The Relationship between Problematic Use of Smartphones and Social Anxiety

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Abstract: This study investigated the smartphone use as the indicators of smartphone addiction and their associations with social anxiety as related variables. Problematic use of smartphones which is well known to be associated with anxiety might act as a common underlying factor explaining social anxiety disorder. This study aims to analyze the associations between mobile phone dependence and social anxiety disorder and to find possible predictors of social anxiety.

Methods: Smartphone addiction assessed using the 20-item Nomophobia Questionnaire (NMP-Q) and Smartphone addiction scale (SAS). Liebowitz Social Anxiety Scale (LSAS) was used to determine social anxiety. The correlational analysis used to investigate the relationship between smartphone addiction and social anxiety. Linear regression conducted to calculate the predictors of social anxiety based on smartphone addiction parameters.

Results: It is revealed that the level of social anxiety and smartphone addiction scales are positively correlated. Linear regression models for male and female participants showed different predictors of social anxiety.

Conclusions: The study provides deeper insights into smartphone use and smartphone addiction as predictors of social anxiety in young people and concluded lesser dependence of males' social anxiety on smartphone addiction level than the females'.

Keywords: Smartphone addiction, nomophobia, smartphone dependence, social anxiety.

INTRODUCTION

The Internet brings many benefits to our lives. Over the last years, the global internet-using population has grown [1]. It is an undeniable fact that the Internet is beneficial for a variety of purposes, such as convenient electronic commerce, rapid sharing of information and contact with other cultures, emotional support and entertainment [2]. The Internet is gradually getting easier and more accessible at a very early age due to improvements in mobile technology and the commonness of smartphones. Males and females spend about the same amount of time online, and some of that time spent differently. At least ten per cent of the students exhibit some problematic behaviours related to spending too much time on the Internet [3].

A smartphone combines the services of the Internet and a mobile phone. Smartphones offer qualitatively different services in addition to the benefits that the Internet does. Both portability and accessibility of a smartphone make it possible to be used anywhere, for any duration.

Smartphone addiction is similar in many aspects of Internet addiction. However, there are also some differences, such as portability, instant and continuous Internet access, easy and direct communication features of smartphones [4]. Behaviour addictions, including smartphone addiction, are generally difficult to define because they relate not only to physical but also to social and psychological factors [5]. The discussions on mobile phone addiction [6-9] have more recently evolved into smartphone addiction.

The research [10] showed that some people become so attached to their devices that they experience high anxiety when they are not with them. It proofs the fact that smartphones have become an essential part of daily life. Considering the fact that nomophobia has become very widespread across the world, the importance of the effects of mental anxiety and the fear on individuals' attitudes and behaviours has increased greatly. We should admit that the nomophobia influences and cause sleep disturbance, depressive states and the formation of intellectual disabilities of users. According to Scientific American, the dependence in nomophobia has critical psychological consequences. It is reported that the research on transactive memory finds that when we have reliable external sources of information about particular topics at our disposal, this reduces our motivation and ability to acquire and retain knowledge about that specific topic [11].

Concerning mental health, recent studies showed that increased smartphone use might be related to sleep disturbances [12]. Additionally, growing

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frequency and time spent on smartphones is closely associated with the severity of smartphone addiction [5, 13]. The survey [14] proved that smartphones are used mostly excessively at night, and most of the respondents experienced initial insomnia and symptoms of depression. More studies on smartphone addiction prove that the overuse of smartphone may become a factor to cause depression [15]. The findings of the study investigating the relationship between early maladaptive schemas (EMSs) and smartphone addiction showed that those who have a higher score on the EMSs were more likely to become addicted to smartphones [16]. The effects of insomnia on mental health is well known. The studies have reported bidirectional associations between insomnia symptoms and depression/anxiety [17]. Relationships between anxiety, depression and other addictive technological behaviours were also reviewed [18]. Nevertheless, not much is known about the correlation between problematic use of smartphones and the levels of social anxiety.

With all above in mind, this paper goal is to analyze the associations and possible predictive effects of smartphone addiction and the levels of social anxiety.

MATERIALS AND METHODS

Participants

Before the experiment, we had obtained the expert approval for the research procedure and materials from Tetiana Scherban, Dr.Sc. in Psychology, Prof., rector of Mukachevo State University. Following this, the Science and Technology University Board of acting as ethics committee gave consent to run the research as they considered it advantageous and as the one which might have beneficial results. Additionally, we had provided the focus group of students with sufficient information about the experiment so that they could make an informed decision whether to get involved in the research or to withdraw from it freely. The participation was voluntary.

There were 300 (168 females, 132 males) participants who were all from Mukachevo State University, Ukraine. All participants were asked if they were using smartphones before forming a group. Participants' ages range from 15 to 22. The sample was selected by using a non-probability sampling technique according to accessibility to the researchers.

Measures

The data was collected using a self-report questionnaire, which consisted of:

1. Nomophobia Questionnaire (NMP-Q). The NMP-Q is a 20-item scale developed by Yildirim and Correia [19]. The NMP-Q comprises four factors (Factor 1: not being able to communicate; Factor 2: losing connectedness; Factor 3: not being able to access information; Factor 4: giving up convenience). These factors emerged from semi-structured interviews during the qualitative phase. More specifically, the four-factor structure among the 20-item instrument was supported in the exploratory factor analysis. The Cronbach's α was excellent across the entire NMP-Q (α = .945) and in each factor (α = .814–.939). Concurrent validity was achieved through its high correlation with Mobile Phone Involvement Questionnaire (MPIQ; r = .71. A 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) is applied to each NMP-Q item leading to a summated total score. The higher the score is, the greater is the severity of nomophobia. Additionally, the interpretation of the NMP-Q scores into the level of nomophobia (out of a total score between 20 and 140). 20 is corresponding to the absence; 21–59 is corresponding to a mild level; 60–99 is corresponding to a moderate degree; and ≥100 is corresponding to a severe level [19].

2. The Smartphone Addiction Scale (SAS), was originally developed in Korean, but it has also been published in English. It is a contemporary scale developed to assess problematic smartphone use [4]. The short version of SAS (SAS-SV; [20] is among the most widely used instruments with validated translations into Turkish [21], Italian [22], Spanish, French [23], and Arabic [24], making it a useful instrument for cross-cultural comparisons and further research. The SAS-SV contains 10 items, and each uses a Likert scale of 1 (strongly disagree) to 6 (strongly agree). The sum of these items gives an overall SAS-SV score (range: 10–60) with a higher score indicating PSU. The measure's items were selected from the original Smartphone Addiction Scale (SAS) based on their validity as established through review by 7 experts [4]. The SAS-SV addresses the following 5 content areas: (1) 'daily-life disturbance', (2) 'withdrawal', (3) 'cyberspace-oriented relationship', (4) 'overuse', and (5) 'tolerance'.

3. The Liebowitz Social Anxiety Scale (LSAS) is a clinician-administered scale that assesses fear and avoidance in 24 situations that are likely to

elicit social anxiety [25]. Thirteen of the items enquire about performance situations (e.g. reporting to a group, eating in public places), while the remaining 11 situations assess social interaction situations (e.g. going to a party, meeting strangers). For each of the 24 situations, clinicians derive ratings of fear and avoidance experienced by the respondent in the past week using 0–3 Likert-type scales. Six subscales can be derived from the ratings: 'Fear of Social Interaction', 'Fear of Performance', 'Avoidance of Social Interaction', 'Avoidance of Performance', 'Total Fear' and 'Total Avoidance'. An overall total score may also be derived by summing the fear and avoidance ratings for all items. The LSAS is used in most clinical trials of medications for social anxiety disorder and different studies evaluating the efficacy of cognitive-behavioural treatments as well.

Data Analyses

SPSS Statistics 22 (Chicago, IL, USA) was used for statistical analysis. The comparison between the groups was performed using t-test. Correlational analysis was used to investigate the relationship between smartphone addiction and social anxiety.

Regression models were built to find significant predictors of social anxiety.

RESULTS

Preliminary Analyses

Among the total sample (n = 300), 82 participants (27.3%) could be identified as having smartphone addictions. Descriptive characteristics of the sample are shown in Table **1**.

Out of 300 participants, 132 (44%) were males, and 168 (56%) were females. Their SAS-SV scores were 25.96 and 27.64, and LSAS-SR scores 44.45 and 39.27 respectively. Both scales showed significant difference (p<0.001). NMP-Q scores were 61.34 and 62.95, which showed no statistically significant difference between the groups.

As for the use of smartphones, the average hours were 2.43 during weekdays and 3.12 during weekends. We divided all participants into 3 categories: less than 1 hour, 1-3 hours and more than 3 hours of daily use. Difference between the groups on all used instruments was statistically significant. It allowed us to conclude that the time of everyday use could be a valid predictor

Table 1: Socio-Demographic Characteristics and Mean Scores of Participants

Variables		N (%)	NMP-Q Mean±SD	LSAS-SR Mean±SD	SAS - SV Mean±SD	p
Gender	Male	132 (44)	61.34 (23.06)	44.45 (17.56)	25.96 (8.57)	<0.001
	Female	168 (56)	62.95 (22.05)	39.27 (16.61)	27.64 (7.08)	
Age group	16-18	138 (46)	56.45 (22.27)	37.23 (15.96)	25.79 (7.98)	<0.001
	18-22	162 (54)	66.79 (21.62)	44.95 (17.41)	27.77 (7.58)	
Self-evaluation of smartphone addiction	Non-addiction	162 (54)	47.54 (14.05)	33.59 (9.77)	23.45 (7.65)	<0.001
	Addiction	75 (25)	90.60 (13.58)	63.36 (13.04)	35.45 (2.73)	
	Don't know	63 (21)	66.29 (11.49)	36.05 (14.16)	25.61 (3.19)	
Time of daily smartphone use	<1h.	30 (10)	36.10 (16.32)	25.00 (6.58)	23.06 (8.94)	<0.001
	1-3h.	168 (56)	60.32 (19.37)	38.04 (14.89)	25.27 (7.60)	
	>3h.	102 (34)	73.09 (21.74)	52.21 (16.71)	30.71 (6.29)	
Purpose of smartphone use	Messaging and social networking	123 (41)	58.90 (23.56)	38.44 (17.35)	28.06 (7.74)	.079
	Playing games	57 (19)	67.11 (23.64)	49.32 (18.00)	27.19 (8.22)	
	Watching TV/films/video	54 (18)	65.22 (26.12)	46.22 (18.23)	27.31 (7.68)	
	Etc.	69 (23)	61.82 (15.03)	36.82 (12.24)	24.17 (7.41)	
Total		300 (100)	62.24 (22.40)	41.55 (17.14)	26.90 (7.78)	-

Notes. NMP-Q - Nomophobia Questionnaire results, LSAS-SR - Liebowitz Social Anxiety Scale results, SAS - SV - Smartphone Addiction Scale short version, p - significance level using Student's t-test.

Table 2: Correlations of Variables on Outcome Measures

Scale		NMP-Q	Fear of Perf	Avoidance of Perf	Fear of Interact	Avoidance of Inter	Total Fear	Total Avoid	Total LSAS	SAS-SV	Gender	Self-valuation	Time	Age
NMP-Q	Correlation	1												
	Sig. (2-tailed)													
Fear of Perf	Correlation	.716**	1											
	Sig. (2-tailed)	.000												
Avoidance of Performance	Correlation	.694**	.806**	1										
	Sig. (2-tailed)	.000	.000											
Fear of Interact	Correlation	.694**	.807**	.717**	1									
	Sig. (2-tailed)	.000	.000	.000										
Avoidance of Interaction	Correlation	.579**	.665**	.670**	.744**	1								
	Sig. (2-tailed)	.000	.000	.000	.000									
Total Fear	Correlation	.742**	.953**	.802**	.948**	.741**	1							
	Sig. (2-tailed)	.000	.000	.000	.000	.000								
Total Avoid	Correlation	.696**	.804**	.912**	.800**	.915**	.844**	1						
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000							
Total LSAS	Correlation	.750**	.920**	.889**	.915**	.856**	.965**	.955**	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000						
SAS-SV	Correlation	.394**	.328*	.232*	.210**	.182	.241**	.245**	.261**	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.022					
Gender	Correlation	.036	-.058	-.212*	-.129	-.152	-.098	-.199*	-.151	.107	1			
	Sig. (2-tailed)	.724	.564	.034	.200	.132	.333	.048	.134	.288				
Self-valuation	Correlation	.493**	.330**	.197*	.195	.090	.278**	.156	.230*	.257**	.062	1		
	Sig. (2-tailed)	.000	.001	.050	.052	.375	.005	.120	.021	.010	.537			
Time	Correlation	.457**	.480**	.422**	.469**	.417**	.499**	.459**	.500**	.351**	.116	.221*	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.251	.027		
Age	Correlation	.183	.137	.140	.145	.233*	.148	.204*	.181	.131	-.004	.120	-.062	1
	Sig. (2-tailed)	.069	.175	.166	.151	.020	.142	.042	.071	.195	.972	.234	.537	

Notes:
**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

both for the development of smartphone addiction and social anxiety.

Based on the conducted research on 300 students, the use of the messaging and social networking was the primary purpose of a smartphone 123 (41%), followed by 57 (19%) students who used them for playing games. Entertainment purposes such as listening to music, watching movies were the major purposes for 54 (18%) of the participants.

In the self-assessment of smartphone addiction, 75 (25%) students considered themselves as addicted to smartphones, 162 (54%) students considered themselves as not addicted to smartphones, and 63 (21%) students were unsure. The questionnaires' scores had a statistically significant difference (p<0.001) among all three groups.

Our main analysis was centered on correlating our measured variable (Table **2**) and building regression models for male and female participants. First, participants' LSAS scores were positively correlated with NMP-Q score, $r = -0.750$, $p < 0.001$, as well as SAS-SV score, $r = 0.261$, $p = 0.022$. Moreover, participants' self-valuation of internet addiction was related to NMP-Q score, $r = 0.493$, $p < 0.001$, LSAS score, $r = 0.230$, $p = 0.021$ and SAS-SV , $r = 0.257$, $p = 0.001$ as well as the time they were using smartphones on daily basis with NMP-Q, $r = 0.457$, $p < 0.001$, LSAS, $r = 0.5$, $p < 0.001$ and SAS-SV, $r = 0.351$, $p < 0.001$.

Having observed significant differences between male and female, all associations tested two-sided for significance and correlations between the male and female samples were compared using the Fisher's z-tests. When testing the associations between LSAS scores and NMP-Q and SAS-SV scores the following Bonferroni correction was applied to control for multiple testing issues: $\alpha = .05/5 = 0.01$ (as we got the associations between total score of LSAS and NMP-Q and SAS-SV scores). After Bonferroni correction in the complete and the female samples, all associations between all scores remained significant.

Regression Models

At the next step a linear regression was used to calculate the prediction power of social anxiety based on smartphone addiction scales (NMP-Q and SAS-SV), self-valuation of smartphone addiction, the purpose of smartphone use, daily use on smartphone and age group separately for female (Table **3**) and male (Table **4**).

An analysis of standard residuals was carried out. It showed the data contained no outliers (Std. Residual Min = -2.303, Std. Residual Max = 2.320 for male model and Std. Residual Min = -2.792, Std. Residual Max =3.097 for female model). Verification if the data met the assumption of collinearity proved that the multicollinearity was not a concern. Tolerance of all scores is between 0.51 and 0.90, VIF = 1.12 to 1.96 for male and 0.50 and 0.89, VIF = 1.12 to 1.99 for female.

The data met the assumption of independent errors (Durbin-Watson value = 1.34 and 2.44 male and female model respectively).

The histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close. The data also met the assumption of non-zero variances.

The analysis showed that SAS-SV, self-valuation, purpose of smartphone use did not significantly predict

Table 3:   Linear Regression Analysis of Social Anxiety – Female

Variable	B	Beta	t	P
(Constant)	-10.393		-1.328	.190
NMP-Q	.462	.613	5.427	.000
SAS-SV	.452	.193	1.815	.036
Self-valuation	-3.438	-.171	-1.915	.061
Purpose	.872	.089	1.054	.297
Time	6.346	.241	2.530	.015
Age	-2.046	-.062	-.730	.469

Notes: Dependent variable = Liebowitz Social Anxiety Scale total score. R^2= 0.687. NMP-Q= Nomophobia Questionnaire; SAS-SV = Smartphone addiction Scale – Short Version.

Table 4:   Linear Regression Analysis of Social Anxiety – Male

Variable	B	Beta	t	P
(Constant)	-13.746		-1.542	.132
NMP-Q	.552	.725	5.848	.000
SAS-SV	.144	.070	.717	.478
Self-valuation	-3.347	-.149	-1.353	.184
Purpose	-.660	-.059	-.625	.536
Time	6.524	.226	2.197	.034
Age	9.201	.265	2.838	.007

Notes: Dependent variable = Liebowitz Social Anxiety Scale total score. R^2= 0.710. NMP-Q= Nomophobia Questionnaire; SAS-SV = Smartphone addiction Scale – Short Version.

the level of social anxiety, however NMP-Q score (Beta = 0.725, t(43) = 5.85, p < 0.05), time of daily use (Beta = 0.226, t(43) = 2.20, p < 0.05) and age (Beta = 0.265, t(19) = 2.84, p < 0.05) did significantly predict the level of social anxiety for male. As for the second model it was found that self-valuation, purpose of smartphone use and age did not significantly predict the level of social anxiety. But NMP-Q score (Beta = 0.613, t(55) = 5.43, p < 0.05), SAS-SV score (Beta = 0.193, t(55) = 1.82, p< 0.05), time of daily use (Beta = 0.241, t(55) = 2.53, p < 0.05) did significantly predict the level of social anxiety for female.

Social anxiety is positively associated with smartphone addiction. Students with marked and severe social anxiety are at a higher risk of being smartphone-addicted than their corresponding group. A potential path process was performed to test the potential mechanism of the association between social anxiety and smartphone addiction. The results suggested that there may be a transactional association between smartphone addiction and social anxiety; for example, social anxiety can result in worsening addiction to smartphones and vice versa. We recommend providing effective multidisciplinary health interventions to schools, families, clinicians, and students to increase their awareness of the adverse effects of social anxiety and smartphone addictions.

DISCUSSION

The users' deep connection with the smartphone has, therefore awoken disturbances about its addiction capacity. Social anxiety is considered as the human fear of being judged or estimated negatively by other people. It may lead the person to feel not adequately, inferior, embarrassed, self-conscious, and humiliated. The problem of a person to become irrationally anxious in social situations and feeling much better when alone

was presumed in our study as social anxiety. Despite many benefits for adolescents, smartphone use brings many serious health problems. Sleep disturbances are common with young people as the consequences of smartphone use. Problematic smartphone use is an important public health challenge as it is mostly related to both anxiety and depression and is linked with poor mental health outcomes. Problematic use of smartphones is also associated with avoidance of performance and social interaction, as well as psychopathology in general. This implies that certain individuals are more at risk of developing mental issues. Therefore, preventive measures targeting these people could prove to be beneficial.

The following study on smartphone addiction that is associated with possible influence on the personality's mental health has provided important insights into the shared understanding of different addictive disorders and discovered different associations of the social anxiety as the result of smartphone addiction. Consequently, this study has tested a model in which smartphone addiction variable was integrated using two measures (NMP-Q and SAS-SV) and social factors like: self-valuation of smartphone addiction, the purpose of smartphone use, time of daily use and age. This study overcomes the lack of research concerning the problematic use of smartphones variables, namely the role of continues stickiness to gadgets in the emergence of socialization problems. It was hypothesized that smartphone addiction scales would show significant weights in predicting rising social anxiety levels among young people. The model hypothesized comprised the following. First, the starting model examined gender, and it was predicted that male and female gender might show a different effect on the role of smartphones problematic use in the context of social anxiety. Second, it was predicted

that purpose, time of smartphone use, and the level of smartphone addiction variables might show a significant predictive effect on the level of social anxiety. Based on this set of analyses, two regression models, separate for female and male, were obtained to differentiate the predictive effect of above-given variables for each gender.

Internet addiction has previously been related to anxiety disorders in grown-ups and teenagers [26-29]. Our results support findings of previous researches [26] showing that individuals' psychosocial well-being, along with their beliefs about interpersonal communication (both face-to-face and online) are important cognitive predictors of negative outcomes arising from Internet use. We also share the idea [27] of face-to-face communication online may decrease self-consciousness and social anxiety, which could facilitate pro-social behaviour and enhance online friendship formation. On the other hand, Weinstein A. *et al*. [31] found no differences between males and females on the level of Internet addiction which wasn't acknowledged in the current study.

A social anxiety disorder may increase in persistent fear of one or more social situations. Social anxiety has been associated with excessive use of the Internet [30, 31] which found proves in the current study as well. The results of the study by Shepherd R.-M, and Edelmann R. [30] appeared to be supportive to the current study, as they hypothesize that the socially anxious individuals may find it easier to interact online(where anonymity can be maintained), rather than engage in face-to-face interaction (where being observed by others might induce a fear of negative evaluation). Problematic Internet use has been associated with deficits in social skills, personality dimensions such as novelty seeking, harm avoidance and possible impairment in certain cognitive processes [31].

It is still unclear whether behavioural addictions are a maladaptive way of coping with depression or anxiety or that depressive and anxiety disorders occur as a consequence of behavioural addictions. A relationship between anxiety, depression and Internet addiction among South Korean males was established [32] and exacerbation of depression, hostility, and social anxiety in the process of acquiring Internet addiction among adolescents was reported [33]. Though we cannot fully support this conclusion as the significant predictive power just for nomophobia scale among observed males. Several studies reported an increased

prevalence of social anxiety (i.e., the fear of being socially rejected; associated with a higher degree of loneliness [26, 31, 34, 35] as well as self-concept deficits [36] in Internet gaming addicts. Like Internet gaming addiction, social network addiction has also been indirectly linked to social anxiety [31], which negatively influences the development of the self-concept.

Our research has found an imbalance in the psychological state of young people addicted to smartphones and the Internet. The results have shown that the addicted youngsters had significantly higher scores in depression and anxiety and were under threat of intellectual disabilities and mental health issues.

CONCLUSIONS

This study could confirm the relationship between social anxiety and smartphone addiction. 3% of students reported have severe social anxiety which constitutes a menace to mental health, and 14% of participants reported marked social anxiety that might be followed by depression and sleep disturbance. It was found 27.3% prevalence of smartphone-addicted in general adolescents, indicating that smartphone addiction is a growing problem among Ukrainian youth. Smartphone addiction was positively associated with social anxiety. Two regression models were performed to test the potential mechanism of the association between smartphone addiction and social anxiety. The results of models suggested that there may be a complex transactional association between two variables: both questionnaires: NMP-Q and SAS-SV were significant predictors of social anxiety for female. For male, just scores of NMP-Q had significant predictive power. The results of regression models allowed us to conclude that social anxiety of male is less dependent on smartphone addiction level than the female's one. In fact, it is still unclear which variables have a more significant influence on the development of youth' social anxiety and can negatively influence mental health.

LIMITATIONS AND FURTHER RESEARCH

This study has multiple methodological limitations, which may be addressed in future research. All data were self-reported. Given the dynamic nature of mental states, often fluctuating, a single point in time may not accurately represent the relationship between the evaluated constructs. Self-report data may also be

subject to recall bias. It is also possible that certain social anxiety variables may have significant inaccuracies when collected through self-report.

Further research is needed to clarify the complex functional relationships between specific variables and to incorporate predictors into a comprehensive and testable model. Moreover, there is a need for replication of these results in longitudinal studies. Considering that youth with social anxiety and smartphone addiction problem has several negative consequences, longitudinal studies, as well as findings carried out in other contexts, could be of great utility. We recommend providing effective multidisciplinary study to increase knowledge of the adverse effects of smartphone addiction and to realize the complex transactional or concomitant association between smartphone addiction, social anxiety, insomnia symptoms and depression.

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