

Exploring the role of Smartphone Addiction in Cognitive Control Among Students: An Emerging Behavioural Concern

Mousumi Mayra

Department of Psychology, Sidho-Kanho-Birsha University, Purulia, West Bengal 723104

E-mail address: mousumi.mayra@gmail.com

Received: 04.06.2026; Accepted: 08.07.2026; Published online: 31.08.2026

DOI: <https://doi.org/10.54280/jse.260803>

Abstract:

Background: In recent years, smartphones have become an inseparable part of students' academic and social lives. Excessive smartphone usage—commonly referred to as smartphone addiction—can negatively affect vital cognitive functions in students, particularly focusing on forgetfulness, distractibility, false triggering, working memory, and inhibitory control.

Aim: To explore the role of smartphone addiction in cognitive failure (forgetfulness, distractibility, and false triggering), inhibition control and working memory in students.

Methods: 200 students from Purulia district were selected through convenience sampling, four standardized psychological tools, i.e., Smartphone Addiction Scale–Short Version (SAS-SV), Cognitive Failures Questionnaire (CFQ), Digit Span (WAIS-IV) & Stroop Task were used to collect data, statistical analysis, i.e., descriptive statistics (Mean & SD), spearman correlation rank, regression analysis and Kruskal-Wallis were computed to test the hypothesis.

Results: Study findings indicate that smartphone addiction plays a significant role in cognitive failure and working memory in students. No significant relationship between Smartphone Addiction and inhibitory control (Stroop Task) was found in the present study.

Conclusion: It was concluded that higher smartphone addiction is associated with more cognitive lapses, especially forgetfulness, distractibility, and false triggering, and also higher smartphone addiction is linked with poorer working memory capacity in students.

Key words: Smartphone Addiction, Cognitive control, Students.

1 Introduction

Smartphone addiction is the excessive use of a smartphone despite the negative effects on the physical, psychological, and social well-being of an individual. In India, the prevalence of smartphone addiction among adolescents and young adults ranges from 24.6% to 44% (Das, Saraswathy & Chaudhary, 2024). According to a survey conducted by the mobile ecosystem from November to December 2019, the highest penetration rate among smartphone users was in the age group of 16-24 years (Kannungo, 2017). It is seen that many college students are now fully dependent on the cell phones, without which they cannot

think about their daily life. Excessive use of smartphone can produce negative influences on the brain, such as nerve damage, attention deficit, emotional distress and deterioration in physical and mental activity (Zhu et al., 2025).

Cognition refers to the mental activities that are involved in the acquisition, processing, storage and retrieval of information. The cerebral cortex plays an important role in various cognitive functions like memory, perception, attention, language and consciousness. Whereas *cognitive failures* are defined as cognitive-based errors during proceeding tasks that an individual should be competent in (Kass, Stanny & Wallace, 2002), such as impaired memory

(e.g., forget where something like a piece of paper or a notebook is placed), distractibility (e.g., start studying a book and get distracted into notification in mobile phone), and blunders (e.g., unintentionally bump into people). These daily failures reflect a slip-up in cognitive processing (Hadlington, 2015). A recent study finding indicates excessive smartphone use can lead to problems like trouble focusing, forgetfulness, and pain in areas like the neck and hands (Lorestani et al., 2025).

Working memory is a unique momentary active store capable of manipulating information essential for many complex cognitive performances, including reasoning, language processing and judgment (Atkinson and Shiffrin, 1968; Baddeley and Logie, 1999). Working memory has been found to require processing of information and simultaneous storage. Baddeley and Hitch (1974). A recent study suggests that moderate correlations exist between working memory, smartphone addiction, and mental fatigue, emphasizing the need for strategies to reduce phone dependency and improve cognitive performance (Akkurt and Aksoy, 2025). Similarly, another study showed positive correlations between smartphone addiction, impaired executive function, and memory impairment. (Lim, J., 2018).

One of the cognitive processes is *inhibitory control*, which is also known as response inhibition, is more specifically an executive function that permits an individual to inhibit their impulses and natural, habitual or dominant behavioural responses to stimuli. A study was conducted in China to explore smartphone addiction and its relation with inhibitory control processes. The results indicate that in the early stage of inhibition processing, excessive smartphone users experience more conflicts, and inhibitory control was more negative in the excessive smartphone use group than the normal use group (Chen et al. al, 2019). Another experimental research finding indicates that in the early stage of inhibition processing, excessive smartphone users experience more conflicts and show a general

deficit that does not depend on smartphone-related cues (Chen et al., 2016).

While global research links excessive screen time to reduced cognitive control and brain changes, existing studies are disproportionately conducted in urban regions with high-income groups; on the other hand, rural communities may have varying levels of digital literacy and access to formal education; hence, empirical data will help to determine whether smartphone reliance creates a cognitive bottle neck (like impaired memory or attention) in this particular population. Therefore, the present study aims to explore the role of smartphone addiction in the cognitive control of young students from the rural communities of Purulia district, West Bengal.

2 Methods

Hypotheses

HA₁- There will be a significant role of smartphone addiction in cognitive failure (forgetfulness, distractibility, false triggering), working memory and inhibitory control of students.

HA₂- There will be a significant effect of gender on smartphone addiction in students.

Design of the study

Ex-post facto design- This is a non-experimental research design

Independent Variable - Smartphone addiction

Dependent variable - Cognitive failure, Inhibitory control and Working memory.

Grouping Variable - Gender (Male & Female)

Sample

In the present study, a total of 200 young adults were drawn through convenience sampling from the region of Purulia district, West Bengal, who are mainly college and university students. Participants with

potential visual or auditory impairments were excluded from the study, as that could affect the test performance.

Tools Used

These are the following tools were used in the study to collect the data

Scale Name	Number of items & dimensions	Psychometry Property
Smartphone Addiction Scale – Short Version By Kwon et. al. (2013)	Items - 10. Dimensions - N/A	Cronbach's alpha coefficient - .844
Cognitive Failures Questionnaire By Broadbent et. al. (1982)	Items - 25 Dimensions: Forgetfulness, Distractibility, False Triggering	Test-retest reliability - ranging from .71 to .83
Digit Span subtest of the Wechsler Adult Intelligence Scale (WAIS) By Wechsler (1955)	Items- Dimensions: Digit Span Forwards, Digit Span Backwards, Digit Span Sequencing	Test-retest reliability -0.96 (Full Scale IQ)
Stroop Test by Stroop (1935)	Items - 30 2 sets- Congruent, Incongruent.	Reliability - 0.73

Procedure

As per the study objectives, data were collected from the targeted population by reaching out to college and university students in Purulia. A data sheet was prepared with an information schedule and the four above-mentioned psychological tools. After collecting the data, it was tabulated and analyzed by using SPSS. Descriptive statistics (Mean & SD), normality test (Shapiro-Wilk test), test of association (Spearman's rho) and inferential statistics (Kruskal-Wallis, Mann-Whitney Rank test) were computed. Based on the statistical analysis, a discussion was done, and conclusion was made. Along with this limitation, future suggestions were also mentioned.

Table 1 indicates that smartphone Addiction (SAS-SV) is positively correlated with Cognitive Failure (CF): $r = .283$, $p < .01$, Forgetfulness (V_{11}): $r = .297$, $p < .01$, Distractibility (V_{12}): $r = .361$, $p < .01$ and

3 Results

Shapiro-Wilk (S-W) tests were conducted to assess the normality of the distribution for each variable. For SAS-SV, cognitive failure composite score, distractibility, false triggering, Stroop Task, and Digit Span, the p -values from both tests were below .05, indicating significant deviation from normality. For forgetfulness, it showed significantly greater p -values ($p > .05$), suggesting normal distribution.

Given these results, non-parametric tests (such as Spearman's rho, Mann-Whitney U, Kruskal-Wallis, etc.) are appropriate for analysing the data, as the assumption of normality is violated for several variables. To analyse the role of smartphone addiction in cognitive control, a regression analysis was conducted.

False Triggering (V_{13}): $r = .368$, $p < .01$, which implies higher smartphone addiction is significantly associated with more cognitive lapses, especially forgetfulness, distractibility, and false triggering.

Table 1: Spearman's Correlation Matrix Among Study Variables
($N = 200$)

Variable	1	2	3	4	5	6	7
1. SAS-SV	—						
2. CF	.28**	—					
3. V11	.30**	.65**	—				
4. V12	.36**	.75**	.62**	—			
5. V13	.37**	.87**	.86**	.83**	—		
6. Stroop Task	.04	-.04	-.05	-.02	-.05	—	
7. Digit Span	-.24**	-.09	-.09	-.05	-.12	-.14*	—

Note: SAS-SV = Smartphone Addiction Scale – Short Version; CF = Cognitive Failure; V₁₁ = Forgetfulness; V₁₂ = Distractibility; V₁₃ = False Triggering. Values with $p < .05$ suggest non-normal distribution.

On the other hand, smartphone addiction (SAS-SV) is negatively correlated with working memory (Digit Span): $r = -.244$, $p < .01$, which indicates that higher smartphone addiction is linked with poorer working memory capacity.

No significant relationship has been found between smartphone addiction and inhibition control (Stroop Task): $r = .038$, $p = .591$, which means inhibition control is not directly affected by smartphone addiction in this study sample.

Table 2 shows predictors of cognitive failure. Models 1, 2, & 3 are statistically significant and explain approximately 7.4% of the variance in forgetfulness, 8 % of the variance in distractibility and 15.1% of the variance

in the false triggering can be explained by smartphone addiction.

And all the t -values are significant at <0.05 , suggesting a positive and significant contribution of smartphone addiction as the predictor.

As inhibitory control cannot be explained by smartphone addiction in the present study Therefore, HA1 is partially accepted. Table 3 shows the gender differences in smartphone addiction. Results indicated no statistically significant difference, $H(1) = 0.06$, $p = .813$. Consequently, the null hypothesis was retained; this suggests that gender does not significantly influence smartphone addiction levels among the students sampled.

Table 2: Predictors of Cognitive Failure (Forgetfulness, False Triggering and Distraction)

Model	Constant				SAS-SV					R ²	Adjusted R ²
	(B)	(SE B)	(t)	(p)	(B)	(SE B)	(β)	(t)	(p)		
Model 1 (F)	4.87	1.79	2.71	.007	.209	.051	.280	4.10	.000	.078	.074
Model 2 (D)	5.79	1.86	3.10	.002	.227	.053	.291	4.28	.000	.085	.080
Model 3 (FT)	-.120	1.71	-.70	.944	.293	.049	.394	6.02	.000	.155	.151

Table 3: Kruskal–Wallis H Test for Gender Differences in Smartphone Addiction Scores ($N = 200$)

Variable	<i>H</i>	df	<i>p</i>	Decision
SAS-SV (by Gender)	0.061	1	.813	Retain the null hypothesis

4 Discussion

The present study established a significant role of smartphone addiction in cognitive failure as well as a significant negative association with working memory. No significant association was found between smartphone addiction and inhibitory control. As a dimension of cognitive failure, forgetfulness can be significantly predicted by smartphone addiction in ($r^2=0.74$) has also been identified in the present study. Forgetfulness can be defined as a failure in memory functioning that leads to difficulty in encoding, storing, or retrieving information when needed. It is thus understood as a cognitive failure in the memory system. Shallow information processing, i.e., encoding lapses, storage difficulty, and retrieval problems, as well as sleep disruption, can cause forgetfulness. Excessive smartphone use can lead to sleep disruption, encoding lapses, and retrieval problems (An and Zhang, 2024).

Frequent smartphone use in young adults has been increasingly associated with higher levels of distractibility. Distractibility can be significantly predicted by smartphone addiction ($r^2=.080$), which refers to a tendency for attention to be easily diverted away from a task or goal by irrelevant internal thoughts and external stimuli; here addiction to smartphones, i.e., getting constant notifications and updates about others' lives, could be responsible for distractibility. It can also be thought of as a lapse in normal cognitive functioning that results in errors or inefficiency in daily activities. The present findings align with previous review article by Mascia et. al. (2022); the particular literature review looks at how using smartphones too much can cause problems like being easily distracted, ignoring people (phubbing), and making more thinking mistakes. The study found that

younger people have more of these problems.

Smartphone addiction has also significantly predicted false triggering ($r^2 = .151$), which referred to as failure in action control, where an automatic or habitual response is triggered in the wrong context & situation. It shows how the brain sometimes misfires by linking the wrong trigger to a response. Exposure to a smartphone for a longer period of time may lead to a tendency towards a habitual response.

The present study also explored that smartphone addiction is negatively associated with working memory ($r=-.24$, $p < .01$), which reflects a brain system that provides temporary storage and manipulation of the information necessary for complex cognitive tasks, such as language comprehension, learning, and reasoning. The current study result aligns with previous research findings, indicating higher the smartphone use, the poorer the working memory capacity. As one study done by Searles (2023) indicates, phone presence negatively impacted cognitive performance, and those with higher levels of phone attachment would exhibit more cognitive costs. Similarly, foundational studies, such as Ward et al. (2017) suggested that just having a phone nearby could impair working memory, a concept they called the “brain drain” effect.

The present study has failed to establish a significant gender difference in smartphone addiction. Which naturally implies both genders are equally involved in excessive smartphone use. Although the previous empirical studies have established a different trend, for instance, gender differences exist in the prevalence, patterns, and underlying mechanisms of smartphone addiction, where females are found to be involved in problematic smartphone use more than their male counterparts (Olson et al., 2023).

Similarly, studies conducted among university students in Saudi Arabia and high school students in Vietnam have also identified higher rates of smartphone addiction among females (Wakeel et al., 2024; Ali et al., 2022). Several researchers found some interesting facts about the addiction patterns of male and female smartphone users across the world. Males often use smartphones more for gaming or information-seeking, behaviours that may be associated with different neurocognitive and motivational pathways, whereas females tend to engage more with social communication applications, such as social networking sites and messaging platforms (Varchetta et.al., 2024). Few research indicates that females may be more prone to experiencing negative mental health outcomes associated with smartphone addiction, such as anxiety and depression (Kanwal, Munir & Abrar, 2024; Ayandele, Popoola & Oladiji, 2020)

Smartphone addiction represents a growing concern among students, significantly impacting cognitive control as well as academic and psychological well-being. Cognitive control, encompassing executive functions such as inhibitory control, working memory, and attentional control, is crucial for goal-directed behaviour such as academic performance and self-regulation. The motivation for addiction often evolves from seeking pleasure to escaping negative emotional states, a transition explained by opponent-process theory and changes in dopamine signalling. Chronic smartphone use may tax frontoparietal regulatory networks, impairing top-down modulation of attention and behaviour, leading to increased response inhibition errors, slower conflict resolution, and reduced working memory efficiency (Nadine, 2025). As the present study empirically established the significant negative association between smartphone addiction and cognitive control, it is essential to implement multifaceted interventions that target behavioural regulation, enhance self-control, promote emotional well-being, and potentially involve neurocognitive training, all aimed at restoring

optimal cognitive function and fostering healthier digital habits among students. In future studies more in-depth understanding of the association is required, for instance, mediating factors like personality traits, environmental factors, and neurophysiology of addiction, and addiction types among genders and different age groups are needed for further investigation.

5 Conclusion

Smartphone addiction is characterized by excessive or uncontrolled smartphone use that disrupts daily life. This behavioural addiction can hijack the brain's learning and reward systems, shifting control from goal-directed actions to rigid, cue-driven compulsions. The present study results indicate that higher smartphone addiction is associated with cognitive lapses, especially forgetfulness, distractibility, and false triggering, and poorer working memory capacity in students. The present study is limited to a small sample size, for which the study results cannot be generalized to larger populations. In the future, consideration of various mediating factors like personality, locus of control and other demographic factors is suggested.

Acknowledgements

I am deeply grateful to all the authorities of the college and university who grant permission to collect data in their respective institution. I am thankful to all the participants who took part in the study willingly. Their cooperation and insights were essential to the success of our study.

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