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The Impact of Nomophobia and Smartphone Presence on Fluid Intelligence and Attention

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Abstract

Nomophobia and even simply the presence of smartphones has an impact on attention and performance, likely through the cognitive mechanism of reduced working memory capacity. When a smartphone, a personally relevant stimulus, is present, working memory capacity is utilized leading to a reduction in the ability to inhibit responses and therefore difficulty with complex attentional tasks. With the increase in smartphone ownership, especially among young adults in developing nations and their proliferation in undergraduate classrooms, it becomes important to understand their cognitive impact in this demographic of users. Therefore, this study evaluated the impact of the presence of undergraduate students' smartphones on their performance on a non-verbal reasoning task, as well as a series of simple to complex attentional tasks. A total of 154 Pakistani undergraduate students participated in this study. Results demonstrated that the presence or absence of the students' smartphones did not affect fluid non-verbal intelligence or simple attentional tasks. However, the level of fear of being without their smartphone was correlated with non-verbal fluid intelligence and simple attention. Importantly, when the students' smartphones were present, they experienced difficulty with a more complex attentional task, regardless of the level of nomophobia. Given the need for fluid reasoning and the complex nature of most material covered within the undergraduate classroom context, this finding indicates a need for education about the detrimental nature of smartphone presence on complex attention, as well as the relationship between nomophobia and fluid reasoning and attention. Implications also include a need for institutional policies clarifying appropriate use of smartphones in the classroom.

Keywords: smartphones; nomophobia; cognition; educational psychology; fluid intelligence; attention; inhibition

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Introduction

According to the latest digital report, one third of Pakistanis own a mobile phone. In merely the past year, there has been a 17% increase in internet usage and a 7% increase in social media access, possibly due to the introduction of 4G services in the country (DataReportal, 2020). Given the rates of mobile phone ownership and social media use, it is not surprising that nomophobia—or fear of being without one's mobile phone—is prevalent

in this population. This is especially true among college students who have demonstrated rates of nomophobia as high as 100% (Schwaiger & Tahir, 2020).

Despite regular international surveys of general mobile phone usage, there are no data currently available for rates of usage within the classroom in Pakistan. Surveys of universities in the United States have found that 91.2% of students have used a digital device during class for activities that did not relate to the class (McCoy, 2013). Moreover, of these students, undergraduate students were more likely than graduate students to use digital devices for non-class purposes during class time. Furthermore, Ravizza et al. (2017) and Kuznekoff et al. (2015) have found that those students for whom their mobile device was most detrimental were the students who used the Internet the most for non-class purposes.

The majority of students recognize that using their devices for non-class purposes leads to lack of attention and missing instruction from the teacher (Lee et al., 2017); however, despite this knowledge, they report being unable to inhibit this behavior (McCoy, 2013; Ravizza et al., 2017). Any distraction in the classroom can be considered detrimental to student learning; however, smartphones appear to have a particularly negative influence. The cognitive impact of using smartphones in class for non-class purposes can be seen practically in lower grades, less information recalled, and impaired notetaking (Kuznekoff et al., 2015). The probable impact on undergraduate students, in particular, cannot be understated.

Despite the physiological, psychological and cognitive consequences, smartphones are a pervasive part of undergraduate students' lives, perhaps to the point of being an addiction (i.e., nomophobia; Yildirim, 2014; Yildirim & Correia, 2015) or even an extended self (Clayton et al., 2015; Hartanto & Yang, 2016). Many students find it difficult to stop using their smartphones in the classroom, despite knowing that distractions such as their smartphones can reduce their ability to recall information. Together, these factors can lead to very serious disadvantages in many areas of cognition that cannot be ignored.

There is currently a dearth of research in developing countries such as Pakistan, where smartphone use and nomophobia—fear of being without one's smartphone—are increasing exponentially. From the literature in primarily Western countries, the detrimental effects of nomophobia are clear, with even the simple presence of a person's smartphone seriously impacting cognition. The current study therefore sought to evaluate the impact of nomophobia and smartphone presence on cognition in a Pakistani sample.

In particular, the primary purpose of this research study is two-fold. Firstly, to extend the previous findings of the impact that nomophobia and smartphone presence have on specific cognitive functions (simple attention, inhibition, and fluid intelligence; Ward et al., 2017) to the South Asian context. Secondly, to disentangle the impact of nomophobia and smartphone presence on those aspects of cognition. Specifically, we are interested to determine if smartphone presence has an additive effect over and above mere nomophobia effects, given the similar theoretical impact on cognition. Moreover, we are interested to what extent smartphone presence affects cognition; specifically, if having the smartphone screen visible creates a greater pull on attention than the simple presence of a person's smartphone.

Nomophobia

A person's level of dependence on their phone—as measured by the degree of nomophobia—provides another level of complexity to the equation of smartphone use and cognition. Nomophobia, similar to other addictive behaviors, is associated with greater hours of smartphone use (Haug et al., 2015; Rozgonjuk et al., 2018; Schwaiger & Tahir, 2020). Higher levels of nomophobia and greater usage become a vicious cycle as fear of giving up convenience, not being able to access information and losing connectedness leads to more hours of use which further reinforces these fears (Nawaz et al., 2017). Other researchers have argued that greater usage leads to increased levels of nomophobia as a result of the loneliness and anxiety that arises from so much phone usage (Kara et al., 2021). This addictive or nomophobic behavior has been attributed to increased pleasurable experiences (Van Deursen et al., 2015), emotional gains (Zhitomirsky-Geffet & Blau, 2016) and flow (Kara, 2021) leading to an inability to control this behavior (Cha & Seo, 2018; Van Deursen et al., 2015; Zhitomirsky-Geffet & Blau, 2016).

Gender is another correlate of nomophobia as women tend to experience greater levels of nomophobia than men (Ajman et al., 2015; Arpaci, 2019; Moreno-Guerrero et al., 2020; Qutishat et al., 2020; Ozdemir et al., 2018; Schwaiger & Tahir, 2020). Nomophobia also has greater impact on those with higher levels of social media use (Ayar et al., 2018; Durak, 2018). All of these factors have a compounding effect, promoting increased smartphone use and creating significant difficulty when separating from the person's smartphone. Moreover, having an anxious attachment style (Arpaci et al., 2017) and certain personality traits such as impulsivity and a lack of perseverance (Roberts et al., 2015) are regarded as risk factors for development of nomophobia.

Nomophobia has been linked to lower academic performance and significant problems in regulation of attention (Aguilera-Manrique, 2018; Mendoza et al., 2018). The physiological and psychological effects of nomophobia include depression (Korat, 2020), anxiety (Hoffner et al., 2016; Prasad et al., 2017; Veerapu et al., 2019), problems with sleep (Veerapu et al., 2019), loneliness (Gezgin et al., 2018; Hoffner et al., 2016; Ozdemir et al., 2018), lack of happiness (Durak, 2019; Ozdemir et al., 2018; Sezer & Yildirim, 2020) and lower well-being (Bülbüloğlu et al., 2020). In addition to high levels of anxiety, unpleasantness, and feelings of decreased self, separation from a person's smartphone can result in physiological effects such as increased heart rate and blood pressure, especially for those who are highly dependent on their devices (Cheever et al., 2014; Clayton et al., 2015; Hartanto & Yang, 2016; Samaha & Hawi, 2016; Yildirim, 2014; Yildirim & Correia, 2015).

Nomophobia and its Impact on Cognition

The cognitive cost of nomophobia can particularly be seen in working memory as it is impacted by the anxiety and preoccupation caused by nomophobia, due to the nature of the central executive (Baddeley, 2003). Baddeley (2003) posits both conscious and unconscious systems of executive control. In this way, nomophobia should affect cognition by bogging down the working memory system via its very nature (i.e., the anxiety and preoccupation of addiction), as well as the increased and therefore habitual nature of smartphone use among people with greater levels of nomophobia. Specifically, simple attention is impacted because of preoccupation with the smartphone, whether or not it is present. The impact on complex attention, specifically inhibition, should occur because smartphone use has become habitual. Overriding automatic schemas or processes requires focused attention, more cognitive capacity, and—often—greater time (Stroop, 1935). This should also have a trickle-down effect on reasoning abilities, as being able to hold information in mind—working memory—is a central component of reasoning well (Baddeley, 2003).

Smartphone Use and its Impact on Cognition

Nomophobia often goes hand in hand with greater hours of smartphone use (Schwaiger & Tahir, 2020), which also has effects on cognition. Previous research indicates that the effects of the habitual use of smartphones include reductions in divided attention (Bargh, 1982; Geller & Shaver, 1976), sustained attention (Stothart et al., 2015; Thornton et al., 2014; Ward et al., 2017), speed of processing, inhibition (Bargh, 1982; Geller & Shaver, 1976; Ward et al., 2017; Wingefeld, 2006), and fluid reasoning (Cain et al., 2016). Moreover, smartphone use is correlated with increased error rates on all these tasks as well as greater impulsivity (Cain et al., 2016; Wilmer et al., 2017). Several studies have also shown that greater hours of phone usage are linked to lesser working memory available for cognitive tasks (Al-Khlaiwi et al., 2020; Bhatt et al., 2017; Pellowe et al., 2015; Thomas et al., 2010). Furthermore, a review of the literature by Wilmer et al. (2017) suggests that habitual use of smartphones affects multiple areas of cognition, including attention, memory, and delay of gratification.

Habitual use of smartphones clearly impacts cognition; however, several research studies have also found that even the “mere presence” of a smartphone can impact higher order attentional processes and reasoning abilities (Cain et al., 2016; Lee et al., 2017; Mendoza et al., 2018; Thornton et al., 2014) and produce anxiety (Deb, 2014). The theory of smartphones as an extended self (Clayton et al., 2015; Hartanto & Yang, 2016; Wilmer et al., 2017) has gained a significant amount of evidence and provides a framework by which to understand the impact the simple presence of a person's smartphone produces. In addition to the cognitive load inherent in engaging in activities not pertinent to the learning environment, smartphones provide an additional burden on cognition. Theoretically, smartphones specifically drain attention via the type of information inherent in smartphone use. Most smartphone platforms such as social media and messaging applications contain highly self-relevant

information. Smartphones therefore have an inherent connection to sense of self, perhaps to the point of being an extension of the self ("Extended Self Theory"; Clayton et al., 2015; Hartanto & Yang, 2016; Wilmer et al., 2017).

Specifically, self-relevant information has been shown to burden cognition via both conscious and unconscious attentional processes (Bargh, 1982). Self-relevant information is attended to without the requirement for conscious attention, whereas, filtering out self-relevant information requires intentional, conscious attentional processes. In one model of working memory, Baddeley (2003) suggests that executive control involves two systems, one involuntary or unconscious and one voluntary or conscious. In a similar fashion to the self-relevance of information, those activities or schemas that are habitual occur automatically, whereas the "supervisory activating system" requires conscious control

Smartphone presence, therefore, should create a greater load on working memory unconsciously, while also creating greater difficulty in complex attentional tasks that require conscious control. Smartphone presence should have a particularly powerful impact on tasks requiring inhibition. The presence of the smartphone provides a visual reminder of the self-relevant information and has a powerful, automatic pull on attention, therefore requiring a greater degree of cognitive control to inhibit or filter out the automatic process of attending to the smartphone (Ward et al., 2017). This impact on working memory also creates a ripple effect on other areas of cognition, specifically, the ability to reason well (Baddeley, 2003).

Therefore, the presence of one's smartphone should create a stronger pull on attention than its absence as there is a conscious reminder adding to the unconscious cognitive load. Moreover, the distance of the smartphone from the person should have an impact as well, with having the phone on the table (either face up or face down) creating a greater pull on attention due to the visual reminder. Finally, the presence of one's smartphone in the face up position should have a stronger influence on attention than face down because of the possibility of the screen lighting up (e.g., an even more salient conscious pull on attention).

Hypotheses

The literature demonstrates that smartphone presence can impact cognitive tasks, but that degree of dependence on one's phone (i.e., nomophobia) also has a relationship with some cognitive tasks. Therefore, this experimental study manipulated smartphone presence in four conditions (i.e., phone face up, phone face down, phone in bag or pocket, or phone in another room) while controlling for the personal internal variable of nomophobia. The following hypotheses were therefore formulated:

H1: After controlling for nomophobia, those in the smartphone face up condition will demonstrate lower performance on all cognitive measures (attention, complex attention, reasoning) than the face down condition.

H2: After controlling for nomophobia, those in the condition of smartphone face up and face down (presence of smartphone) will demonstrate lower performance on all cognitive measures (attention, complex attention, reasoning) than smartphone in pocket/bag or in other room (absence of smartphone).

H3: After controlling for nomophobia, those in the condition of smartphone face up, face down and pocket/bag (smartphone near) will demonstrate lower performance on all cognitive measures (attention, complex attention, reasoning) than smartphone in other room (smartphone absent).

Method

Participants

Sample size was estimated through review of the extant literature and the sample was obtained through convenience sampling. A total of 154 undergraduate psychology students participated in this research study for course credit. One student reported color blindness and could not continue (due to the SCWT), one student reported not owning a smartphone, and another did not have their phone at the time of the experiment and were therefore excluded. Additionally, several students were excluded due to missing data on the main measurement

tools (11) or multivariate outliers (4), thus resulting in a sample of 138 students. Demographic variables are presented in Table 1. One participant declined to report their sex and five participants did not report their year of study.

Table 1. *Demographics of the Sample.*

Variable	<i>M (SD)</i>	Frequency (%)
Age	20.43 (1.93)	
Sex		
Male		45 (32.60)
Female		92 (66.70)
Semester		
Freshman		66 (47.80)
Sophomore		14 (10.10)
Junior		22 (15.90)
Senior		27 (19.60)
Hours per day checking phone	6.94 (4.10)	
Times per day checked phone	41.55 (46.13)	

Measurement Tools

The Nomophobia Questionnaire (NMP-Q; Yildirim, 2014; Yildirim & Correia, 2015)

The NMP-Q (Yildirim, 2014; Yildirim & Correia, 2015) is a 20-item self-report measure that can be used to assess the severity of nomophobia or fear of being without one's phone. Scores range from 20–140, with higher scores indicating greater severity (i.e., < 20 = *absence*; 21–60 = *mild*; 61–100 = *moderate*; 101–120 = *severe*). This questionnaire has been shown to have excellent internal consistency (Cronbach's $\alpha = .945$) and good construct validity ($r = .71$). In the current study the reliability as measured by Cronbach's α was excellent (.907). The NMP-Q consists of four primary factors or dimensions: not being able to communicate, loss of connectedness, not being able to access information, and giving up convenience, each of which have good internal consistency (Cronbach's α was .939, .874, .827, and .814, respectively); however, only the total scale score of the NMP-Q was utilized for analyses in this study.

The Stroop Color and Word Test (Trenerry et al., 1989)

The Stroop Color and Word Test (SCWT; Trenerry et al., 1989) evaluates both simple and complex attention, both of which are thought to be impacted by smartphone presence and nomophobia. The first condition, simple color naming with congruence between the color and word, is measured in reaction time (number of seconds). In the second, incongruent condition, the color names and the words do not match. This condition, again measured in reaction time, provides a measurement of the participant's ability to inhibit the automatic attentional task of reading in order to name the color of the ink. Test-retest reliability and discriminant validity have been well established (.90 and .79, respectively; Trenerry et al., 1989).

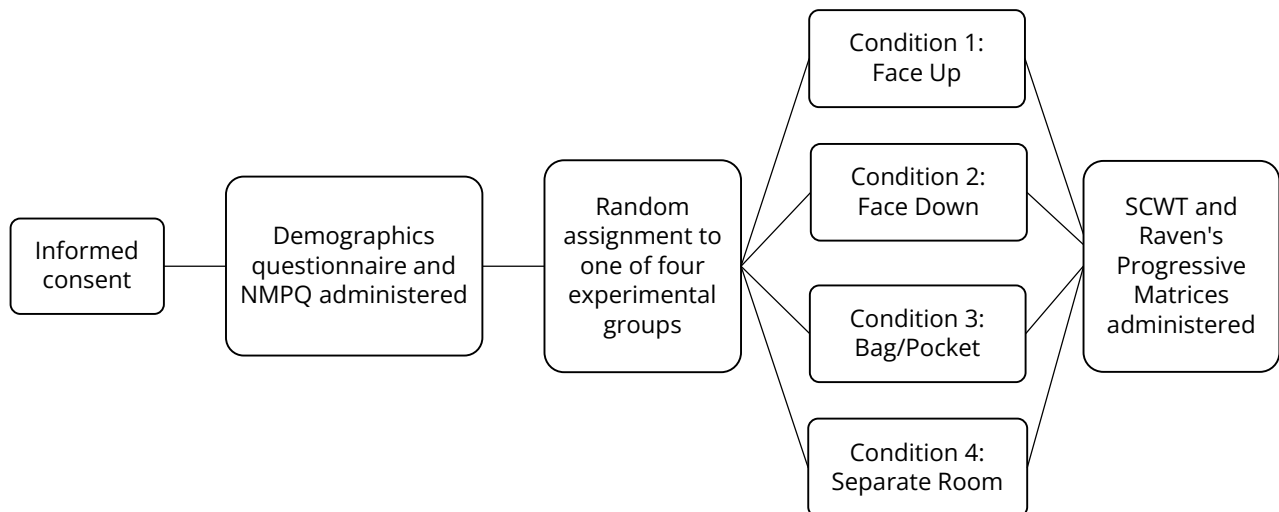
Raven's Progressive Matrices (Raven, 1941)

Raven's Progressive Matrices (Raven, 1941) is a 60-item tool used to measure non-verbal fluid reasoning, which has been posited to be impacted by smartphone presence and nomophobia. The scale consists of five sets from A to E, containing 12 items in each set (e.g., A1 to A12, B1 to B12). Within and between each, there is an incremental increase in difficulty. The scale has test re-test reliability varying with respect to age from .83 to .93 (Raven, 1941). Raven's Progressive Matrices correlates strongly ($r = .86$) with other intelligence scales (Raven, 1941).

Procedure

Prior to initiation of the study protocol, all ethical considerations were taken into account and the study was approved by the Institutional Review Board of the university (IRB reference number: IRB-72/04-2018; see Figure 1 for a schematic of the procedure).

Figure 1. Schematic Describing the Procedure.



Participants were recruited through the offering of extra credit marks for Psychology courses. Students approached the researchers voluntarily by visiting the Cognitive Psychology Research Lab. All participants were first given the informed consent form explaining the purpose of the study and their rights as participants, which was also explained to them verbally. After filling the Demographics Questionnaire that included questions about age, sex, semester, hours per day checking phone, and number of times per day checking phone, the participants were asked to fill the NMP-Q. Subsequently, each participant was randomly assigned to one of four smartphone conditions (i.e., phone face up, phone face down, phone in bag or pocket, or phone in another room). A research assistant then administered the Stroop color and word test and Raven's Progressive Matrices. If the person's phone had been kept in a separate location, it was then returned to them and participants were thanked for their participation and informed of the procedure for obtaining the results of the study. No violations of any ethical procedures occurred during the duration of the experiment.

Data Analysis

Firstly, descriptive statistics for the study tools and preliminary analyses were computed. Next, to answer the hypotheses in regards to fluid reasoning, a one-way analysis of covariance with planned comparisons was computed to compare each of the four smartphone conditions with Raven's Progressive Matrices as the dependent variable and NMP-Q as a covariate. To test the hypotheses in the area of simple attention, another ANCOVA with planned comparisons was computed comparing the four smartphone conditions on SCWT congruent response times using NMP-Q as a covariate. Finally, the hypotheses in regard to inhibition were tested using an analysis of variance with planned comparisons to compare the four smartphone conditions on the difference scores between the congruent and incongruent SCWT (i.e., the Stroop Effect). NMP-Q was not included in the third set of analyses (inhibition) as it did not correlate with the Stroop Effect in the preliminary analyses.

Results

Descriptive statistics of the measurement tools for the sample are displayed in Table 2. The average level of nomophobia in this sample was moderate with over half of participants reporting this level of nomophobia

(59.4%), no participants reporting absence of nomophobia, few reporting mild nomophobia (11.6%) and 26.1% reporting severe levels of nomophobia. The average for the Raven's Progressive Matrices was 39.22 ($SD = 8.84$). For the SCWT congruent participants took 56.79 seconds on average ($SD = 11.70$) and for SCWT incongruent the average was 113.21 seconds ($SD = 10.58$). The statistically significant discrepancy between the values for SCWT congruent and SCWT incongruent demonstrates the presence of the Stroop Effect in this sample [$M = 56.42$, $SD = 14.15$, $t(137) = -46.844$, $p < .001$].

Table 2. *Descriptive Statistics of the Measurement Tools Used in the Study.*

Variable	<i>M</i>	<i>SD</i>	Frequency (%)	α
NMP-Q Total Score	85.98	22.03		.907
Absence of Nomophobia			0 (0)	
Mild			16 (11.6)	
Moderate			86 (59.4)	
Severe			32 (26.1)	
Raven's Total Score	39.22	8.84		
SCWT Congruent	56.79	11.70		
SCWT Congruent Errors	0.54	1.75		
SCWT Incongruent	113.21	10.58		
SCWT Incongruent Errors	1.67	2.60		
SCWT Difference Score	56.42	14.15		

Note. NMP-Q = range for NMP-Q; Raven's = Raven's Progressive Matrices; SCWT = Stroop Color and Word Test

Preliminary Analyses

Randomization to groups was confirmed via ANOVA comparing each condition on age [$F(3, 134) = 0.149$, $p = .930$], year of study [$F(3, 132) = 0.003$, $p = .999$], hours per day checking phone [$F(3, 134) = 0.425$, $p = .736$], times per day checking phone [$F(3, 118) = 0.515$, $p = .673$], and Nomophobia [$F(3, 134) = 0.104$, $p = .957$]. There were no significant differences in demographic variables or levels of nomophobia among the four conditions, indicating that randomization to experimental condition was successful.

Tests of normality indicated that two scales were not normally distributed: SCWT congruent (Skewness = 1.549; Kurtosis = 3.774) and SCWT incongruent (Skewness = 1.916; Kurtosis = 1.670). These scales were transformed to improve normality (see Pallant, 2016; Tabachnick & Fidell, 2013, SCWT congruent = Log10 [Skewness = 0.038; Kurtosis = -0.438], SCWT incongruent = Reflect Log10 [Skewness = 0.621; Kurtosis = -1.336]). Additional tests of normality, including linearity and homogeneity of regression slopes did not violate the assumptions of multivariate analyses. As noted in the participants section, four multivariate outliers were removed prior to completion of the analyses (Mahalanobis distance of $p < .001$).

Table 3. *Bivariate Correlations of the Study Variables.*

Variable	1	2	3
1. NMP-Q			
2. Raven's Progressive Matrices	-.182*		
3. SCWT Congruent Time	.228**	-.099	
4. SCWT Incongruent Time	.081	-.090	.196*

Note. NMP-Q = Nomophobia Questionnaire; SCWT = Stroop Color and Word Test.

* $p < .05$, ** $p < .001$.

Bivariate correlations indicated a significant but small negative correlation between the NMP-Q and Raven's, as well as NMP-Q and SCWT congruent. There was no relationship between NMP-Q and SCWT incongruent (for bivariate correlations between study variables see Table 3), therefore, the NMP-Q was included in only two analyses as a covariate (Raven's and SCWT Congruent Time). SCWT incongruent was adjusted to an ANOVA.

Raven's Progressive Matrices

To evaluate the impact of the four conditions on non-verbal fluid intelligence, a one-way ANCOVA with planned comparisons was computed with nomophobia as a covariate ($r = .228, p < .001$) and the RAVENS as the dependent variable (Hypothesis 1 contrasts: -1, 1, 0, 0; Hypothesis 2 contrasts: -1, -1, 1, 1; Hypothesis 3 contrasts: -1, -1, -1, 3). This analysis was not significant and therefore the hypotheses were not supported [$F(3, 133) = 0.589, p = .623$]. These findings indicate that the four conditions did not have a significant impact on Raven's scores; however, there was a significant but weak negative relationship between the NMP-Q and the Raven's [$F(3, 133) = 4.592, p = .034, partial \eta^2 = .033$]. This demonstrates that across the four conditions, the weak negative relationship between NMP-Q and Raven's remained stable. The higher the level of nomophobia, the lower the level of non-verbal fluid intelligence ($r = -.182, p < .05$; see Table 3).

Stroop Color Word Test Congruent Condition

Bivariate correlations (see Table 3) indicated a weak positive relationship between the NMP-Q and the congruent SCWT, therefore an ANCOVA with planned comparisons of the four conditions on SCWT congruent response time using NMP-Q as a covariate was computed to test our hypotheses (Hypothesis 1 contrasts: -1, 1, 0, 0; Hypothesis 2 contrasts: -1, -1, 1, 1; Hypothesis 3 contrasts: -1, -1, -1, 3). There were no significant differences between groups on this simple attentional task [$F(3, 133) = 1.056, p = .370$]; however, the covariate (NMP-Q) was significantly, though weakly positively correlated with the time taken on the SCWT congruent task [$F(1, 137) = 7.091, p = .009, partial \eta^2 = .051$] indicating that our hypotheses were not supported. This simple attentional task was not impacted by the smartphone condition, but was related to the level of nomophobia. The greater the level of nomophobia, the slower the response time on this simple attentional task ($r = .228, p < .001$; see Table 3).

Difference Score of Congruent and Incongruent Conditions: Stroop Effect

Finally, an ANOVA with planned comparisons was computed to compare the difference score for the congruent and incongruent SCWT across the four experimental conditions (Hypothesis 1 contrasts: -1, 1, 0, 0; Hypothesis 2 contrasts: -1, -1, 1, 1; Hypothesis 3 contrasts: -1, -1, -1, 3), thus testing the effect of the experimental conditions on the Stroop Effect. The omnibus F was significant [$F(3, 134) = 3.128, p = .028$]. The planned comparisons indicated that the only statistically significant difference was the third contrast, Hypothesis 3 [$t(134) = 2.757, p = .007$]. When the participants' smartphone was in another room, the Stroop Effect was reduced (i.e., the participants performed better on this complex attentional task) compared to the other three conditions (Face Up, Face Down, Bag/Pocket). Hypotheses 1 and 2 were not supported. Table 4 displays results of the ANOVA.

Table 4. Results of ANOVA With Planned Comparisons of the Stroop Effect.

Contrast	Contrast	Value	SE	df	t	p
1 Face Up	Face Down	-.1578	.1415	134	-1.115	.267
2 Face Down/Face Down	Bag/Pocket/Other Room	.1934	.1983	134	.975	.331
3 Face Down/Face Down/Bag/Pocket	Other Room	.9500	.3446	134	2.757	.007*

Note. Stroop Effect = Difference between time for SCWT Congruent and SCWT Incongruent.

$F(3, 134) = 3.128, p = .028, \eta^2 = .065. *p < .05$

Discussion

Several important findings have resulted from this research study. Firstly, the relationship between nomophobia and aspects of fluid intelligence and simple attention. Secondly, the impact of smartphone presence on tasks that require complex attention, particularly inhibition.

The Relationship Between Nomophobia and Fluid Intelligence

The results indicate a weak, but persistent negative correlation between nomophobia and fluid intelligence as measured by the Raven's. Interestingly, smartphone presence (i.e., the experimental conditions) did not produce an impact on fluid intelligence. This suggests that the level of addiction or the relevance of a person's smartphone

has greater impact on non-verbal fluid reasoning, whether or not the phone is actually present. Theoretically, this indicates that the automatic pull on attention caused by the self-relevance of a person's smartphone has an impact on cognition, even when the phone is absent.

With the growing number of smartphone users and the high levels of nomophobia found in Pakistani undergraduates (Schwaiger & Tahir, 2020), this finding of the effect of nomophobia on fluid intelligence is worrisome. Fluid intelligence is required for a number of daily tasks that include problem solving, creative thinking and critical analysis, as well as the acquisition of crystallized intelligence (Cattell, 1963). University students in particular require the ability to access fluid intelligence for their daily educational tasks, specifically the difficult work of learning new material in the classroom. Critical thinking, a common goal of university education, relies heavily on fluid intelligence.

The deficits in fluid intelligence created by nomophobia could have long-term negative impacts on the age group of this study in particular as emerging adults are often involved in both education and employment. They are often required to make serious, life-altering choices at this stage in their development, which requires fluid intelligence. Impacts on fluid intelligence can be especially detrimental for university students as one of their primary responsibilities is to learn critical thinking skills and develop their store of crystallized intelligence for later use in the job field.

The Relationship Between Nomophobia and Simple Attention

Higher levels of nomophobia were also found to be related to reduced performance on a simple attentional task (SCWT Congruent Condition). Previous studies have also reported that higher dependency on phones is related to greater interference in simple attentional tasks likely due to anxiety's detrimental effect on working memory (Baddeley, 2003; Cheever et al., 2014; Hartanto & Yang, 2016). Specifically, working memory capacity reduction due to anxiety results in not only lower performance on simple attentional tasks, but also a reduction in overall performance (Ramirez & Beilock, 2011). The current study has extended these findings, suggesting that the relationship between smartphones and simple attention is likely due to an addiction-like condition (i.e., nomophobia) in which the presence or absence of the participant's smartphone plays almost no role.

This widely prevalent problem of nomophobia can have an impact on simple attention, especially in undergraduate students. When students must engage in tasks requiring attention such as listening to lectures, note-taking, and sitting for examinations, the presence or absence of their phones is not as important as the underlying presence of nomophobia. The issue of smartphone use, and possible abuse, may be more severe and impactful than initially thought.

The Impact of Smartphone Presence on Inhibition

While the presence or absence of smartphones does not appear to affect performance on simple attentional tasks, the participants' performance on SCWT incongruent condition was better when the phone was not in the room with the participants. The task required them to use conscious attention to inhibit an automatic response (Trenerry et al., 1989). Personally-relevant stimuli in the environment, such as smartphones make it harder to use the limited cognitive resources of working memory to inhibit other automatic responses. These results are also in line with previous research (Stothart et al., 2015; Thornton et al., 2014; Ward et al., 2017) which has found that the mere presence of smartphones compromises performance because fewer attentional resources are available for the task when the personally relevant stimulus is present (Bargh, 1982).

The impact of smartphone presence on complex attention, namely inhibition, has important implications. While having smartphones in the classroom may not be harmful when students are engaging in activities requiring simple attention, it can lead to significantly reduced functioning when they are required to complete complex attentional tasks such as inhibition.

This finding has important implications for both undergraduate students and others. For example, the content of most undergraduate classes is considered complex and students having their phones on their desks might reduce

their capacity to absorb new ideas and think critically about material presented to them. It might also make it more difficult for students to stop themselves from checking their phones during the class, a task of inhibition.

Limitations and Recommendations

These results have important pedagogical implications, but also several limitations. One major limitation is in generalizability due to the sampling technique and sample characteristics. Nonprobability sampling by its very nature is problematic given the reduced likelihood of a representative sample; however, one of the strengths of the present study is randomization to smartphone condition. This helps to mitigate the effects of internal personal variables. Regarding the representativeness of the sample, these results are likely limited in their generalizability. Though nomophobia and its effects are more likely to be present in young adults, smartphone use in all age groups is increasing. Therefore, future studies should also consider levels of nomophobia and its effects in other populations in order to present a holistic view of their impact.

In spite of these limitations, this research study provides clarity about the differential impact of nomophobia and smartphone presence on cognition. The results suggest that having and using smartphones in the classroom will negatively impact students' performance in class by occupying working memory and therefore reducing students' capacity to use their attentional resources. The recommendation by Mendoza et al. (2018) to implement the policy of not using smartphones in class to reduce distraction could be employed. This study also suggests going a step further: smartphones should be placed out of sight as the mere presence of smartphones leads to cognitive deficits in complex attention such as reduction in ability to inhibit automatic responses. Additionally, working memory is theorized to be important for information transfer to storage in long term memory (Baddeley, 2003). It is possible that the personally-relevant stimuli found in smartphones, such as alerts and notifications, may occupy working memory and the information would not be encoded as thoroughly in long term memory.

It has been found that high rates of nomophobia are linked to greater number of hours of usage (Schwaiger & Tahir, 2020), thus young adults should be made aware of its detrimental effects. Although it is impossible to completely cut off phone usage, awareness campaigns could lead to people being more conscious of their phone usage thereby devising ways to reduce screen time. Mindfulness strategies may be used to treat nomophobia. It should be considered at the primary and secondary prevention levels as well as to treat those who are already suffering from nomophobia and its detrimental effects (Arpaci et al., 2017). Importantly, in children and young adults, parental restriction restores some degree of control and thus mediates the relationship between smartphone usage and nomophobia (Chang et al., 2019). In some cases where nomophobia is already present, however, there can be detrimental effects on fluid intelligence and simple attention that cannot be ignored. These findings should be addressed at the societal level and treatment for nomophobia normalized. These findings also indicate a need for policies to address more than just smartphone presence in the classroom. Education about nomophobia, including coping skills and treatment options for reducing dependence on smartphones, should be considered a part of university policies.

The present research, completed with a South Asian population, is an important addition to the current field of knowledge about smartphones and cognition. Previous research only examined university students in the United States. Arpaci et al. (2017) has presented the argument that culture, through its impact on attachment styles, can partially account for the prevalence of nomophobia and problematic phone use, and therefore also has implications for treatment of nomophobia. Those from collectivist cultures tend to have more anxious attachment styles (Arpaci et al., 2017) and this attachment style can also extend to mobile phones and their use. Moreover, Pakistan has a predominantly collectivist culture (Islam, 2004) and adheres to both vertical and horizontal collectivism (Arpaci et al., 2017). Vertical collectivism could theoretically increase the tendency toward problematic smartphone use because of the tendency toward a hierarchical power structure and also a belief that others are more important than the self, leading individuals to sacrifice time and energy to those in higher positions. Additionally, the adherence to horizontal collectivism leads to a greater focus on the group as compared to the individual which also increases the chances of developing nomophobia because there is greater anxiety about not being able to connect with the group. As per Arpaci's (2019) recommendation, the type of collectivism that one adheres to needs to be accounted for when designing any treatment plan to address nomophobia.

Author Contribution Statement

First author: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Second author: Performed the experiments; Wrote the paper.

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Conflict of interest

The Author(s) declare(s) that there is no conflict of interest.

References

- Aguilera-Manrique, G., Márquez-Hernández, V. V., Alcaraz-Córdoba, T., Granados-Gámez, G., Gutiérrez-Puertas, V., & Gutiérrez-Puertas, L. (2018). The relationship between nomophobia and the distraction associated with smartphone use among nursing students in their clinical practicum. *PLoS One*, *13*(8), Article e0202953. <https://doi.org/10.1371/journal.pone.0202953>
- Ajman, K., Sharma, P., & Manu. (2015). A descriptive study to assess the risk of developing nomophobia among students of selected nursing colleges Ludhiana, Punjab. *International Journal of Psychiatric Nursing*, *1*(2), 1–6. <http://dx.doi.org/10.5958/2395-180X.2015.00051.1>
- Al-Khlaiwi, T. M., Habib, S. S., Meo, S. A., Alqhtani, M. S., & Ogailan, A. A. (2020). The association of smart mobile phone usage with cognitive function impairment in Saudi adult population. *Pakistan Journal of Medical Sciences*, *36*(7), 1628–1633. <https://doi.org/10.12669/pjms.36.7.2826>
- Arpaci, I. (2019). Culture and nomophobia: The role of vertical versus horizontal collectivism in predicting nomophobia. *Information Development*, *35*(1), 96–106. <https://doi.org/10.1177/0266666917730119>
- Arpaci, I., Baloğlu, M., Kozan, H. İ. Ö., & Kesici, Ş. (2017). Individual differences in the relationship between attachment and nomophobia among college students: The mediating role of mindfulness. *Journal of Medical Internet Research*, *19*(12), Article e404. <https://doi.org/10.2196/jmir.8847>
- Ayar, D., Gerçeker, G. Ö., Özdemir, E. Z., & Bektaş, M. (2018). The effect of problematic internet use, social appearance anxiety, and social media use on nursing students' nomophobia levels. *Computers Informatics Nursing*, *36*(12) 589–595. <http://dx.doi.org/10.1097/CIN.0000000000000458>
- Baddeley, A. (2003). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience*, *4*(10), 829–839. <https://doi.org/10.1038/nrn1201>
- Bargh, J. A. (1982). Attention and automaticity in the processing of self-relevant information. *Journal of Personality and Social Psychology*, *43*(3), 425–436. <https://doi.org/10.1037/0022-3514.43.3.425>
- Bhatt, C. R., Benke, G., Smith, C. L., Redmayne, M., Dimitriadis, C., Dalecki, A., Macleod, S., Sim, M. R., Croft, R. J., Wolfe, R., Kaufman, J., & Abramson, M. J. (2017). Use of mobile and cordless phones and change in cognitive function: A prospective cohort analysis of Australian primary school children. *Environmental Health*, *16*(1), Article 62. <http://dx.doi.org/10.1186/s12940-017-0250-4>

- Bülbüloğlu, S., Özdemir, A., Kapıkıran, G., & Sarıtaş, S. (2020). The effect of nomophobic behavior of nurses working at surgical clinics on time management and psychological well-being. *Journal of Substance Use, 25*(3), 318–323. <https://doi.org/10.1080/14659891.2019.1692926>
- Cain, M. S., Leonard, J. A., Gabrieli, J. D. E., & Finn, A. S. (2016). Media multitasking in adolescence. *Psychonomic Bulletin & Review, 23*(6), 1932–1941. <https://doi.org/10.3758/s13423-016-1036-3>
- Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology, 54*(1), 1–22. <https://doi.org/10.1037/h0046743>
- Cha, S.-S., & Seo, B.-K. (2018). Smartphone use and smartphone addiction in middle school students in Korea: Prevalence, social networking service, and game use. *Health Psychology Open, 5*(1), 1–15. <https://doi.org/10.1177/2055102918755046>
- Chang, F.-C., Chiu, C.-H., Chen, P.-H., Chiang, J.-T., Miao, N.-F., Chuang, H.-Y., & Liu, S. (2019). Children's use of mobile devices, smartphone addiction and parental mediation in Taiwan. *Computers in Human Behavior, 93*, 25–32. <https://doi.org/10.1016/j.chb.2018.11.048>
- Cheever, N. A., Rosen, L. D., Carrier, L. M., & Chavez, A. (2014). Out of sight is not out of mind: The impact of restricting wireless mobile device use on anxiety levels among low, moderate and high users. *Computers in Human Behavior, 37*, 290–297. <https://doi.org/10.1016/j.chb.2014.05.002>
- Clayton, R. B., Leshner, G., & Almond, A. (2015). The extended iSelf: The impact of iPhone separation on cognition, emotion, and physiology. *Journal of Computer-Mediated Communication, 20*(2), 119–135. <https://doi.org/10.1111/jcc4.12109>
- Deb, A. (2014). Phantom vibration and phantom ringing among mobile phone users: A systematic review of literature. *Asia-Pacific Psychiatry, 7*(3), 231–239. <https://doi.org/10.1111/appy.12164>
- Van Deursen, A. J. A. M., Bolle, C. L., Hegner, S. M., & Kommers, P. A. M. (2015). Modeling habitual and addictive smartphone behavior: The role of smartphone usage types, emotional intelligence, social stress, self-regulation, age, and gender. *Computers in Human Behavior, 45*, 411–420. <https://doi.org/10.1016/j.chb.2014.12.039>
- DataReportal. (2020, February 18). *Digital 2020: Pakistan*. <https://datareportal.com/reports/digital-2020-pakistan>
- Durak, H. Y. (2018). What would you do without your smartphone? Adolescents' social media usage, locus of control, and loneliness as a predictor of nomophobia. *Addicta: The Turkish Journal on Addictions, 5*(3), 543–557. <http://dx.doi.org/10.15805/addicta.2018.5.2.0025>
- Durak, H. Y. (2019). Investigation of nomophobia and smartphone addiction predictors among adolescents in Turkey: Demographic variables and academic performance. *The Social Science Journal, 56*(4), 492–517. <https://doi.org/10.1016/j.soscij.2018.09.003>
- Geller, V., & Shaver, P. (1976). Cognitive consequences of self-awareness. *Journal of Experimental Social Psychology, 12*(1), 99–108. [https://doi.org/10.1016/0022-1031\(76\)90089-5](https://doi.org/10.1016/0022-1031(76)90089-5)
- Gezgin, D. M., Hamutoglu, N. B., Sezen-Gultekin, G., & Ayas, T. (2018). The relationship between nomophobia and loneliness among Turkish adolescents. *International Journal of Research in Education and Science, 4*(2), 358–374. <https://doi.org/10.21890/ijres.409265>
- Hartanto, A., & Yang, H. (2016). Is the smartphone a smart choice? The effect of smartphone separation on executive functions. *Computers in Human Behavior, 64*, 329–336. <https://doi.org/10.1016/j.chb.2016.07.002>

- Haug, S., Castro, R. P., Kwon, M., Filler, A., Kowatsch, T., & Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *Journal of Behavioral Addictions, 4*(4), 299–307. <https://doi.org/10.1556/2006.4.2015.037>
- Hoffner, C. A., Lee, S., & Park, S. J. (2016). "I miss my mobile phone!": Self-expansion via mobile phone and responses to phone loss. *New Media and Society, 18*(11), 2452–2468. <https://doi.org/10.1177/1461444815592665>
- Islam, N. (2004). Sifarish, sycophants, power and collectivism: Administrative culture in Pakistan. *International Review of Administrative Sciences, 70*(2), 311–330. <https://doi.org/10.1177/0020852304044259>
- Kara, M. (2021). High schoolers' usage intensity of mobile social media and nomophobia: Investigating the mediating role of flow experience. *Participatory Educational Research, 8*(1), 409–422. <https://doi.org/10.17275/per.21.24.8.1>
- Kara, M., Baytemir, K., & Inceman-Kara, F. (2021). Duration of daily smartphone usage as an antecedent of nomophobia: Exploring multiple mediation of loneliness and anxiety. *Behaviour & Information Technology, 40*(1), 85–98. <https://doi.org/10.1080/0144929X.2019.1673485>
- Korat, N. R. (2020). Nomophobic symptoms and depression among adults' of Rajkot district. *The International Journal of Indian Psychology, 8*(1), 110–112. <https://doi.org/10.25215/0801.013>
- Kuznekoff, J. H., Munz, S., & Titsworth, S. (2015). Mobile phones in the classroom: Examining the effects of texting, Twitter, and message content on student learning. *Communication Education, 64*(3), 344–365. <https://doi.org/10.1080/03634523.2015.1038727>
- Lee, S., Kim, M. W., McDonough, I. M., Mendoza, J. S., & Kim, M. S. (2017). The effects of cell phone use and emotion-regulation style on college students' learning. *Applied Cognitive Psychology, 31*(3), 360–366. <https://doi.org/10.1002/acp.3323>
- McCoy, B. (2013). Digital distractions in the classroom: Student classroom use of digital devices for non-class related purposes. *Faculty Publications, College of Journalism & Mass Communications*, Article 71. <http://digitalcommons.unl.edu/journalismfacpub/71>
- Mendoza, J. S., Pody, B. C., Lee, S., Kim, M., & McDonough, I. M. (2018). The effect of cellphones on attention and learning: The influences of time, distraction, and nomophobia. *Computers in Human Behavior, 86*, 52–60. <https://doi.org/10.1016/j.chb.2018.04.027>
- Moreno-Guerrero, A. J., Aznar-Díaz, I., Cáceres-Reche, P., & Rodríguez-García, A.-M. (2020). Do age, gender and poor diet influence the higher prevalence of nomophobia among young people? *International Journal of Environmental Research and Public Health, 17*(10). <https://doi.org/10.3390/ijerph17103697>
- Nawaz, I., Sultana, I., Amjad, M. J., & Shaheen, A. (2017). Measuring the enormity of nomophobia among youth in Pakistan. *Journal of Technology in Behavioral Science, 2*(3–4), 149–155. <https://doi.org/10.1007/s41347-017-0028-0>
- Ozdemir, B., Cakir, O., & Hussain, I. (2018). Prevalence of nomophobia among university students: A comparative study of Pakistani and Turkish undergraduate students. *Eurasia Journal of Mathematics Science and Technology Education, 14*(4), 1519–1532. <https://doi.org/10.29333/ejmste/84839>
- Pallant, J. (2016). *SPSS Survival Manual*. Open University Press.
- Pellowe, E. L., Cooper, A., & Mattingly, B. A. (2015). Are smartphones inhibiting smartness? Smartphone presence, mobile phone anxiety, and cognitive performance. *Undergraduate Journal of Psychology, 28*(1), 20–25. <https://journals.uncc.edu/ujop/article/view/319>

- Prasad, M., Patthi, B., Singla, A., Gupta, R., Saha, S., Kumar, J. K., Malhi, R., & Pandita, V. (2017). Nomophobia: A cross-sectional study to assess mobile phone usage among dental students. *Journal of Clinical and Diagnostic Research*, 11(2), ZC34–ZC39. <https://doi.org/10.7860/JCDR/2017/20858.9341>
- Qutishat, M., Lazarus, E. R., Razmy, A. M., & Packianathan, S. (2020). University students' nomophobia prevalence, sociodemographic factors and relationship with academic performance at a university in Oman. *International Journal of Africa Nursing Sciences*, 13, Article 100206. <https://doi.org/10.1016/j.ijans.2020.100206>
- Ramirez, G., & Beilock, S. L. (2011). Writing about testing worries boosts exam performance in the classroom. *Science*, 331(6014), 211–213. <https://doi.org/10.1126/science.1199427>
- Raven, J. C. (1941). Standardisation of progressive matrices, 1938. *British Journal of Medical Psychology*, 19(1), 137–150. <https://doi.org/10.1111/j.2044-8341.1941.tb00316.x>
- Ravizza, S. M., Uitvlugt, M. G., & Fenn, K. M. (2017). Logged in and zoned out: How laptop internet use relates to classroom learning. *Psychological Science*, 28(2), 171–180. <https://doi.org/10.1177/0956797616677314>
- Roberts, J. A., Pullig, C., & Manolis, C. (2015). I need my smartphone: A hierarchical model of personality and cell-phone addiction. *Personality and Individual Differences*, 79, 13–19. <http://dx.doi.org/10.1016/j.paid.2015.01.049>
- Rozgonjuk, D., Levine, J. C., Brian, H. J., & Elhai, J. D. (2018). The association between problematic smartphone use, depression and anxiety symptom severity, and objectively measured smartphone use over one week. *Computers in Human Behavior*, 87, 10–17. <http://dx.doi.org/10.1016/j.chb.2018.05.019>
- Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, 57, 321–325. <https://doi.org/10.1016/j.chb.2015.12.045>
- Schwaiger, E., & Tahir, R. (2020). Nomophobia and its predictors in undergraduate students of Lahore, Pakistan. *Heliyon*, 6(9), Article e04837. <https://doi.org/10.1016/j.heliyon.2020.e04837>
- Sezer, Ö., & Yildirim, O. (2020). The relationship between nomophobia and trait anxiety, basic psychological needs, happiness in adolescents. *International Journal of Human Sciences*, 17(2), 535–547. <https://doi.org/10.14687/jhs.v17i2.5917>
- Stothart, C., Mitchum, A., & Yehnert, C. (2015). The attentional cost of receiving a cell phone notification. *Journal of Experimental Psychology: Human Perception and Performance*, 41(4), 893–897 <http://dx.doi.org/10.1037/xhp0000100>
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18(6), 643–662. <https://doi.org/10.1037/h0054651>
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics*. Pearson.
- Thomas, S., Benke, G., Dimitriadis, C., Inyang, I., Sim, M. R., Wolfe, R., Croft, R. J., & Abramson, M. J. (2010). Use of mobile phones and changes in cognitive function in adolescents. *Occupational and Environmental Medicine*, 67(12), 861–866. <https://doi.org/10.1136/oem.2009.054080>
- Thornton, B., Faires, A., Robbins, M., & Rollins, E. (2014). The mere presence of smartphones may be distracting: Implications for attention and task performance. *Social Psychology*, 45(6), 479–488. <https://doi.org/10.1027/1864-9335/a000216>
- Trenerry M. R., Crosson B., DeBoe J., & Leber W. R. (1989). *Stroop Neuropsychological Screening Test*. Psychological Assessment Resources.

Veerapu, N., Philip, R. K. B., Vasireddy, H., Gurralla, S., & Kanna, S. T. (2019). A study on nomophobia and its correlation with sleeping difficulty and anxiety among medical students in a medical college, Telangana. *International Journal of Community Medicine and Public Health*, 6(5), 2074–2076. <https://dx.doi.org/10.18203/2394-6040.ijcmph20191821>

Ward, A. F., Duke, K., Gneezy, A., & Bos, M. W. (2017). Brain drain: The mere presence of one's own smartphone reduces available cognitive capacity. *Journal of the Association for Consumer Research*, 2(2), 140–154. <https://doi.org/10.1086/691462>

Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017). Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in Psychology*, 8, Article 605. <https://doi.org/10.3389/fpsyg.2017.00605>

Wingenfeld, K., Mensebach, C., Driessen, M., Bullig, R., Hartje, W., & Beblo, T. (2006). Attention bias towards personally relevant stimuli: The individual emotional Stroop task. *Psychological Reports*, 99(3), 781–793. <https://doi.org/10.2466/pr0.99.3.781-793>

Yildirim, C. (2014). *Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research* (Publication No. 14005) [Master's thesis, Iowa State University]. Iowa State University Digital Repository. <https://dr.lib.iastate.edu/handle/20.500.12876/28192>

Yildirim, C., & Correia, A.-P. (2015). Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Computers in Human Behavior*, 49, 130–137. <https://doi.org/10.1016/j.chb.2015.02.059>

Zhitomirsky-Geffet, M., & Blau, M. (2016). Cross-generational analysis of predictive factors of addictive behavior in smartphone usage. *Computers in Human Behavior*, 64, 682–693, <https://doi.org/10.1016/j.chb.2016.07.061>

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