire addicted or regular smartphone practices. In another study, a GPA less than 3.0 is correlated with age at first smartphone use and alcohol use (Boumosleh & Jaalouk, 2018).

Mobile Phone Usage Behavior, Purposes, and Situations

Smartphone users in Türkiye check their smartphones an average of 78 times a day, while European countries' average is 48 (Deloitte, 2018). Another research revealed that the most prevalent reasons for smartphone use among university students in Türkiye are for using social media at 51.9%, and about 36% of these students spend 4-6 hours with their

smartphones daily. The duration of 9 hours daily minimum usage caused significantly higher smartphone addiction scores (Bavlı et al., 2018). Similarly, Gökçearslan et al. (2016) noted that the duration of smartphone use is positively correlated with smartphone addiction. In another study, 61% of the participants agreed that using smartphones too much affected their health negatively (Subramaniam et al., 2020). Taiwanese college students, with 102.61 mins daily mobile phone use, used their phones mostly for calling (53.5%), texting (37.5 %), and setting alarms (24.2 %) (Hong et al., 2012). Roberts et al. (2014) reported three common uses of mobile phones texting, sending e-mails, and social media, respectively. Social networking and instant messaging apps are the most utilized smartphone applications (Hussain et al., 2017; Kolhar et al., 2021). Messaging app usage, particularly WhatsApp usage, elevates the addictive smartphone behaviors of younger individuals (Zhitomirsky-Geffet & Blau, 2016). In another study, it was found that using smartphones for connecting to social media and making new acquaintances increased smartphone addiction risk, whereas using them for studying or checking news decreased that risk. Concerning gender differences, using smartphones for playing games, having new friends, and following news were more often used by male students than female students. This statistical difference was not found for the other purposes of use such as for social media, studying, messaging, shopping, etc. (Çoban & Gündoğmuş, 2019).

This study addresses the relationship between education and information technology (IT), particularly with the prevalence of smartphone use and addiction among university students. University students are among the largest group of smartphone users. On one hand, technology and widespread access to mobile phones provide students with vast amounts of information at their fingertips, allowing different ways of learning. However, the increase in access to technology also has a downside. Many students have become addicted to their smartphones, which can be a major distraction in the classroom and affect their ability to focus and retain information as well as in their daily lives. To address this issue, educators need to find a balance between utilizing technology as a tool for learning and ensuring that students are using it in a way that does not interfere with their education. This can be achieved by understanding the smartphone use of university students and their addiction to these devices. What is more is that university students are likely to be a part of the future workforce and therefore, their smartphone use patterns and habits may impact their productivity and job performance in the future. For these reasons, it is important to understand smartphone use among university students and their addiction, which is their dependence, so that educators and students may be able to find a balance that leverages the benefits of technology while mitigating its potential negative effects. Furthermore, researching smartphone use and addiction among this population can provide valuable understanding and insights into the extent and nature of the problem as well as potential dangers in this regard. Regarding education, incorporating technology in ways that enhance the learning experience can be explored based on the purposes and situations of smartphone use by university students. Overall, the information this type of research provides can be a guide and be useful to develop effective prevention and intervention strategies to promote healthy technology use to overcome long-term consequences. In brief, this study provides novel contributions regarding smartphone use and situations on smartphone addiction among university students. This study would add valuable perspectives to the discourse on education and technology, especially smartphone use and situations as well as smartphone addiction.

To sum up, smartphone addiction is a growing concern around the world. Due to the notably increased penetration of smartphone use among university students with an alarming risk to both physical and mental health, it is necessary to conceptualize the problematic use of smartphones by considering the cultural context. Additionally, due to the lack of agreement on determining risk groups in terms of student characteristics, this study aims to investigate mobile phone addiction among university students, reveal the correlation between mobile phone usage behavior and mobile phone addiction, and examine how MPAS scores differ by student characteristics. This study enriches the relevant literature by understanding mobile phone addiction prevalence, student characteristics, mobile phone use purposes, and situations in a comprehensive manner.

Parallel to the purpose of this study, the following research questions were answered:

1. What is the prevalence of mobile phone addiction among university students as indicated by MPAS scores?
2. How do MPAS scores differ by student characteristics (i.e., gender, age, grade level, student's smartphone use time in a day)?
3. What is the relationship between mobile phone usage behaviors (i.e., daily Internet Use Duration (IUD), daily Smartphone Use Duration (SUD), daily Smartphone Check Frequency (SCF), Smartphone Ownership Duration (SOD), cumulative Grade Point Average (cGPA), and MPAS scores?
4. Which mobile phone use purposes and situations predict MPAS scores?

Methodology

Research Design

This study employed the correlational research method. Correlational research aims to explore the association between variables and to describe the degree to which at least two quantitative variables are related without any manipulation of them. It helps understand important phenomena by investigating relationships among variables (Fraenkel et al., 2012). In

brief, the present study tried to reveal the differences between the MPAS scores of university students and explore the relationships between MPAS scores and the related variables.

Participants

A convenience sampling method was employed in this study. Six hundred undergraduate and graduate students from 51 universities in Türkiye participated in the study voluntarily. They were provided with necessary information about the study, and their consent was taken before collecting the data. 68.5% (n=411) of the participants were female, and 31.5% (n=189) of them were male. Their ages were between 18 and 45 years old with a mean of 23.35 (*SD* = 4.21). When the grade level of the participants was inspected, 1.33% (n=8) are preparatory students; 10% (n=60) were freshmen; 16.67% (n=100) were sophomores; 26.67% (n=160) were juniors; %19 (n=114) were seniors; 2.83% (n=17) were 5th graders; 2.5% (n=15) were 6th graders; and 21% (n=126) were graduate students. The mean of the cGPA of the participants was 2.89 (*SD*=.57).

Most participants are not experienced smartphone users with a mean use of 3.22 years (*SD* = 2.20). The average daily use of a smartphone is 4.60 hours (*SD* = 3.22). Participants check their smartphones 32.49 times a day on average (*SD* = 49.72). 90% (n=540) of the participants have an internet package on their smartphones. The mean daily internet use on their smartphones is 3.47 hours (*SD* = 2.76). Participants mostly use their mobile phones in the evening (n=230, 38.33%,). Additionally, 36% (n=216) of them use their mobile phone equally throughout the day. Table 1 provides the characteristics of the participants.

Table 1. Characteristics of the Participants

Category	Variable	n	%
Gender	Female	411	68.5
	Male	189	31.5
Age	Less than 20	141	23.5
	21	107	17.83
	22	92	15.33
	23	64	10.67
	More than 23	196	32.67
Grade Level	Undergraduate	474	79
	Graduate	126	21

Note. The total number of participants is 600.

Data Collection Instruments

The data were collected using student characteristics form and MPAS developed by Hong et al. (2012) based on the revision of Young's (1998) Internet Addiction Scale. The student characteristics form included 13 questions focusing on student characteristics: age, gender, university, grade level, cGPA, smartphone ownership duration, net package ownership, daily smartphone use, daily smartphone check, daily internet use, smartphone use time a day, smartphone use purposes, and smartphone use situations. The items for smartphone use purposes (17 items) and smartphone use situations (14 items) were constructed based on previous studies (e.g., Chan, 2015; Hong et al, 2012; Humphreys et al., 2013; Matthews et al., 2009; Merlo et al., 2013; Roberts et al., 2014).

The operational definitions of the variables are as follows based on the order of appearance in the research questions:

- Age refers to the age of the student, represented as a numerical value. It was used as a categorical variable in the statistical analyses.
- Gender refers to the gender of the student, represented as a categorical variable with two categories: male or female.
- Grade level refers to the current academic level of the student, represented as a categorical variable (e.g., Freshman, Sophomore, Junior, Senior).
- Smartphone use time a day refers to the part of the time the student uses their smartphone daily (morning/midday, evening, night, or equal throughout the day mostly), represented as a categorical variable.
- cGPA refers to the cumulative grade point average of the student, represented as a numerical value.
- Smartphone ownership duration refers to the length of time the student has owned their smartphone, represented as a numerical value.
- Daily smartphone use refers to the duration the student uses their smartphone daily, represented as a numerical value.
- Daily smartphone check refers to the frequency with which the student checks their smartphone daily, represented as a numerical value.

- Daily internet use refers to the duration the student uses the internet on their smartphone daily, represented as a numerical value.
- Smartphone use purposes refer to the reasons the student uses their smartphone, represented as a categorical variable such as messaging, calling, checking social media accounts, internet search, etc.
- Smartphone use situations refer to the situations in which the student uses their smartphone, represented as a categorical variable such as during lessons, on public transport, walking, driving, and when alone, etc.

The MPAS was adapted to Turkish culture by the researchers (Çelik et al., 2017). Its psychometric properties in Turkish culture were investigated and explored through a confirmatory factor analysis (CFA). It was found that the factor structure of the Turkish version of the MPAS is identical to the original version. The scale originally consists of 11 items; however, 2 items (using a mobile phone at night influences my sleep, and I try to hide my mobile phone usage time) were omitted from the original instrument after the CFA. Overall, the MPAS is comprised of three latent variables/factors: (1) Time management and its problem (3 items), (2) Academic problems in school and their influence (3 items), and (3) Reality substitute (3 items). The items are in the form of a 6-point Likert scale, ranging from completely disagree (1) to completely agree (6). The minimum and maximum total scores which can be obtained from the scale are 9 and 54 (Hong et al., 2012).

Evaluation of the Measurement Model of the MPAS

To evaluate the model fit of the MPAS, a CFA was conducted. For the model fit, X2/df (Chi-Square/Degrees of Freedom), RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), AGFI (Adjusted Goodness of Fit Index), and SRMR (Standardized Root Mean Square Residual) indices were checked based on J. F. Hair et al. (2006). The values obtained from the analysis results indicated a good model fit ($\chi 2/df$= 2.837, RMSEA= .055, CFI= .983, AGFI= .953, SRMR=.039).

Table 2. Model Fit Indices and Reference Values

Indices	Value	Recommended value	Reference
$\chi 2/df$	2.837	Acceptable fit: $2<\chi 2/df<5$ Perfect fit: $0<\chi 2/df<2$	Kline (2005); Tabachnick and Fidell (2007)
RMSEA	.055	Values less than .07	J. F. Hair et al. (2019)
CFI	.983	.95 and above	Hu and Bentler (1999)
AGFI	.953	.90 and above	Kline (2005)
SRMR	.039	.08 or less	J. F. Hair et al. (2019)

Convergent and discriminant validity were evaluated to ensure the construct validity. For the convergent validity, standardized item loading estimates and average variance extracted (AVE) values were checked. All the standardized loading estimates were greater than .50. The AVE values were calculated at .52 for factor1, .75 for factor2, and .49 for factor3. AVE values were higher than 0.5 except for factor 3. In line with these results, it can be determined that convergent validity is supported (J. F. Hair et al., 2017). The internal consistency of the three factors was .76, .90, and .70, respectively. Also, the composite reliability values were greater than .70. The overall internal consistency of the instrument was .88. These values suggest that the MPAS results are reliable.

Table 3. Validity and Reliability Analysis

Factors	Items	Item loading	α	CR	AVE
Time management and its problem	I1	.770	.76	.77	.52
	I2	.642			
	I3	.750			
Academic problems in school and its influence	I4	.889	.90	.90	.75
	I5	.819			
	I6	.884			
Reality substitute	I7	.577	.70	.73	.49
	I8	.919			
	I9	.536			

Note. α: Cronbach's alpha, CR: Composite reliability, and AVE: Average variance extracted.

HTMT2 (heterotrait-monotrait ratio of correlations) ratio, which provides an improved criterion for ensuring discriminant validity, was used to evaluate the discriminant validity of the MPAS (Henseler, 2021; Roemer et al., 2021). The HTMT2 estimates the correlation between latent variables in a consistent manner (Henseler, 2022). All values were below .90, and therefore, discriminant validity was satisfied (Roemer et al., 2021). Overall, the convergent and discriminant validity results suggest that the MPAS has construct validity and provides valid results.

Table 4. Discriminant Validity (HTMT2 Ratio)

Factors	1	2	3
1. Time management and its problem	1		
2. Academic problems in school and its influence	.61	1	
3. Reality substitute	.88	.65	1

Data Collection

Before data collection, necessary permission was obtained from the ethics committee. Data were collected during the fall semester of the 2014-2015 academic year through an online survey platform, Google Forms. The link to the measurement instrument was distributed over Facebook groups which focus on the subjects in education. Volunteer university students filled in the instrument. The respondents who were not university students and did not own smartphones were not included in the study. For this reason, two questions were asked to see whether they were students and owned smartphones. Moreover, the responses were checked to see whether there was any pattern in the participants' responses. Time stamps of the responses were checked to prevent multiple entries performed by the same participant. It was ensured that participants' responses remained confidential and anonymous. The data collection process lasted 2 weeks. After data collection, the data were placed into a Microsoft Excel document for the initial data check. Then the data were transferred to the Statistical Package for Social Sciences (SPSS).

Data Analysis

The total score of the MPAS was computed, and this total score was used in the analysis as the dependent variable. A two-stage cluster analysis was carried out to examine the prevalence of mobile addiction among university students. Descriptive statistics (e.g., mean, standard deviation, minimum and maximum values) were used to present the data. Independent samples t-tests were performed to investigate whether mobile addiction scores differ by gender, age, and grade level. A one-way ANOVA was conducted to investigate whether mobile addiction scores differ by smartphone use time in a day. Pearson correlation test was used to examine the relationship between smartphone ownership duration, daily use duration, daily check frequency, daily Internet use duration on smartphones, cGPA, and MPAS scores. A multiple linear regression (MLR) analysis was conducted to examine how well smartphone use purposes and situations predict mobile addiction. The factor structure and validity of the MPAS were analyzed through a CFA. The internal consistency of the MPAS was checked through Cronbach's alpha and composite reliability.

Necessary assumptions have been met for the statistical analyses. In particular, normality was assessed using skewness and kurtosis values, which were found at .394 and -.515, respectively. Independent samples t-test requires normal distribution of the differences between scores, homogeneity of variance, and independent scores. ANOVA requires independent observation, normal distribution of scores within groups, and homogeneity of variance (Field, 2009). MLR requires the absence of outliers, normality and homoscedasticity of the residuals, linearity, absence of multicollinearity, and independence of error assumptions (Tabachnick & Fidell, 2007). Before the analysis, these assumptions were met. The data were analyzed using SPSS 22, and the CFA was conducted using AMOS 21 at a .05 significance level. However, to address the multiple comparison problems, the Bonferroni correction technique was used to adjust the alpha levels (Huck, 2012) for research questions two and four.

Results

Prevalence of Mobile Phone Addiction

MPAS scores obtained from MPAS ranged from 9 to 54 with a mean of 26.28 (*SD* = 9.60). To evaluate the prevalence of MPA among university students, two-stage cluster analyses were conducted concerning MPAS scores. A two-cluster solution was created using a log-likelihood distance measure after ensuring that there was no violation of assumptions. The clusters were tagged as more addicted (n = 323, 53.8%) and less addicted (n = 277, 46.2%). The cluster quality was good with an average Silhouette measure of cohesion and separation value of .7. The characteristics of university students who are more addicted and less addicted to their mobile phones have been given in Table 5. The results show that university students clustered as more mobile phone addicted use their smartphones 5.55 hours a day on average, while less addicted students' average daily use time is 3.26 hours. More addicted students use the internet on their smartphones for 4.18 hours a day on average, while this is 2.50 hours for less addicted students. Lastly, while more addicted students check their smartphones 40.92 times a day on average, this frequency is 22.69 for less addicted students.

Table 5. Cluster Characteristics

Cluster	Variable	M	SD	Min.	Max.
More Addicted	MPAS score	33.47	6.65	25	54
	SOD (years)	3.19	2.14	.50	16
	SUD (hours)	5.55	3.41	1	16
	IUD (hours)	4.18	3.03	0	16
	SCF (number)	40.92	55.47	3	500
Less Addicted	MPAS score	17.88	4.16	9	24
	SOD (years)	3.26	2.27	.50	15
	SOD (hours)	3.49	2.56	1	16
	IUD (hours)	2.50	2.17	0	12
	SCF (number)	22.69	39.98	1	500

Note. MPAS: Mobile Phone Addiction Scale score, SOD: Smartphone Ownership Duration, SUD: Smartphone Use Duration, IUD: Internet Use Duration, SCF: Smartphone Check Frequency

Mobile Phone Addiction over Student Characteristics

Independent samples t-tests were carried out to examine whether MPAS scores differ by gender, age, and grade level. The results indicated that there is a significant mean difference between MPAS scores of male and female university students (t (598) = -2.988, p < .01, Cohen's d= .27). Female students (M= 27.08, SD= 9.62) have significantly higher MPAS scores when compared to male students (M= 24.56, SD= 9.36). Regarding age, there was no significant mean difference between MPAS scores of university students who are younger and older than 23 (t (598) = 2.107, p > .01). Regarding grade level, there is a significant mean difference between MPAS scores of undergraduate and graduate university students (t (598) = 2.812, p < .01, Cohen's d= .28). Undergraduate students (M= 26.84, SD= 9.53) have significantly higher MPAS scores when compared to graduate university students (M= 24.15, SD= 9.63). Table 6 provides MPAS scores concerning student characteristics.

Table 6. Mobile Phone Addiction Concerning Student Characteristics

Variables	Category	f	M	SD	t	p
Gender	Female	411	27.08	9.62	-2.988	.003
	Male	189	24.56	9.36		
Age	22 and younger	340	27.00	9.38	2.107	.036
	23 and older	260	25.33	9.83		
Grade Level	Undergraduate	474	26.84	9.53	2.812	.005
	Graduate	126	24.15	9.63		

A one-way ANOVA was conducted to examine whether MPAS scores differ by smartphone use time in a day (morning/midday, evening, night, or equal throughout the day mostly). It was found that MPAS scores differ by smartphone use time in a day (F (3, 596) =6.68, p < .01, η^2= .03). The Scheffe post-hoc test result revealed that there is a significant mean difference between MPAS scores of university students who mostly use their smartphones at night (M=28.79, SD=9.23) and morning/midday (M=22.53, SD=9.63), and between at night (M=28.79, SD=9.23) and evenings (M= 24.94, SD= 8.89).

Relationship between Mobile Phone Usage Behaviors, cGPA, and Mobile Phone Addiction

A Pearson correlation analysis was conducted to examine the relationship between MPAS scores and related variables. The results showed that there is a significant positive moderate correlation between daily internet use duration and MPAS scores (r= .376, p < .01), between daily smartphone use duration and MPAS scores (r= .369, p < .01), and between daily smartphone check frequency and MPAS scores (r= .273, p < .01). Moreover, there is a significant low negative correlation between MPAS scores and cGPA (r= -.112, p < .01). However, there is no correlation between smartphone ownership duration and MPAS scores (r= .010, p > .05). Table 7 presents the correlations between variables of interest.

Table 7. Correlations Between Variables

Variable	IUD	SUD	SCF	cGPA	SOD	MPAS score
IUD	-					
SUD	.740**	-				
SCF	.330**	.292**	-			
cGPA	.173**	-.153**	-.025	-		
SOD	.040	.105*	.025	.021	-	
MPAS score	.376**	.369**	.273**	-.112**	.010	-

Note. ** $p < .01$, * $p < .05$; MPAS score: Mobile Phone Addiction Scale score, SOD: Smartphone Ownership Duration (in years), SUD: Smartphone Use Duration (in hours), IUD: Internet Use Duration (in hours), SCF: Smartphone Check Frequency (in numbers)

Association of Mobile Phone Use Purposes and Situations with Mobile Phone Addiction

Multiple linear regression analyses were conducted to examine how well smartphone use purposes and situations predict MPAS scores. Three smartphone use purposes explained 14.1% of the variance in MPAS scores (R^2= 14.1, F (20, 579) = 4.74, p< .02). It was found that checking social media apps (β = .144, p< .02), messaging (β = .133, p< .02), and editing photos (β = .124, p< .02) significantly contributed to MPAS scores. Table 8 provides multiple linear regression results based on significant variables.

Table 8. Multiple Linear Regression Results

Purposes	B	SE B	β	t	sr^2	R^2	ΔF
						14.1	4.74*
Checking social media apps	.469	.135	.144*	3.47	.02		
Messaging	.204	.073	.133*	2.81	.01		
Editing photos	.144	.052	.124*	2.77	.01		
Situations	B	SE B	β	t	sr^2	R^2	ΔF
						20.4	11.55*
When getting bored	1.98	.592	.129*	3.34	.02		
During lessons	.737	.184	.183*	4.02	.02		
When watching TV or a movie	.164	.073	.097*	2.67	.01		
When alone	.185	.073	.101*	2.55	.01		

Note. * $p < .02$

Four smartphone use situations explained 20.4% of the variance in MPAS scores (R^2=20.4, F (13, 586) = 11.55, p< .02). It was found that when getting bored (β = .129, p< .02), during lessons (β = .183, p< .02), when watching TV or movie (β = .097, p< .02), and when feeling alone (β = .101, p< .02) significantly contributed to MPAS scores.

Discussion

The purpose of this study was to investigate mobile phone addiction among university students concerning student characteristics, mobile phone usage behaviors, and mobile phone use purposes and situations.

Prevalence of Mobile Phone Addiction

This research points out the prevalent use of mobile phones among Turkish university students. The results revealed that students who were clustered as more addicted use their smartphones 5.55 hours a day, connect to the internet from their devices 4.18 hours a day, and check their smartphones 40.92 times a day on average. Bavlı et al. (2018) reported that 36% of the university students in Türkiye spend 4-6 hours with their smartphones a day. Deloitte (2018) noted that smartphone users in Türkiye check their devices an average of 78 times a day, which is about two times above the daily average addiction value, of 40.92. The existing research on Turkish university students also shows the alarming risk of MPA. In the same study, the European countries' average was reported as 48, which clearly shows that the problem has no boundaries. In addition to the results of existing studies, which have reported the descriptive statistics of mobile phone/smartphone use, the current study further suggests 5.55 hours of daily smartphone use as a threshold indicating mobile phone addiction risk. 3.26 hours average daily smartphone use on the other hand was found less addicted with a lower limit score. Additionally, 22.69 times daily smartphone check average, and 2.50 hours daily mobile internet use were found as lower limits for less addicted university students. The clustered data also reveals that more than half of the students (53.8%) in Türkiye were tagged as more mobile phone addicted.

Mobile Phone Addiction over Student Characteristics

Regarding MPA according to student characteristics, being a female at a lower grade level, and using mobile phones mostly at night make students more vulnerable to MPA. Female students have significantly higher MPAS scores when compared to male students. Findings regarding gender and MPA have been inconclusive in the literature. No gender differences were found in mobile addiction and smartphone addiction among college students (B. Chen et al., 2017; Yang et al., 2020). A recent study showed that male students have a higher prevalence of smartphone addiction than female students (Ou-Yang et al., 2023). However, other studies have shown that smartphone usage, the amount of time spent on smartphones, and smartphone/cell phone addiction are higher among female students (Demirci et al., 2015; Nayak, 2018; Roberts et al., 2014). This is quite opposite of the view that males are more invested in technology (Roberts et al., 2014). This gender difference can stem from smartphone usage patterns or purposes of females and males (Demirci et al., 2015; Roberts et al., 2014) as the differences in the way of cell-phone use by males and females can lead to different addictive patterns across the genders (Nayak, 2018). Smartphone use motives and how smartphones are used vary across genders (B. Chen et al., 2017; C. Chen et al., 2017). For female users, perceived enjoyment and pastime influences on smartphone addiction are substantial. That is, female users are more likely to be triggered by intrinsic motives, and this tends to activate their addictive behaviors (C. Chen et al., 2017). Females use and spend more time on social media when compared to males (Varchetta et al., 2020), and they spend more time on texting, and this can be for maintaining and fostering relationships (Roberts et al., 2014). Male students mostly play games, watch videos, and listen to music while female students use multimedia applications and social networking services (B. Chen et al., 2017). Furthermore, when compared to males, females experience more social stress and use their smartphones more for social purposes. This makes them potentially develop habitual or addictive smartphone behavior (Van Deursen et al., 2015). As mobile phone use and self-esteem are negatively associated (Hong et al., 2012), female university students may have low self-esteem. Despite the small difference, males have higher scores on the standard measures of global self-esteem when compared to females (Kling et al., 1999), and a cross-cultural comparison showed that males report higher self-esteem than females (Bleidorn et al., 2016).

Regarding age, there is no significant mean difference between MPAS scores of university students who are younger and older than 23. Additionally, undergraduate students have significantly higher MPAS scores when compared to graduate students. These results are partly in line with previous research studies. Age is negatively related to MPA (Demirci et al., 2015), and it has a negative influence on habitual or addictive smartphone behavior (Van Deursen et al., 2015). Addictive smartphone behavior can also be caused by lower levels of self-regulation (Van Deursen et al., 2015). Under normal circumstances, undergraduate students are younger than graduate ones. Younger students might be having low levels of self-regulation, whereas older ones are less likely to have habitual or addictive smartphone behaviors as their smartphone use for process and social-oriented purposes tend to decrease; they face less social stress; and they are good at self-regulating their behavior (Van Deursen et al., 2015). Briefly, more educated individuals may be more successful in regulating their addictive smartphone behaviors. Moreover, Hong et al. (2012) disclosed that MPA and mobile phone usage were significantly higher among people with low self-esteem. A significant negative association was found between self-esteem, age, and cell phone addiction (Smetaniuk, 2014). Accordingly, undergraduate students may be having low levels of self-esteem. A cross-cultural comparison with 48 nations showed that self-esteem is associated with age-related increases from late adolescence to middle adulthood (Bleidorn et al., 2016). Additionally, MPAS scores differ by smartphone use time in the day in favor of the ones who use their smartphones mostly at night. This can be explained by the fact that students may be finding more free time at night to use their smartphones than at other times during their day.

Relationship Between Mobile Phone Usage Behaviors, cGPA, and Mobile Phone Addiction

For the relationship between mobile phone usage behaviors and MPA, this study showed a positive moderate correlation between the paired combination of daily internet use duration, daily smartphone use duration, and daily smartphone check frequency with MPAS scores. Additionally, there was a high positive correlation between daily smartphone use duration and daily internet use duration. Concerning the internet requiring tasks, the results of a recent study showed that 97% of university students use social media applications; in fact, only 1% of them use social media for educational purposes (Kolhar et al., 2021). The positive relationship between daily smartphone use duration and smartphone addiction was affirmed in another study conducted with younger students (Gezgin et al., 2018). Gezgin et al. (2018) conversely reported a positive relationship between the duration of smartphone ownership and smartphone addiction. Thus, the age of starting to use a smartphone and duration of smartphone use remain open for further inquiry across different age groups. The moderate positive correlation of internet use duration, daily smartphone use duration, daily smartphone check frequency with MPA, and high positive correlation between daily internet use and MPA lead to question marks on the possible relationship between internet addiction and MPA.

Association of Mobile Phone Use Purposes and Situations with Mobile Phone Addiction

Concerning mobile use purposes and situations, among the mobile phone use purposes, checking social media apps, messaging, and editing photos significantly contributed to MPAS scores. Among the use purposes, checking social media apps, messaging, and editing photos significantly explained 14.1% of the variance in MPAS scores. Individuals get

pleasurable experiences potentially acting as rewards while using their smartphones, and in this way, it is plausible that process-oriented smartphone use can develop into habitual use (Van Deursen et al., 2015). If smartphones are used for enjoyment, mood regulation, pastime, and conformity, individuals tend to develop smartphone addiction (C. Chen et al., 2017). Using cell phones for entertainment purposes and for maintaining social and interpersonal relationships can be addictive unlike more utilitarian uses of the cellphones (Roberts et al., 2014). In other words, motives are important factors for the development of MPA (C. Chen et al., 2017). Smartphone use for process-oriented and social-related purposes is a powerful determinant of habitual and addictive smartphone behaviors (Van Deursen et al., 2015). Time spent on social media, especially on Facebook, is the third most time-consuming activity among college students, and time spent on social networking sites can be a good indicator of cell phone addiction (Roberts et al., 2014). A significant number of students use social media applications (Kolhar et al., 2021), and they might find these applications rewarding because individuals with smartphone addiction are more reliant on rewards (Kheradmand et al., 2023). The results of this study confirm that social media apps can cause MPA. Besides, university students might be editing photos to publish on social media apps; therefore, this purpose might be leading to MPA as well. In addition, messaging, including WhatsApp, Messenger, and SMS, is one of the most widely stated purposes of smartphone use (Nayak, 2018; Roberts et al., 2014), and messaging apps usage, especially WhatsApp usage, elevates addictive smartphone behaviors of younger individuals (Zhitomirsky-Geffet & Blau, 2016). This was supported by this study too as the messaging can contribute to MPA. Messaging app's persuasive design might also be supporting this since it was shown that persuasive designs contribute to problematic smartphone use (Chen, Hedman et al., 2023).

Among the mobile phone use situations, when getting bored, during lessons, while watching TV or a movie, and when being alone significantly explained 20.4% of the variance in MPAS scores. Students' minds are occupied with whether they might have received some message or with the information they need to check using their phones (Nayak, 2018). For this reason, they can easily use their smartphones even if they are in the middle of something like watching TV or movies. Students check their phones in the middle of the night or during class time, and these behaviors can reinforce their addiction (Nayak, 2018). Moreover, students use their smartphones continuously during class time so that they do not miss anything on social media (Al-Furaih & Al-Awidi, 2021). As this can be a habit for them to use their smartphones not to miss anything, they can develop addictive smartphone behaviors easily. In today's world, using social networking sites has taken on a routine for young adults for generating several gratifications (Foroughi et al., 2022). Social networking and instant messaging apps are the most utilized smartphone applications (Hussain et al., 2017; Kolhar et al., 2021). When students are bored and alone, they may be using their smartphones more than in other situations for social networking or instant messaging, especially, knowing that Snapchat, Instagram, Facebook, Twitter, TikTok, YouTube, and WhatsApp use are very popular among university students (Kolhar et al., 2021; Smith & Short, 2022; Willoughby et al., 2022). Overall, the students with addiction tendencies typically perceived mobile phones as a consistent partner, a means of getting away, void filler, or a platform for multimedia (Chen, 2023). These also confirm the aforementioned mobile use purposes and situations.

Conclusion

In conclusion, both the data and the existing literature revealed that MPA is an alarming and remarkable problem among Turkish university students. Above 5 hours of daily smartphone use, 4 hours of which is spent on the Internet, and above 40 times the daily average smartphone check are considered characteristics of those students clustered as more mobile phone addicted, and these features are positively correlated with their MPAS scores. Another important conclusion is that females, undergraduate students, and those who use their smartphones mostly at night have more tendency to be classified as more addicted. Lastly, checking social media, messaging, and editing photos significantly contributed to MPAS scores, which explains about 14% of the variance in MPAS scores. Additionally, four situations of smartphone use (when getting bored, being alone, watching TV or something, and during lessons) explained a 20% variance in MPAS scores. Although these are not enough to see the whole picture of mobile phone addiction, it provides one more step to understanding mobile phone addiction among university students. We can conclude that the need for socializing gets students to be more connected with their smartphones like a bridge to connect them with others.

Recommendations

The study shows that there is an alarming risk of MPA among Turkish university students. Half of the students attending this study were clustered as more addicted. Unfortunately, the existing literature shows that the global picture also confirms that this problem is not just limited to Turkish students. Being a female at a lower grade level and using mobile phones mostly at night make students more vulnerable to MPA. Also, students mostly use smartphones to connect with others. Detecting and being aware of the purpose of using smartphones can be useful to help to support these vulnerable groups at least in educational contexts. Designing instructional activities or interventions to get students to use smartphones for educational purposes in class or out-of-class environments and to get students to be aware of excessive smartphone use with its possible health risks are the preliminary implications of this study. Particularly, interventions can be developed considering mobile phone use purposes and situations to prevent MPA. Also, mobile phone use purposes and situations can be used to enhance the educational experiences of university students as well.

Considering the developments in and capacities of mobile phones as well as the emergence of different social media platforms, mobile phone use may have increased even more. Therefore, modeling studies focusing on mobile phone use purposes, use situations, and usage behaviors based on student characteristics can be useful to understand MPA better. Also, these can be obtained by real-time behavioral measurements to provide objective results. In addition, this study can be replicated by using the factor scores instead of the total score of the measurement instrument. Furthermore, there is a bunch of terminologies referring to MPA and/or mobile phone addiction. First, there is an urgent need for standardizing the terminology. The relationship between different types of technology-related addictions such as smartphone addiction, problematic smartphone use, nomophobia, social media addiction, or game addiction, etc. might be significant research topics. What is more, revealing what lies beneath the common point of these addictions and whether it differs by gender, age, grade level and socioeconomic status of the university students should be the main focus of future research studies.

Limitations

The study has a few limitations. Firstly, the sample overrepresented females when compared to the percentage of males. Secondly, the sample mostly consisted of homogenous undergraduate students; therefore, the age distribution of the sample mainly consisted of the early twenties. Future studies should include a heterogeneous broad sample regarding gender, age, and grade level to obtain generalizable results about the MPA of university students.

Ethics Statements

Necessary ethical approval was obtained from the Applied Ethics Research Center of the Middle East Technical University. The participants provided their consent to participate in this study.

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