

ORIGINAL ARTICLE

Relationship between Smartphone Addiction and Nomophobia, Anxiety, Self-Control in High School Students

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Main Points

- Smartphone use is quite common among adolescents, who are in the high-risk group in terms of nomophobia, anxiety, and self-control.
- Smartphone is an indispensable communication tool for high school students, because it allows socialization.
- Smartphone addiction is an important problem that negatively affects the academic success, physical and mental health of individuals.

Abstract

This cross-sectional descriptive study, conducted among 970 high school students, aimed to examine the effects of smartphone use on nomophobia, anxiety, and self-control on high school students. Data were collected with the Personal Information Form, the Smartphone Addiction Scale, the Nomophobia Scale, the Beck Anxiety Inventory, and the Brief Self-Control Scale. It was determined that the students' smartphone addiction was above a moderate level and that smartphone addiction was found to bear an effect on nomophobia, self-control, and anxiety. Evidence-based interventions to minimize smartphone use should be planned and implemented, especially in adolescents, who are reported to be the group at highest risk in terms of addiction.

Keywords: Anxiety, nomophobia, self-control, smartphone addiction, student

Introduction

Technological tools developed with new technology facilitate people's activities in daily life. Currently, the most commonly used tools are smartphones (Anshari et al., 2016). Smartphones, which work like a computer, are used for various purposes in many areas of our daily life, such as connecting to the internet, accessing social media, listening to music, playing games, shopping, taking photos, and navigating (Kanmani et al., 2017; Prasad et al., 2017). According to 2021 data, there are 6.37 billion smartphone users worldwide, and this number is predicted to increase to 7.51 billion in 2026. This gives an idea of how widely smartphones are used. It is known that individuals in the younger age group, whose

adaptation to new technologies is quite fast, use the smartphone more (Statista, 2021). It has become an indispensable communication tool for high school and university students, especially because it allows socialization. Using a smartphone can even be called a characteristic feature of today's youth (Akyürek, 2020; Kumcağız et al., 2020).

Although many features of smartphones can positively affect human life, their excessive and uncontrolled use can cause some social, physical, and psychological problems. One of these problems, nomophobia, defined as the involuntary fear of being deprived of a mobile device, is thought to be the trigger for smartphone addiction (Argumosa-Villar et al., 2017). This situation has become an

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important problem that negatively affects individuals' academic success, and their physical and mental health (Prasad et al., 2017). Studies have shown that with the increase in smartphone use, the degree of nomophobia in individuals also increases (Bartwal & Nath, 2020; Gonçalves et al., 2020).

Nomophobic individuals experience anxiety when they forget to take their smartphones with them, or if their phone batteries remain low or run out, or when they are out of range (Awofala, 2020). A study by Nuri et al. (2021) showed that problematic use of smartphones among high school students increased their anxiety level. Another study, conducted to determine the relationship between the level of nomophobia and anxiety, determined that 73% of the students were nomophobic and 83% of them had increased anxiety if their smartphones were not accessible (Sharma et al., 2015). It has also been revealed that nomophobia is seen more among high school students who attach great importance to communication and that they also experience many psychological problems (Melsi et al., 2020).

Nomophobia can also cause situations that lead to loss of self-control over one's life (constantly checking the smartphone, especially before going to sleep at night and when waking up in the morning, carrying a charger with you, keeping the smartphone switched on for 24 hours, and going to sleep with the smartphone) (Tavolacci et al., 2015). Self-control is thought to be highly related to smartphone addiction. Students with low self-control are prone to problematic phone use and experience more psychological problems because they are unable to control themselves (Servidio, 2021). In a study conducted to examine the behaviors of students who are prone to nomophobia, it was concluded that with problematic smartphone use, self-control over behaviors is often lost (Geng et al., 2021).

These data show that smartphone use is quite common among adolescents, who are in the high-risk group in terms of nomophobia, anxiety, and self-control (Kaplan & Gezgin, 2016; Polat, 2017). Studies on the use of smartphones among high school students were found in the literature (Çakır & Oğuz, 2017; Dirik, 2016; Gültekin & Mazılı, 2020), but no study was found examining its effects on nomophobia, anxiety, and self-control. Therefore, this study aims to examine the effects of smartphone use on nomophobia, anxiety, and self-control among high school students, who think about their smartphones whenever mobile devices are mentioned. It will contribute to the literature because it is the first study on the subject, and the subject concerns a current issue.

Methods

Sample and Application

This descriptive, cross-sectional study was carried out among students of high schools located in a city center in the west of Turkey, between September 2020 and June 2021. The universe of this research comprised 1180 high school students (of grades 9, 10, 11, and 12) during the 2020 – 2021 academic year. The sampling method was not used in the research, and all students volunteering to participate in the research were included. Accordingly, a total of 970 (participation rate: 82.2%) high school students participated in the study.

The criteria for inclusion in the study were: being a student in high school, having a smartphone, and volunteering to participate in

the study. The exclusion criteria were: not having a smartphone and not volunteering to participate in the study.

Data Collection Tools

Data were collected through a form created using Google Forms. The Personal Information Form, the Smartphone Addiction Scale – Short Version (SAS), the Nomophobia Scale – Questionnaire (NMP-Q), the Beck Anxiety Inventory (BAI), and the Brief Self-Control Scale – Short Form (BSCS) were used as data collection tools.

Personal Information Form

This form was prepared by the researcher by scanning the literature (Zhang et al., 2021; Dirik, 2016). The form consists of questions related to the sociodemographic variables of high school students, such as gender, class, and smartphone usage habits.

Smartphone Addiction Scale – Short Version (SAS-SV)

The Smartphone Addiction Scale (SAS-SV) is a 6-point Likert-type scale developed by Kwon et al. (2013) to measure the risk of smartphone addiction among adolescents. The scale comprises 10 items, the responses to which are scored between 1 and 6. The total scores range between 10 and 60. Higher scores for the scale indicate a higher risk of addiction. Cronbach's alpha coefficient for the original version of the scale is .91. Noyan et al. (1998) conducted the Turkish validity and reliability studies of the scale. Using the scale in this study, Cronbach's alpha value was found to be .91.

Nomophobia Scale – Questionnaire (NMP-Q)

The Nomophobia Questionnaire (NMP-Q) was developed by Yildirim and Correia (2015) and adapted to Turkish by Yildirim et al. (2016). It consists of a seven-point Likert-type scale of 20 items (Cronbach's α , .92). Each of the 20 questions in the scale is scored by the participants, such that 1 point = absolutely disagree, 7 points = strongly agree. In all, 20 – 140 points can be obtained from the Nomophobia Scale. A score of 20 points on the scale indicates that the individual does not have nomophobia, a score between 20 and 60 points indicates mild nomophobia, a score between 60 and 100 points indicates moderate nomophobia, and a score between 100 and 140 points indicates excessive nomophobia. The use of the scale in this study showed Cronbach's alpha value to be .90.

Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory (BAI) is a scale consisting of 21 items developed by Beck et al. (1988) to measure anxiety symptoms. It is a Likert-type scale consisting of 21 items and scored between 0 and 3. One option of "None," "Mild Degree," "Medium Degree," or "Severe" must be marked for each item. The highest score is 63 points. A high score indicates the severity of anxiety, and a score of 0 – 7 points indicates no anxiety, 8 – 15 points indicate mild anxiety, 16 – 25 points indicate moderate anxiety, and 26 – 63 points are divided into four categories. Ulusoy et al. (1998) conducted the Turkish validity and reliability studies of the scale (test-retest reliability coefficient $r = .57$). In our study, the Cronbach's alpha value was found to be .78.

Brief Self-Control Scale – Short Form (BSCS)

The Brief Self-Control Scale – Short Form (BSCS) is a scale consisting of 13 items, developed by Tangney et al. (2004), to measure

self-control. It is a Likert-type scale and is scored between 1 and 5. Nebioğlu et al. (2012) conducted the Turkish validity and reliability studies of the scale (Cronbach’s α , .79). In our study, the Cronbach’s alpha value was found to be .80.

Statistical Analysis

Statistical analysis of the data was performed using the SPSS 22.0 (IBM SPSS Corp., Armonk, NY, USA) package program. For the data analysis, the percentage, mean \pm SD, *t*-test, one-way analysis of variance, Tukey’s test, and Pearson’s correlation coefficient were used. Multiple regression analysis was used to determine the effects of independent variables on dependent variables. The significance level in the tests was taken as $p < .05$.

Table 1.
Personal Characteristics of Students (n = 970)

Variables	n	%
Gender		
Female	320	33.0
Male	650	67.0
Grades		
9	55	5.7
10	271	27.9
11	433	44.6
12	211	21.8
Daily smartphone use		
0 – 2 hours	123	12.7
2 – 4 hours	388	40.0
4 – 6 hours	433	44.6
6 hours and more	26	2.7
Daily smartphone check		
1 – 10 times	81	8.4
11 – 20 times	403	41.5
21 – 30 times	335	34.5
31 – 40 times	151	15.6
Carrying a charger		
Yes	283	29.2
No	687	70.8
Spending time with a smartphone before going to sleep		
Yes	778	80.2
No	192	19.8
Checking the smartphone when you wake up in the morning		
Yes	598	61.6
No	372	38.4
Turning off the smartphone while sleeping		
Yes	350	36.0
No	620	64.0

Results

Sixty-seven percent of the students who participated were male, 44.6% of them were in the 11th grade, and 44.6% of them reported that they use a smartphone for 4 – 6 hours a day. In addition, 41.5% reported that they check their smartphone 11 – 20 times a day, 80.2% spend time with their smartphone before going to sleep, 61.6% check their smartphone when they wake up in the morning, and 64.0% do not turn off their smartphone while sleeping (Table 1).

The mean scores of the students participating in the study revealed that they had a smartphone addiction that was above a moderate level, with an average score of 38.21 ± 12.03 , they experienced above-moderate nomophobia with an average score of $93.65 + 4.91$, their self-control was moderate, with an average score of $41.73 + 7.86$, and they experienced moderate anxiety, with an average score of $16.76 + 13.11$ (Table 2).

The Smartphone Addiction Scale scores of the 11th graders who revealed that they use a smartphone for 4 – 6 hours a day, check their smartphones 31 – 40 times, carry a charger, check their smartphones when they wake up in the morning, and do not turn off the smartphone while sleeping, were found to be high and statistically significant ($p < .05$). The Nomophobia Scale mean scores of those who reported that they use smartphones for 6 hours or more daily, check their smartphones 31 – 40 times, carry a charger, check their smartphones when they wake up in the morning and do not turn off the smartphone while sleeping, were found to be high and significant ($p < .05$), (Table 2). The self-control scale scores of those who answered that they use smartphones for 0 – 2 hours a day and check their smartphones 1 – 10 times a day, and who do not check their smartphone when they wake up in the morning, were found to be high and statistically significant ($p < .05$). Moreover, the anxiety scale scores of those who use smartphones for 6 hours or more daily, carry a charger, and check their smartphone when they wake up in the morning were found to be high and significant ($p < .05$) (Table 2).

In Table 3, the correlation between smartphone addiction, nomophobia, self-control, and anxiety was examined. It was determined that the relationship between smartphone addiction and nomophobia was positive and high ($p < .01$; $r = .83$); between smartphone addiction and self-control, was moderately negative ($p < .01$; $r = -.59$); and between smartphone addiction and anxiety, was positive and weak ($p < .01$; $r = .27$).

The regression table was drawn to explain the effect on smartphone addiction of nomophobia, self-control, and anxiety. Accordingly, it was determined that nomophobia, self-control, and anxiety were effective factors in smartphone addiction. Nomophobia, self-control, and anxiety explained smartphone addiction at the level of 58.0% ($R^2 = .587$; $p = .00$), (Table 4).

Discussion

Today, changes in communication and information technology continue rapidly. These changes and developments can cause harm and also yield benefit. In this study, the effects of smartphone addiction on nomophobia, self-control, and anxiety, and their relationship with various variables were examined.

Table 2.
Distribution of Scale Scores on Personal Characteristics of Students ($n = 970$)

Variables	n	Mean + SD			
		SAS	NMP-	BSCS	BAI
Mean+SD (Scale)		38.21 + 12.03	93.65 + 4.91	41.73 + 7.86	16.76 + 13.11
Gender					
Female	320	37.95 + 12.31	91.95 + 5.81	42.24 + 7.42	16.69 + 13.11
Male	650	38.55 + 11.62	92.61 + 9.11	41.07 + 8.39	15.92 + 11.53
Grades					
9 ¹	55	33.72 + 9.18	90.12 + 4.35	40.12 + 5.75	15 + 98 + 7.28
10 ²	271	36.18 + 10.17	91.74 + 5.91	41.98 + 6.92	15.68 + 5.21
11 ³	433	38.33^{b+} + 11.12^{**}	91.27 + 3.98	41.76 + 7.28	16.28 + 4.02
12 ⁴	211	37.42 + 8.75	93.12 + 3.11	41.57 + 10.12	16.12 + 3.18
Differences (post hoc)		***3>1; 4>1			
Daily smartphone use					
0 – 2 hours ¹	123	31.95 + 5.75	90.02 + 9.19	44.28^{b+} + 5.12[*]	15.02 + 2.38
2 – 4 hours ²	388	36.78 + 9.62	93.12 + 12.18	41.07 + 7.42	16.28 + 5.02
4 – 6 hours ³	433	38.62^{b+} + 9.28^{**}	93.65 + 17.49	41.24 + 4.28	18.10 + 7.57
6 hours and more ⁴	26	38.21 + 10.12	94.28^{b+} + 19.79[*]	38.12 + 5.20	19.16^{b+} + 6.58[*]
Differences (post hoc)		***3>1	***4>1	***1>4	***4>1
Daily smartphone check					
1 – 10 times ¹	81	33.12 + 11.98	88.92 + 11.03	45.28^{b+} + 6.32[*]	14.38 + 9.31
11 – 20 times ²	403	35.57 + 9.68	90.18 + 5.88	42.12 + 3.75	16.28 + 7.02
21 – 30 times ³	335	38.21 + 11.33	93.27 + 6.10	41.98 + 10.75	15.98 + 7.28
31 – 40 times ⁴	151	39.01^{b+} + 5.28^{**}	95.02^{b+} + 10.12[*]	37.62 + 5.78	16.28 + 5.21
Differences (post hoc)		***4>1; 4>2	***4>1; 4>2		
Carrying a charger					
Yes	283	43.65^{a+} + 11.98^{**}	96.28^{a+} + 5.65^{**}	40.92 + 7.23	18.28^{a+} + 9.21[*]
No	687	33.12 + 5.75	90.08 + 5.12	41.98 + 10.28	14.02 + 7.92
Spending time with a smartphone before going to sleep					
Yes	778	38.57 + 9.15	92.18 + 5.28	41.02 + 7.28	15.48 + 8.72
No	192	37.28 + 10.92	92.61 + 4.35	41.21 + 10.92	16.78 + 10.76
Checking the smartphone when you wake up in the morning					
Yes	598	40.05^{a+} + 28.12[*]	97.75^{a+} + 10.52^{**}	39.71 + 5.70	18.92^{a+} + 10.12[*]
No	372	36.22 + 10.01	90.02 + 3.88	44.28^{a+} + 12.01[*]	13.41 + 3.92
Turning off the smartphone while sleeping					
Yes	350	36.93 + 6.35	88.89 + 10.11	41.14 + 7.28	15.75 + 7.28
No	620	40.75^{a+} + 10.21[*]	96.95^{a+} + 3.28^{**}	41.98 + 5.75	16.22 + 3.24

* $p < .05$; ** $p < .01$; ***Tukey's Test. ^at-Test; ^bANOVA test. SAS = Smartphone addiction scale; NMP-Q = Nomophobia Questionnaire; BSCS = Brief Self-Control Scale; BAI = Beck Anxiety Inventory. ^{1,2,3,4}It determines difference is caused by which.

The high school students who participated in the study were found to have smartphone addiction above-moderate levels. No significant difference was found according to the gender variable. The average smartphone addiction score of students who

reported that they use a phone for a longer period daily, check their phone frequently, carry a charger with them, and do not turn off their phone while they slept, was statistically significant and high.

Table 3.
The Correlation Between SAS, NMP-Q, SCS, and BAI (N = 970)

	SAS	NMP-Q	BSCS	BAI
SAS	1.00			
NMP-Q	0.83*	1.00		
BSCS	-0.59*	-0.52*	1.00	
BAI	0.27*	0.51*	-0.32*	1.00

Pearson's Moments Multiplication Correlation, *p < .01.

Similar to this study, in a study conducted with high school students, it was determined that smartphone addiction is higher in those who carry a charger, use a phone for a longer time, check their phone as soon as they wake up, and do not turn off their phone at night, while the gender variable did not affect addiction (Göktaş, 2019). Similarly, in the study conducted by Gezgin et al. (2016) on the determination of smartphone addiction in students, it was determined that students who use the phone for a long time daily and check their phones frequently are more addicted. In these studies, it was interpreted that individuals who are addicted to smartphones are expected to carry their chargers with them and constantly check their phones due to their constant use of phones, while the findings of this study also support the interpretation.

It is seen that smartphones, which offer countless conveniences in our daily lives, also bring problems that affect people's life routines. This study focused on nomophobia – the fear of being deprived of a mobile device – which triggers smartphone addiction. The students were found to have above-average nomophobia. Another similar study also concluded that the nomophobia level of the students was above the average (Adnan & Gezgin, 2016). In the study, the relationship between various variables and nomophobia was examined. While no significant difference was found in the level of nomophobia according to the gender variable, it was established that the level of nomophobia was higher and more significant in students who use smartphones for longer periods during the day, check their phones frequently, carry a charger with them, and do not turn off their phones at night.

In similar studies, it has been found that the level of nomophobia is higher in those who use their smartphones for longer periods during the day, carry a charger, check their phones more frequently (Janki & Bhola, 2020), and do not turn off their phones at night (Tavolacci et al., 2015). As in this study, there are

similar studies in which it was determined that the gender variable did not affect the degree of nomophobia (Erdem et al., 2017; Mohammadi Nasab et al., 2021; Öz & Tartop, 2018). These results are similar to the results of this study. The fact that individuals check their smartphones as soon as they wake up in the morning, spend longer time with their smartphones, and make an effort to keep them on for 24 hours, shows the importance they place on future notifications from their smartphones. By an in-depth examination of the causes of these findings, the characteristic features of nomophobia can be more clearly revealed.

The study determined that smartphone-addicted and nomophobic students experience moderate anxiety. It was detected that the anxiety of the students who use a smartphone for a longer time, check their phone when they wake up in the morning, and carry a charger with them is significantly higher. As a result of a study conducted by Sharma et al. (2015) with medical students, it was determined that approximately 73% of the students were nomophobic and 83% had panic attacks when their mobile devices could not be accessed. In similar studies conducted to examine the relationship between smartphone addiction and anxiety, it was established that people experience psychological problems such as stress and anxiety as a result of long-term smartphone use and increased screen exposure (Kim et al., 2018; Lee et al., 2016). Running out of battery or being unable to reach the phone is a situation that creates anxiety in nomophobic individuals. Therefore, it is proposed that these individuals need to check their phones many times a day. The results of the study also support this interpretation.

Self-control is the ability to control one's self, and not every individual has the same level of self-control (Bermúdez, 2021). In the study, it was determined that the self-control of students was moderate, and the self-control of students who used fewer phones and controlled less was higher and statistically significant. In a study, it was determined that young people who are addicted to smartphones lose their self-control over their daily behaviors with long-term phone use (Jeong et al., 2020). In a similar study, it was concluded that the self-control of young people who are addicted to smartphones is quite low (Polat, 2017). In the study of Kim et al. (2016), it was indicated that those with a tendency to smartphone addiction have low self-control. It is seen that these results are similar to the results of the study.

The study established that there is a positive and significant relationship between smartphone addiction and nomophobia and anxiety, and a negative significant relationship with self-control. Considering that nomophobia triggers smartphone addiction, it has been reported that the level of addiction may increase if

Table 4.
Regression Table of the Effect on SAS of NMP-Q, BSCS, and BAI (N = 970)

Dependent Variable	Independent Variable	β	t	p	R ²	Adj. R ²	F
	Constant		5.348	.00*	0.587	0.579	59.879
SAS	NMP-Q	5.818	6.052	.00*			
	BSCS	-0.409	-4.876	.00*			
	BAI	3.145	4.052	.00*			

*p = .00, R = regression coefficient.

nomophobic individuals are not provided interventional treatment (Göktaş, 2019). In a review of studies on the subject, it was determined that the level of nomophobia increased as smartphone addiction increased, along with anxiety, and that there was a positive relationship between them (Gezgin & Çakır, 2016). A study conducted by Grant et al. (2016) with university students concluded that smartphone addiction increases the level of depression and anxiety and decreases the self-control of individuals. A study conducted in Korea concluded that smartphone addiction mostly affects adolescents, which is our study group, and that this group is vulnerable to smartphone addiction. In the same study, it was observed that as smartphone addiction increased, adolescents' self-control decreased (Jo et al., 2018). Similarly, another study conducted with high school students found a negative significant relationship between the smartphone addiction levels of adolescents and their self-control levels (Polat, 2017). A study examining the relationship between self-control and anxiety determined that students with low self-control were in the at-risk group in terms of anxiety and that there was a negative relationship between them (Servidio, 2021). These results seem to be similar to those of our study.

As a result of the multiple regression analysis applied in the study, it was determined that the students' nomophobia, self-control, and anxiety levels affected smartphone addiction by 58%. According to the results of multiple regression analysis applied in another study, it was revealed that self-control and anxiety have a significant effect on smartphone addiction levels (Qiufeng et al., 2021). Yet another study indicated that the degree of nomophobia is a very important factor in the degree of smartphone addiction (Göktaş, 2019).

According to the results of this study, smartphone addiction was found have an effect on nomophobia, self-control, and anxiety. Adolescents, who are seen as the group at the highest risk in terms of smartphone addiction, can be encouraged to participate in social activity programs so that they do not spend much time on the phone and do not have the fear of separation. Since the term nomophobia is new, the awareness of its danger is low, which increases the risk day by day; therefore, studies focusing on increasing awareness of this issue can be conducted. Awareness studies can be carried out on both the dangers and the convenience of technology. Since families have the greatest responsibility in these matters, families should also be guided on the subject, and seminars on smartphone addiction and the struggle to overcome it can be organized.

We live in an age of technology, and it is not possible for students to completely abandon the use of smartphones. However, evidence-based interventions to minimize smartphone use should be planned and implemented, especially among adolescents, who are reported be the group facing the highest risk in terms of addiction. Nurses, who play an important role in the development of public health, should inform both adolescents and other at-risk groups in society about smartphone addiction and the dangers that may accompany it.

Limitations and Directions/Suggestions for Future Research

This study has some limitations. The study data were gathered from high school students in a province in the west of Turkey; this can be considered as a limitation in terms of generalizing the study results

for the entire population. In addition, the collection of data online, due to the pandemic, may be another limitation of the study.

In contrast, this is the first study to examine the effects of smartphone addiction on nomophobia, self-control, and anxiety among high school students. The internet usage rate of the young population is very high and is increasing, thanks to this generation of smartphones which can provide internet access from any location. Smartphone usage times increase in daily life, social life, and in relationships, and create negative effects. These negative effects can lead to a form of addiction. The findings of this study will guide the future studies to be conducted with high school students on smartphone addiction and its risks. In addition, it is thought that it would be beneficial to have the study group comprising students from different education levels (primary and secondary school students), since the use of smartphones falls at younger ages.

Ethics Committee Approval: Permission for the study was given by the high schools in the city center, and ethical approval was obtained from the Human Research Ethics Committee of a university on August 31, 2020, with approval number 855.

Informed Consent: Informed consent was obtained from the participants who agreed to participate in the study online.

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