

Social Media Engagement, ChatGPT Use, and Mind Wandering among Students: The Mediating Role of Cognitive Flexibility

Shashidhar Gupta¹, Roshan Lal Dewangan², Imlisongla Longkumer³, Smriti Pathak⁴

¹Department of Psychology, S.N. Sinha College, Jehanabad, Bihar, India

²Department of Applied Psychology, Kazi Nazrul University, Asansol (West Bengal), India

³Department of Psychology, Nagaland University, Kohima Campus, Meriema, HQs Lumami, India

⁴Jindal School of Psychology & Counselling, O.P. Jindal Global University, Sonipat, Haryana, India

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In academic settings, digital engagement is often treated as a single source of distraction. This study challenges that notion by contrasting the association of social media engagement (SME) and ChatGPT use (CGU) on student cognition. Analyzing data from 1,027 participants, we found that SME correlates with reduced cognitive flexibility and increased mind wandering (M-W). In a revealing divergence, CGU was positively associated with cognitive flexibility. Mediation analyses confirmed that cognitive flexibility fully explains the link between CGU and lower M-W, while it also partially mediates the negative association of SME with M-W. This clear dichotomy suggests that unlike the distracting nature of social media, AI tools like ChatGPT can facilitate adaptive thinking processes that help maintain focus. The implications for education are significant; rather than imposing broad restrictions, a more thoughtful strategy that promotes positive uses of AI while limiting excessive social media engagement is necessary.

Keywords: Higher education; Digital cognition; generative AI; Social Media Addiction.

Address of correspondence: Correspondence regarding this manuscript should be addressed to Roshan Lal Dewangan, Department of Applied Psychology, Kazi Nazrul University, Asansol (West Bengal), India. Email: roshan.dewangan@knu.ac.in, ORCID: <https://orcid.org/0000-0003-3900-9400>

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Introduction

The widespread adoption of digital technology has been a major driver of the educational technology revolution. By July 2024, mobile phone penetration reached 70% of the global population (5.68 billion), with 67.1% (5.45 billion) active internet users (Kemp, 2024). Supported by this infrastructure, EdTech funding rose sharply from USD 0.5 billion in 2010 to USD 16.1 billion in 2020 (Education Intelligence Unit, 2022), further accelerated by the COVID-19 shift to online education. Consequently, the EdTech and smart classrooms market is projected to grow at a compound annual growth rate of 20%, from USD 214.73 billion in 2025 to USD 445.94 billion in 2029 (Prasser, 2025). This digital integration has also fueled a parallel surge in social media use among students.

Platforms such as TikTok and Facebook, once primarily used for social interaction, are increasingly being used in education (Chugh & Ruhi, 2018; López-Carril et al., 2024). Yet, social media use (SMU) often extends beyond educational purposes. Terms like “social media addiction” and “problematic SMU” are now common in mental health research. Systematic reviews linked SMU in young adults to anxiety, depression, poor sleep, and reduced well-being (Ahmed et al., 2024). Parallel to social media, artificial intelligence (AI) is reshaping education. Generative AI (genAI) tools such as ChatGPT are transforming information access, communication, and learning (Ivanov et

al., 2024). A global survey of 3,839 students across 16 countries found 86% used AI in their studies (Digital Education Council, 2024). However, as with social media, genAI adoption also carries significant limitations and potential risks.

SMU and Cognitive Functioning

Students are expected to sustain attention during extended lectures or dense readings to support comprehension and academic performance. However, the mind frequently “drifts off” from the primary task toward unrelated internal thoughts or external stimuli, a phenomenon known as mind wandering (M-W) (Smallwood & Schooler, 2006). Research has consistently linked M-W to deficits in task performance, including reduced academic achievement (Randall et al., 2014; Wammes et al., 2016). Social media amplifies this tendency through features such as frequent push notifications (acoustic, visual, and pop-up messages) that disrupt cognitive flow and promote task-switching, thereby triggering spontaneous M-W. Such interruptions fracture sustained attention and increase the intrusion of task-unrelated thoughts (Koesmeier & Büttner, 2024; van Koningsbruggen et al., 2017). The Executive Failure Hypothesis and Resource Control Theory further suggest that social media distractions impair executive control—the cognitive processes that allow for the regulation of attention, behavior, and emotions to achieve goals. Repeated digital interruptions deplete limited

attentional resources, complicating efforts to regain focus and reinforcing habitual and unintentional thought drift (Smallwood & Schooler, 2015).

To explain the mechanism of M-W, recent studies have focused on the role of cognitive flexibility. Cognitive flexibility can be understood as the higher-order executive capacity that allows individuals to dynamically adapt their cognitive and behavioral strategies in response to changing internal and external demands (Deng et al., 2022). However, there are differences in conceptualization of association between M-W and cognitive flexibility. From the perspective of the set-shifting model (Wong, Willoughby, et al., 2023), this involves the ability to deliberately disengage from one mental task, inhibit prepotent responses, and activate new, contextually relevant information in working memory. Concurrently, the trait model emphasizes that cognitive flexibility also entails the efficient allocation of limited attentional resources to maintain goal-directedness, particularly when self-generated thoughts such as M-W compete for executive resources (Deng et al., 2022).

Task-switching studies paint a mixed picture. These studies have treated M-W propensity as the independent variable and switching speed as the dependent variable. Counterintuitively, higher M-W often predicts better switch performance, suggesting that individuals prone to drifting thoughts may also be quicker at shifting between tasks (Wong et al., 2022; Wong, Willoughby, et al., 2023; Wong & Yu, 2024). M-W itself does not necessarily disrupt switching accuracy, indicating that lapses of attention do not always translate into measurable performance costs. Electrophysiological data even show shared control signals (P3) in M-W vs on-task switch trials, implying that similar brain mechanisms support both internal thought shifts and external task-set shifts (Wong, Pat, et al., 2023). Overall, cognitive flexibility (smaller switch costs) has been observed in high mind-wanderers as an outcome, reinforcing the idea that frequent M-W can sometimes reflect mental flexibility rather than control failure (Hartanto & Yang, 2022). However, one study among children (8-12 years) did not find significant association between task-switch ability and M-W (Hasan et al., 2024).

Few studies have used trait or self-report measures of cognitive flexibility together with M-W scales, treating flexibility as either a correlate or mediator of M-W. Deng et al. (2022) found that higher levels of trait M-W, particularly spontaneous, were associated with lower self-reported cognitive flexibility, with boredom mediating this relationship. Similarly, Zhou et al. (2024) reported that lowered flexibility in cognitive control was associated with increased deliberate and spontaneous M-W, and that cognitive flexibility, alongside habitual automaticity, partially mediated the link between childhood adversity and M-W (Zhou et al., 2024).

Despite emerging evidence linking cognitive flexibility to M-W, a scarcity of research exists within the context of SMU. Although studies have associated internet and social media addiction with poorer cognitive flexibility (Dong et al., 2014; Imran et al., 2025; Tanhan et al., 2024; Wang et al., 2023), the role of cognitive flexibility in the relationship between SMU and M-W remains largely unexplored.

Impact of ChatGPT uses in higher education

ChatGPT exhibits considerable potential to enhance student learning through its extensive knowledge base, swift feedback, and content creation abilities, which can promote engagement and interaction (Dirks-Naylor, 2025; Faisal, 2024). In the realm of higher education, it has been utilized

to aid in academic writing (Song & Song, 2023), improve understanding of intricate concepts (Haindl & Weinberger, 2024; Sun et al., 2024), and support problem-solving (Urban et al., 2024). Nonetheless, some researchers contend that its application may hinder learning, associating it with a decline in creative writing skills (Niloy et al., 2024), reduced flow experience, lower self-efficacy, and inferior learning outcomes in comparison to conventional methods (Yang et al., 2025). A recent meta-analysis (Heung & Chiu, 2025) contrasted the impact of ChatGPT-based and non-ChatGPT learning on student engagement. They discovered a medium effect size on total student engagement with ChatGPT-based learning. Furthermore, compared to non-ChatGPT-based learning, ChatGPT-based learning was more successful in promoting student behavioral, cognitive, and emotional involvement.

Current Study

As noted earlier, few studies have examined the role of cognitive flexibility in the association between SME and M-W. Cognitive flexibility was selected as the proposed mediator because it represents a core executive and self-regulatory capacity relevant to both digital engagement and M-W. Whereas M-W involves a shift of attention away from the focal task toward task-unrelated thoughts, cognitive flexibility refers to the capacity to adapt cognitive and behavioral strategies in response to changing demands, shift between mental sets, and regulate goal-directed attention (Deng et al., 2022; Dennis & Vander Wal, 2010). Previous studies have shown that lower self-reported cognitive flexibility is associated with greater M-W, particularly spontaneous M-W, suggesting that cognitive flexibility may be an important self-regulatory mechanism underlying task-unrelated thought (Deng et al., 2022; Zhou et al., 2024).

This mechanism is especially relevant in the context of SME. Social media cues and notifications can interrupt task focus, promote attentional capture, and increase vulnerability to task-unrelated thoughts (Koessmeier & Büttner, 2024; van Koningsbruggen et al., 2017). In addition, problematic social media and internet use have been associated with poorer cognitive flexibility and deficits in cognitive control (Dong et al., 2014; Tanhan et al., 2024; Wang et al., 2023). Therefore, higher SME may be associated with greater M-W partly because it is linked to lower cognitive flexibility.

The present study focused on the two established components of the Cognitive Flexibility Inventory: Alternatives and Control (Dennis & Vander Wal, 2010). The Alternatives facet reflects the ability to generate multiple explanations and alternative solutions, whereas the Control facet reflects the tendency to perceive difficult situations as manageable. These two components were examined separately because they may represent distinct self-regulatory routes through which digital engagement relates to M-W. For example, SME may be associated with lower flexibility by reducing students' ability to consider alternative task-focused responses and by weakening perceived control over attention.

In addition to SME, the present study examined ChatGPT use (CGU). To date, no study has directly examined the association between CGU and M-W. However, emerging evidence suggests that CGU may be negatively associated with divergent thinking (Niloy et al., 2024). Both social media platforms and ChatGPT can provide highly engaging, rapidly accessible, and personalized information, which may encourage habitual use and attentional capture (Krishnamoorthy et al., 2025).

At the same time, CGU may differ from SME because students often use ChatGPT for academic writing support, task assistance, idea generation, and problem-solving functions commonly reported in educational contexts (Nemt-allah et al., 2024; Song & Song, 2023; Urban et al., 2024). Therefore, CGU may show a different pattern of association with cognitive flexibility and M-W than SME. Specifically, CGU may be positively associated with cognitive flexibility when students use it for structured academic purposes, although such associations should be interpreted cautiously given the cross-sectional nature of the study.

Before testing the mediation models, we first examined whether SME and CGU were associated. This step was important because both represent forms of digital engagement and may share variance. Establishing their association also provided the rationale for controlling for SME when examining the association between CGU and M-W. Accordingly, we first hypothesized that SME and CGU would be positively associated (H1). Second, we hypothesized that the Alternatives and Control facets of cognitive flexibility would mediate the positive association between SME and M-W (H2). Third, we hypothesized that the Alternatives and Control facets of cognitive flexibility would mediate the association between CGU and M-W after controlling for SME (H3).

Methods

Participants

Participants were recruited through purposive sampling from seven higher education institutions (five public and two private) located across three cities in India. To ensure diverse representation, students were drawn from different academic disciplines (Arts, Science, and Commerce) and from varied locality backgrounds (rural, urban, and semi-urban). Eligibility criteria included ownership of a personal cellphone and sufficient English proficiency for reading, writing, and comprehension. In total, 1,097 survey forms were received; after excluding 70 incomplete responses, data from 1,027 participants were retained for the final analysis.

Measures

Social Media Engagement Questionnaire (SMEQ)

Social media engagement (SME) was assessed using the SMEQ (Przybylski et al., 2013). The instrument consists of five items that capture how frequently individuals use social media across different points of the day (e.g., upon waking, during meals, and before going to bed). Responses were recorded on an eight-point Likert-type scale ranging from '0 (not at all in a day) to 7 (every day)'. Higher scores indicate greater engagement with social media. In the present study, the scale demonstrated good internal consistency (Cronbach's $\alpha = .77$).

ChatGPT Usage Scale (CGUS)

ChatGPT uses was measured with the CGUS (Nemt-allah et al., 2024); a 15-item instrument that assesses usage across three domains: Academic Writing Aid, Academic Task Support, and Reliance and Trust. Items are rated on a 5-point Likert scale ranging from '1 (strongly disagree) to 5 (strongly agree)'. The scale demonstrated good internal consistency in its original validation (Cronbach's $\alpha = .85$). In the present study, reliability was also good (Cronbach's $\alpha = .88$).

Mind-Wandering Questionnaire (M-WQ)

M-W was assessed using the M-WQ (Mrazek et al., 2013), which measures the frequency with which task focus is interrupted by task-unrelated thoughts. The scale consists of five items rated on a 6-point Likert scale ranging from '1 (almost never) to 6 (almost always)'. In its original development, the M-WQ demonstrated good reliability (Cronbach's $\alpha = .85$). In the present study, we found similar internal consistency (Cronbach's $\alpha = .83$).

Cognitive Flexibility Inventory (CFI)

Cognitive flexibility was assessed using the CFI (Dennis & Vander Wal, 2010), which measures two aspects of flexible thinking: (a) Alternatives (CFI-A)—the ability to perceive multiple alternative explanations for life events and human behavior, as well as to generate multiple alternative solutions to difficult situations (13 items); and (b) Control (CFI-C)—the tendency to view challenging situations as controllable (7 items). Each item is rated on a 7-point Likert scale ranging from '1 (strongly disagree) to 7 (strongly agree)'. In its original development, the CFI demonstrated strong internal consistency, with Cronbach's α values of .91 (at two occasions, seven weeks apart) for the Alternatives subscale, and .86 to .84 for the Control subscale. Consistent with previous results, in this study CFI-A has Cronbach's $\alpha = .92$ and CFI-C has Cronbach's $\alpha = .88$.

Procedure

The study protocol was reviewed and approved by the Human Research Ethics Committee of Kazi Nazrul University, Asansol, West Bengal (Ref. KNU/REC/CC/5/2025). Data collection was conducted in person at the premises of the participating institutions. After receiving a clear explanation of the study in classroom settings, students were provided with informed consent forms. Those who agreed to participate then completed the questionnaire. Participation was entirely voluntary.

Statistical Analyses

Data were first screened for missing values, outliers, and violations of statistical assumptions. Descriptive statistics for all study variables were then computed. To test the study hypotheses, Pearson's correlation coefficients and two mediation analyses were conducted. To align the hypotheses with the measurement structure of the Cognitive Flexibility Inventory, cognitive flexibility was modeled through its two subscales: Alternatives and Control. These two facets were entered as parallel mediators rather than using a total cognitive flexibility score. In the first mediation model, social media engagement (i.e., SMEQ scores) was entered as the independent variable and M-W (i.e., M-WQ score) as the dependent variable, with the Alternatives and Control subscales of the Cognitive Flexibility Inventory (CFI-A and CFI-C) specified as mediators. In the second mediation model, CGUS score was included as the independent variable, SMEQ was treated as a covariate, and the mediators remained the same as in the first model. All statistical analyses were performed using SPSS 25 for Windows, with mediation tested via Hayes' PROCESS macro (Model 4; Hayes, 2022).

Results

Data from 1,027 participants representing diverse academic disciplines and locality backgrounds, were included in the final analyses. The participants' age ranged

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between 18-34 years with mean age 21.98 (SD = 2.22). Further participant characteristics are presented in Table 1.

Table 1. Demographic details of the participants (N = 1027)

Variable		Frequency (%)
Gender	Female	534 (52)
	Male	493 (48)
Locality	Rural	319 (31.1)
	Semi-urban	115 (11.2)
	Urban	593 (57.7)
Religion	Christian	310 (30.2)
	Muslim	65 (6.3)
	Hindu	652 (63.5)
Education Level	Bachelor	496 (48.3)
	Masters	517 (50.3)
	PhD	14 (1.4)
Academic Discipline	Arts	511 (49.8)
	Commerce	253 (24.6)
	Science	263 (25.6)
Having Laptop	Yes	534 (52)
	No	493 (48)
Having Tablet	Yes	129 (12.6)
	No	898 (87.4)

For large sample sizes (N > 50), skewness values within ± 2 and kurtosis values within ± 3 are generally considered indicative of normality (Hahs-Vaughn & Lomax, 2020, pp. 128–130). Based on these criteria, all study variables in the present sample were normally distributed. SME was significantly positively correlated with CGU and M-W but negatively correlated with both facets of cognitive flexibility. In contrast, CGU showed positive correlations with both cognitive flexibility facets (Table 2).

Table 2. Descriptive Statistics and Pearson Correlations (N = 1027)

Variable	M (SD)	Skewness (SE .08))	Kurtosis (SE .15)	1	2	3	4	5
1. SMEQ	17.90 (9.20)	.08	-.70	—	.24**	.44**	-.48**	-.35**
2. CGUS	54.36 (9.77)	-1.11	1.67		—	.11**	.14**	.10**
3. M-WQ	16.30 (6.06)	.22	-.47			—	-.35**	-.31**
4. CFI-A	68.22 (13.75)	-1.67	2.63				—	.54**
5. CFI-C	33.05 (9.45)	-.76	.12					—

Note. **p < .01 (two-tailed). CFI-A = Cognitive Flexibility Inventory-Alternative; CFI-C = CFI-Control; CGUS = ChatGpt Uses Scale; M-WQ = Mind-Wandering Questionnaire; SMEQ = Social Media Engagement Questionnaire.

Table 3. Mediation Analysis of the association of Social Media Engagement (SMEQ) on Mind-Wandering (M-WQ) through Cognitive Flexibility for Alternatives (CFI-A) and Cognitive Flexibility of Control (CFI-C)

Path	B	SE	t	p	95% CI (LL–UL)	β
Direct Association						
SMEQ → CFI-A	-.72	.04	-17.63	< .001	-.80, -.64	-.48
SMEQ → CFI-C	-.36	.03	-11.98	< .001	-.42, -.30	-.35
SMEQ → M-WQ	.22	.02	10.44	< .001	.18, .26	.33
CFI-A → M-WQ	-.06	.02	-3.56	< .001	-.09, -.03	-.13
CFI-C → M-WQ	-.08	.02	-3.88	< .001	-.12, -.04	-.13
Total Association						
SMEQ → M-WQ	.286	.02	15.48	< .001	.25, .32	.44
Indirect Association						
Total Indirect	.07	.01	—	—	.05, .09	.11
Via CFI-A	.04	.01	—	—	.02, .06	.06
Via CFI-C	.03	.01	—	—	.01, .05	.05

Note. CFI-A = Cognitive Flexibility Inventory-Alternative; CFI-C = CFI-Control; M-WQ = Mind-Wandering Questionnaire; SMEQ = Social Media Engagement Questionnaire.

In the first mediation analysis, results indicated that SMEQ was negatively associated with both cognitive flexibility for alternatives (B = -.72, p < .001) and cognitive flexibility of control (B = -.36, p < .001). Both CFI-A (B = -.06, p < .001) and CFI-C (B = -.08, p < .001) were inversely associated with M-WQ. The direct association of SMEQ on M-WS remained significant (B = .22, p < .001), while the total association was also significant (B = .29, p < .001). Bootstrap analyses confirmed significant indirect association through CFI-A (B = .04, 95%CI .02—.06) and CFI-C (B = .03, 95%CI .01—.05). Thus, higher SMEQ score was associated to greater M-WQ scores directly and indirectly through reduced cognitive flexibility. The mediation model is presented in Table 3 and Figure 1.

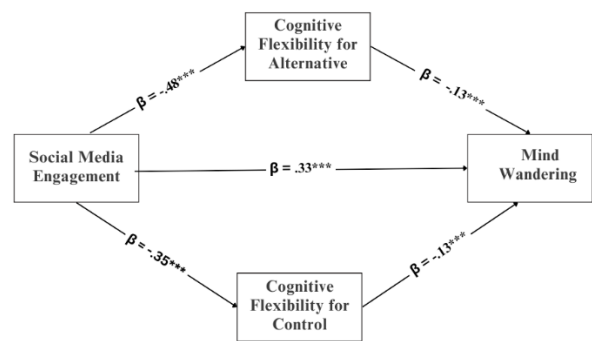


Figure 1. Mediation model of Social Media Engagement and Mind Wandering via Cognitive Flexibility (for alternative and control)

Second mediation analysis examined whether cognitive flexibility mediated the association of CGU on M-W, controlling for social media engagement. CGUS was positively associated with both CFI-A ($B = .38, p < .001$) and CFI-C ($B = .19, p < .001$). Conversely, SMEQ scores were negatively associated with both CFI-A ($B = -.82, p < .001$) and CFI-C ($B = -.41, p < .001$). In the second stage, both CFI-A ($B = -.06, p < .001$) and CFI-C ($B = -.09, p < .001$) significantly associated to lower M-WQ. The direct link of CGUS on M-WQ remained significant but small ($B = .04, p = .02$). SMEQ also exhibited a strong positive association with M-WQ ($B = 0.20, p < .001$). The total association of CGUS on M-WQ was not significant ($B = 0.001, p = .94$), indicating that CGUS score was associated with reduced M-WQ scores through higher cognitive flexibility. This mediation model is presented in Table 4 and Figure 2.

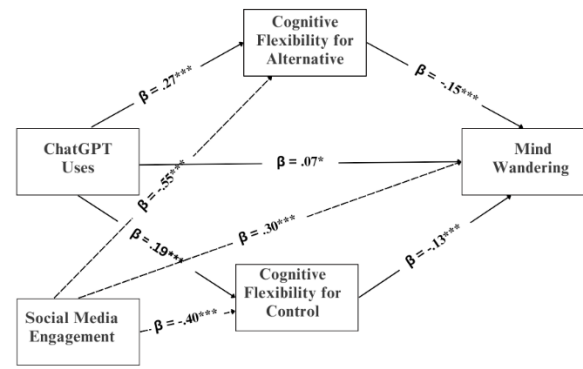


Figure 2. Mediation model of ChatGPT Uses and Mind Wandering via Cognitive Flexibility (for alternative and control), controlling for Social Media Engagement

Table 4. Mediation of the association between ChatGPT uses (CGUS) and mind-wandering (M-WQ) through cognitive flexibility (CFI-A, CFI-C), controlling for social media engagement (SMEQ)

Path	B	SE	t	p	95% CI (LL-UL)	β
Direct Association						
CGUS → CFI-A	.38	.04	10.07	< .001	.31, .46	.27
CGUS → CFI-C	.19	.03	6.56	< .001	.13, .24	.19
SMEQ → CFI-A (covariate)	-.82	.04	-20.32	< .001	-.89, -.74	-.55
SMEQ → CFI-C (covariate)	-.41	.03	-13.42	< .001	-.47, -.35	-.40
CFI-A → M-WQ	-.06	.07	-4.01	< .001	-.10, -.03	-.15
CFI-C → M-WQ	-.09	.02	-4.05	< .001	-.13, -.04	-.13
CGUS → M-WQ	.04	.09	2.27	.024	.006, .08	.07
SMEQ → M-WQ (covariate)	.20	.02	8.97	< .001	.16, .24	.30
Total Association						
CGUS → M-WQ	.001	.02	.07	.941	-.03, .04	.002
Indirect Association						
Total Indirect	-.04	.008	—	—	-.06, -.03	-.07
Via CFI-A	-.02	.007	—	—	-.04, -.01	-.04
Via CFI-C	-.02	.005	—	—	-.03, -.007	-.03

Note. CFI-A = Cognitive Flexibility Inventory-Alternative; CFI-C = CFI-Control; CGUS = ChatGPT Uses Scale; M-WQ = Mind-Wandering Questionnaire; SMEQ = Social Media Engagement Questionnaire.

Discussion

This study sought to address a critical gap in research by examining how social media engagement (SME) and ChatGPT use (CGU) are associated with M-W through the mediating role of cognitive flexibility among higher education students. Specifically, we tested whether SME and CGU would be positively correlated, and whether these forms of digital engagement would demonstrate parallel associations with cognitive flexibility and M-W. Data from 1,027 students were analyzed to evaluate these hypotheses.

Consistent with expectations, SME and CGU were significantly and positively correlated, supporting our initial hypothesis (H1). This relationship reflects current digital realities, where many users are introduced to and actively discuss ChatGPT through social media platforms such as X (formerly Twitter), Reddit, and TikTok. Indeed, recent sentiment analyses highlight ChatGPT as one of the most frequently discussed topics on X, with nearly half of users (49%) reporting positive views regarding its utility (Bina, 2025). At the same time, emerging research has

begun to document the risks of problematic CGUs. Studies suggest that excessive or compulsive engagement with ChatGPT correlates positively with patterns observed in social media addiction, internet gaming disorder, and generalized internet addiction (Maral et al., 2025). These associations appear to stem from overlapping psychological traits, such as impulsivity, digital dependence, and a tendency toward cognitive offloading (Maral et al., 2025).

Furthermore, as expected (H2), SMEQ scores were significantly associated with M-W, with cognitive flexibility serving as a meaningful mediator in this relationship. Specifically, higher levels of social media engagement were negatively associated with both dimensions of cognitive flexibility (control and alternatives) and positively associated with M-W. These results are consistent with prior meta-analytic and neuroimaging evidence showing that problematic internet use is associated with impairments in inhibitory control, decision-making, and working memory, and that internet and smartphone addiction are linked to altered prefrontal, cingulate, insular, and frontoparietal systems involved in cognitive control (Ioannidis et al., 2019; León Méndez et

al., 2024). Similar evidence from smartphone-user research also suggests that excessive or problematic smartphone use is associated with reduced inhibitory control (Chen et al., 2016; Fabio et al., 2022). Such impairments in self-regulatory capacity may help explain why excessive social media engagement is often accompanied by increased M-W and reduced cognitive flexibility (Deng et al., 2022; Koessmeier & Büttner, 2024; van Koningsbruggen et al., 2017).

Hypothesis 3 provided a more stringent test of the association between ChatGPT use and M-W because SME was included as a covariate. This adjustment was necessary because ChatGPT use and SME were significantly correlated, and SME was itself strongly associated with M-W. By controlling for SME, the model estimated the association of ChatGPT use with M-W beyond the variance shared with broader digital engagement. Although ChatGPT use showed a small positive bivariate correlation with M-W, this total association became non-significant after social media engagement was taken into account. This suggests that the simple association between ChatGPT use and M-W may partly reflect shared variance with broader digital engagement, especially social media engagement. However, ChatGPT use was positively associated with both facets of cognitive flexibility, and these facets were negatively associated with M-W. The significant negative indirect association indicate that ChatGPT use may be linked to lower M-W through greater cognitive flexibility. At the same time, the small positive residual direct association suggests that ChatGPT use may also involve other pathways not captured by cognitive flexibility. Therefore, the findings are better interpreted as an inconsistent mediation or competing-pathways pattern rather than full mediation.

Although SME and CGU are correlated, their link to cognitive flexibility and M-W vary significantly; this emphasizes the necessity to differentiate between forms of digital engagement that may be distracting and those that are cognitively beneficial. Although the correlation between SMEQ and CGU was statistically significant, the coefficient was small. ChatGPT shares certain features with social media (for example, accessibility, interactivity, and its role as a platform for rapid information exchange), yet it differs in its primary purpose and mode of engagement. Whereas social media is largely designed for entertainment, social connection, and continuous information flow, ChatGPT is oriented toward task support, problem-solving, and knowledge generation (Nemt-allah et al., 2024). These functional differences may partly explain why ChatGPT use was positively associated with cognitive flexibility, thereby indirectly reducing M-W.

Above finding has practical implications for higher education globally, highlighting distinct cognitive profiles associated with SME versus CGU. Research shows that heavy social media use have been associated to fragmented attention, poor planning, and weakening of

executive control, but increased mind-wandering (Chenji & Raghavendra, 2025; Naik et al., 2025; Sina et al., 2023). In contrast, ChatGPT can foster learning and higher-order thinking when thoughtfully integrated into instruction (Dirks-Naylor, 2025; Heung & Chiu, 2025). However, some studies caution that ChatGPT users may exert less cognitive effort and retain information less effectively than unassisted learners (Kosmyrna et al., 2025). This suggests that while SME may undermine sustained focus, the benefits of CGU depend on intentional pedagogical design (Salih et al., 2025).

Therefore, a balanced approach is essential for education policy and practice. In line with UNESCO guidance on AI literacy, equity, and inclusion (Miao et al., 2021), ChatGPT should be embedded within structured learning tasks, such as guided prompts, research projects, or problem-solving activities, to encourage active engagement with AI outputs (Salih et al., 2025). When used as a scaffold for brainstorming, critical reflection, and complex thinking, ChatGPT can help students sustain focus and reduce unproductive digital distractions (Dirks-Naylor, 2025).

Some cautions are warranted when interpreting these results in the context of higher education. Although CGUs was positively correlated with cognitive flexibility, the associations were relatively small. In contrast, SME demonstrated substantially stronger negative correlations with cognitive flexibility. These findings suggest that while ChatGPT has the potential to support adaptive thinking, its use in ways that mirror social media patterns such as habitual scrolling, passive engagement, or compulsive reliance could undermine these benefits, as speculated in previous studies (Krishnamoorthy et al., 2025; Maral et al., 2025).

Limitations

This study has several limitations. First, due to its cross-sectional design, the findings are limited to demonstrating associations and cannot establish causality or the direction of effect. For more reliable findings future research should employ longitudinal studies which may provide direction of the relationship. Second, in this study M-W has been taken as dependent variable, however, reverse direction of the association cannot be ruled out. Third, although this study addresses a gap in the literature concerning cognitive flexibility in the context of SME and CGU, it relied on self-report measures. Consequently, it suffers from the inherent limitations of such methodologies, such as social desirability bias, recall bias, and the inability to objectively assess the underlying cognitive processes. To overcome these issues, future studies should incorporate performance-based neuropsychological measures of cognitive flexibility. Fourth, the patterns of ChatGPT usage likely vary across different academic disciplines (e.g., Arts vs. Science) and educational levels (e.g., Master's vs. PhD). This study did not explore these potential moderating factors. Investigating these aspects would be a valuable direction

for future research. Lastly, the study focused on general patterns of SME and CGU without distinguishing between specific platforms, usage contexts, or qualitative differences in engagement (e.g., academic vs. leisure use).

Conclusion

This study highlights the contrasting cognitive association of social media engagement and ChatGPT use among higher education students. Social media engagement was strongly associated with reduced cognitive flexibility and greater M-W, reinforcing concerns about its detrimental impact on executive control. In contrast, ChatGPT use showed small but significant positive associations with cognitive flexibility, and its effect on M-W was fully mediated through this pathway. These results indicate toward the need to distinguish between distracting and cognitively supportive forms of digital engagement. Practically, the findings suggest that while excessive social media use may erode attention and increase susceptibility to distraction, purposeful use of ChatGPT was associated with higher cognitive flexibility, which in turn was associated with lower M-W; however, this pattern should be interpreted as correlational rather than causal. Furthermore, the modest effect sizes warrant caution, as ChatGPT use may become maladaptive if approached in ways similar to social media.

Ethics approval and consent to participate: This study was conducted in accordance with the 1964 Helsinki Declaration, its later amendments, or comparable ethical standards. The study protocol and procedures were approved by the Human Research Ethics Committee of Kazi Nazrul University, Asansol (West Bengal) (Ref. KNU/REC/CC/5/2025). Written informed consents were obtained from all the participants before their recruitment in this study.

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