THE EFFECT OF SOCIAL MEDIA USAGE ON ATTENTION SPANS IN FEMALE UNIVERSITY STUDENTS

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Abstract - In recent years, owing to dramatic increases in smartphone usage time, particularly among the younger generations, concentration and attentional difficulties have emerged as particularly salient concerns. The prevalence of such difficulties has raised questions about the potential causal linkbetween smartphone usage and cognitive performance. However, the results of previous research on the correlationsbetween media multitasking and (deficiencies in) attentional functioning remain mixed. Specifically, while some studies reported a negative correlation between the two variables, others highlighted potential cognitive benefits, rather than impairments, particularly in action video game playing. In this context, the present study examines the relationship between mobile technology use, especially screen time during social media usage, and continuous concentration in female university students. We used the Social Media Use Integration Scale (SMUIS) to evaluate the study participants'reported screen timeand did an online test to measure their ability to concentrate. The results revealed no significant association between social media usage patterns and female university students' ability to concentrate. This outcome could be attributed tolimitations of measurement methods used in the present study and task variations. However, our findings warrant further research, particularly longitudinal studies, so asgain abetter understanding of the long-term impacts of smartphone usage on continuous concentration in today's younger female populations.

Keywords - Mobile Technology, Smartphone, Social Media, Concentration Attention Spans

I. INTRODUCTION

Social media platforms, or social networking sites (SNS), which are typically accessed by smartphones, have become an indispensableelement of the university students' everyday lives, offering numerous opportunities for communication, information exchange, and social connections [1-5]. In parallel, however, concerns have emerged with regardthe possibleadverse consequences of excessive smartphone use, particularly among younger cohorts such as adolescents and university students. Specifically, previous research documented strong relationships between excessive smartphone use and threats to physical wellbeing, such as daytime sleepiness [6], pain [7], and risky dietary patterns [8], as well as a broad range of emotional impairments, including depression [9], stress [10], or suicidal ideation [11].

For instance, in the domain of physical health, there is substantial evidence to suggest that excessive smartphone usage leads to physical problemssuch asshorter sleep time, daytime fatigue, delayed falling asleep and reduced sleep quality[12-14], as well as musculoskeletal pain and decreased physical fitness [15]. Likewise, younger people's overreliance on smartphones, also widely referred to as problematic smartphone use (PSU), was previously reported to strongly correlate with various mental health problems, such as anxiety, depressive states, stress, eating disorders,among other mental issues [16-18].
A distinct area whereexcessive smartphone usage to access social media platforms can have a particularly detrimental effecton young people's wellbeing is cognitive functioning, which includes aspects such as attention, concentration, and memory, all of which affect students' academic performance[14, 19, 20]. For instance, in a large-scale study involving 451 US and 406 European students, Karpinski et al. [20] found that excessive use of social media platformsvia a smartphone negatively correlated with the students' GPA. Similarly, in a study involving99 undergraduate studentsfrom a Midwestern U.S. university, Sapci et al. [19] found that every hour of additional phone use per daydecreased the students' current term GPA by on average 0.152 points.

Furthermore, numerous studies highlighted that excessive social media usage can adversely affect attention spans, conventionally defined as "an individual's ability to attend to a stimulus or object over a period of time" [21]. Indeed,several previous studies explored whether media technologies and forms of media content would adversely affect selective attentionand result in shorter attention spans [22–24]. However, while some confirming evidence—including the one about both positive and negative impacts of social media use on attention—has been reported [25], the exact relationship between social media use and sustained attention remains largely inconclusive, with some studies showing no relationship and others showing a negative relationship [26].
Along with inconsistency in previous findings, previous research that aimed to quantify on the association between cognitive function deficits, including the lack of sustained attention,and excessive smartphone use to access social media platforms has faced several important limitations. The

first prominent gaplies in creating a placebo control group [27]. As smartphone usage has become almost ubiquitous, particularly among younger generations, finding individuals willing to refrain from using their phones for an extended period is problematic.The second gap in the literature is that it remains unclear which specific social media behaviorsassociated with smartphone use might be linked to particular cognitive deficits. While some progress has been made in identifying potentially affected cognitive skills [28, 29], isolating specific multimedia behaviors associated with these deficits has not yet been attempted. The third gap in previous research concerns the causal relationship between social media usage via a smartphone, on the one hand, and cognitive deficits, on the other hand, remains unclear. That is, there remains a question whether it is social media usage that causes cognitive deficits or, vice versa, it israther specific cognitive deficits that lead (or predispose) an individual to more frequent social media usage. Addressing these limitations would ideally require longer-term cohort studies, which are not always feasible or practical.

In summary, while smartphones and other mobile technologies have been praised for their versatility and potential to enhance human cognition when used responsibly [30], concerns have emerged regarding the potential long-term effects of excessive engagement with these devices on individuals' cognitive abilities, including thinking, memory, attention, and emotional regulation [31, 32]. This highlightsthe need for further research on the multi-dimensionalrelationship between smartphone use and cognitive functioning. Longitudinal studies, experimental designs, and standardized measures are recommended to gain a deeper understanding of the causal connections. Additionally, factors such as age, gender, duration of smartphone use, and specific smartphone activities should be considered as potential moderators of these effects.

In this context, in this study, we seek to explore the complex dynamics between smartphones and cognition—and, more specifically, attention spans—in a representative sample of female university students. Our specific focus is on the influence of social media usage via a smartphone on continuous concentration abilities of female university students, which are assessed here both using a survey and experimentally (via cognitive task performance)

The remainder of this study is structured as follows. In Section 2, we review previous literature on smartphone-related interruptions on focused and divided attention, as well as the impact of smartphone usage on cognitive performance and multitasking abilities. Section 3 provides detail onthe methodology used in the present study. The results are reported in Section 4. In the subsequent Section 5, we contextualize ourfindings in relevant previous research, outline the limitations of our study, and discuss directions of further research. Section 6 concludes.

II. RELATED WORK

To date, several studies have explored the effects of smartphone-related interruptions on focused and divided attention, as well as the influence of smartphone useon individuals' cognitive performance and multitasking abilities. In one relevant study, Small et al. [33] used MRI to demonstrate that different neural pathways were activated in the brains of subjects who were familiar with the use of search engines as compared to those who were not. The sample included 24 neurologically normal subjects aged 55 to 76 years old, half of whom had little to no experience in performingInternet searches, while the other halfembraced advanced Internet users withmore extensive experience. The experienced group showed double the level of activation in brain areas involved in vision, complex reasoning, and decision making, , such as the frontal lobe anterior region, the hippocampus, and so on.However, more recent research revealed that excessive use of technologies, manifesting as Internet addition (IA) and smartphone addiction (SPA), adversely affects cognitive executive functions (see, e.g., a review in [34]). For instance, several studies demonstrated that individualswith IAshow certain executive dysfunctions such as impulsive behaviors [35], risky decision making [36], and impairment in working memory [37].

Interesting results were also reported by Imren and Tekman [26] who explored the effects media multitaskingbehavior on sustained attention and working memory in a sample of Turkishyoung adults. Sustained attention and working memory of the study study participants were evaluated based on their performance on Continuous Performance Task (CPT) and Digit Span tasks, respectively. The resultsrevealed that, while a positive correlation was observed between media multitasking and digit span taskperformance, the relationship betweenmultitasking and the reaction time of false response in the CPTtask was negative. Therefore, the results suggested that, although media multitasking may inhibit maintaining attention, it can improve working memory [26].

Similarly, although excessive screen time was found to be associated with attention problems, particularly in children [38], the nature of this relationship proved to be non-linear, suggesting that other various other variables should be taken into account [39]. Yet, from a clinical perspective, children with excessive screen time had a higher risk of meeting criteria for Attention-Deficit-HyperactivityDisorder (ADHD) [40]. Collectively, the evidence available to date suggests that, although screen time can have a negative impact on attention span, further research is needed on potential non-linear effects and the influence of socio-economic factors

Furthermore, Baumgartner et al. [41] investigated the types of cognitive functions that might be affected by smartphone usage and which specific multimedia behaviors could cause these effects. The study participants were adolescents aged 11 to 15 years old (48% girls, 52% boys). The authors measured three types of executive function—namely, working memory, inhibition, and shifting —with theself-report survey and three standard tests (Eriksen Flankers task, Digit Span, and Dots-Triangles task). There results revealed that, while teenagers who reported to more frequently media multitask also had more problems in the three aforementioned executive functions, the test results did not support this self-reported assessment. In fact, the results revealed that those study participants who multitasked more frequently actually performed better in the Eriksen Flankers test, presumably because they were better able to ignore distractions. Furthermore, there were no significant differences in the study participants' abilities in the Digit Span and Dots-Triangle tasks. Overall, while Baumgartner et al.'s [41] study provided valuable insights into the types of cognitive deficits that might be associated with multimedia usage, a limitation of this study is that the authors used a broad definition of the concept of multimedia that included various media activities. This precluded a more focused investigation of the links between specific effects and particular multimedia behaviors.

In another relevant study, Ophir et al. [42] explored media multitasking—i.e., individuals' concurrent consumption of several items or content streams, which is typically associated with social media platform and smartphone use and is widely spread among the younger populations like university students. On classifying the study participants into heavy multi-media users (HMM) or light multi-media users (LMM) based on their weekly number of hours spent on multimedia activities, the authors predicted that chronic multitaskers would pay more attention to irrelevant stimuli in their external environment and have more irrelevant representations in memory. This hypothesis was testedin a series of cognitive control studies. The results revealed that, as compared to light multi-media users,heavy multimedia users showeda reduced ability to filter out distractions and poorercontinuous performance.

Ophir et al.'s [42] findings led Cain et al. [28] to further explore the mechanisms behind the identified correlations. Using an experimental task based on the additional singleton paradigm, where the study participants searched for a shape singleton in the possible presence of an irrelevant color singleton [28], the authors found that HMMs used a wider attention span than LMMs, suggesting that they were less able to focus on a single task. However, the specific multimedia activity linked to this trait remained unclear.

In a later study, seeking to establish the causality between multimedia usage and cognitive deficits—namely, whether multimedia usage causes cognitive deficits or, alternatively, whether individualswith pre-existing deficits would be more likely to indulge in an extensiveuse of multimedia—Cain et al. [29] explored the connection between multimedia usage and cognition in a sample of 74 middle school adolescents (average age: 14 years)from Boston area. Relying on Ophir et al.'s [42] study that documented comparable effects in adults, Cain et al. [29] hypothesized a strong inverse association between media multitasking and executive function (i.e., lowerworking memory capacity), higher impulsivity, and lowerscores onnational reading and math tests.The results revealed a significant inverse correlation between multimedia usage and test scores in math and English, suggesting that the correlation between multimedia use and cognitive function could be a result of cognitive and attentional differences between subjects rather than a cause. In addition, Cain et al. [29] tested personality traits such as grit and conscientiousness, known to be associated with better academic performance and potentially excessive multimedia usage. However, the authorsfound no association with these traits. Yet, they did find a link between multimedia usage and what they called "growth mindset,"measuring the extent to which he study participants believed in their ability to improve with effort. In addition, there was a significant inverse relationship between this mindset and multimedia usage. All in all, while these findings highlight that certain students could bemore likely to extensively use multimedia and less likely to perform well in cognitive tasks, the causative relationship between the two remains unresolved.

III. METHODOLOGY

A sample of 25 female university students (mean age: 21.67 years) was recruited for the study. All participants provided written informed consent prior to study completion.Ethical approval was obtained from KAU Research Ethics Committee. Furthermore, all methods were carried out in accordance with the university' guidelines and regulations. The participants were selected using purposive sampling. The study participants' self-reported screen time was evaluated using the Social Media Use Integration Scale (SMUIS), which was originally developed and validated by Jenkins-Guarnieri et al. [43]. Jenkins-Guarnieri et al. defined the SMUIS as "a scale of online social media use that evaluates s the integration of the social behavior and daily routines of users, together the importance of and emotional connection to such use" [43].While the original purpose of the SMUIS was to evaluate Facebook use, the authors purposefully designed the scalefor a subsequent easy adaptation to measure other forms of online use [43]. The present assessment included information on the frequency, duration, types of platforms, and specific activities engaged in on social

media. Furthermore, tomeasure the study participants' ability to concentrate, the female respondentscompleted an online test of continuous concentration tasks using TestMyBrain.org [44], a non-profitplatform offering a variety of scales and cognitive tasks.

	Mean	Standard Deviation
Screen time	7.36	2.15
SMUIS	38.5	9.70
Concentration	74.22	14.09
Age	21.7	1.1

TABLE1 Means and standard deviation of screen time, SMUIS scores, and concentration scores in the sample (N = 25)

The collected data, comprising social media usage information and theresults of the students' performance on concentration tasks, were analyzed using the statistical package RStudio [45]. The mean values of the screen time, SMUIS scores, and concentration scores on the continuous concentration tasks performed by the participants are shown in Table 1. Furthermore, correlational analyses were conducted to examine the associations between the study participants' social media usage patterns and ability to concentrate. Multiple regression analysis was then employed to explore the predictive potential of specific social media usage patterns on concentration. The regression models included appropriate covariates to control for potential confounding factors, such as age and academic performance.

IV. RESULTS

The average multimedia usage reported by the study participants was 7.29 hours per week. We first conducted a Spearman's rank correlation analysis to explorethe relationship between screen time and concentration variables. The analysis revealed a Spearman's rho coefficient of -0.1289, suggestinga weak negative correlation between the two variables. However, this correlation was not statistically significant ($p = 0.5484$).

Subsequently, a linear regression analysis was performed to investigate the relationship between concentration ability and both the SMUIS scores and the reported screen time (see Figure 1). The coefficient for SMUIS was -0.1170, which was not statistically significant ($p = 0.691$). Similarly, the coefficient for reported screen time amounted to -1.0619, and it also did not reach statistical significance ($p = 0.427$). Finally, the overall model's statistical significance was evaluated using the F-statistic, yielding a value of 0.3593 with 2 and 25 degrees of freedom ($p = 0.7017$).

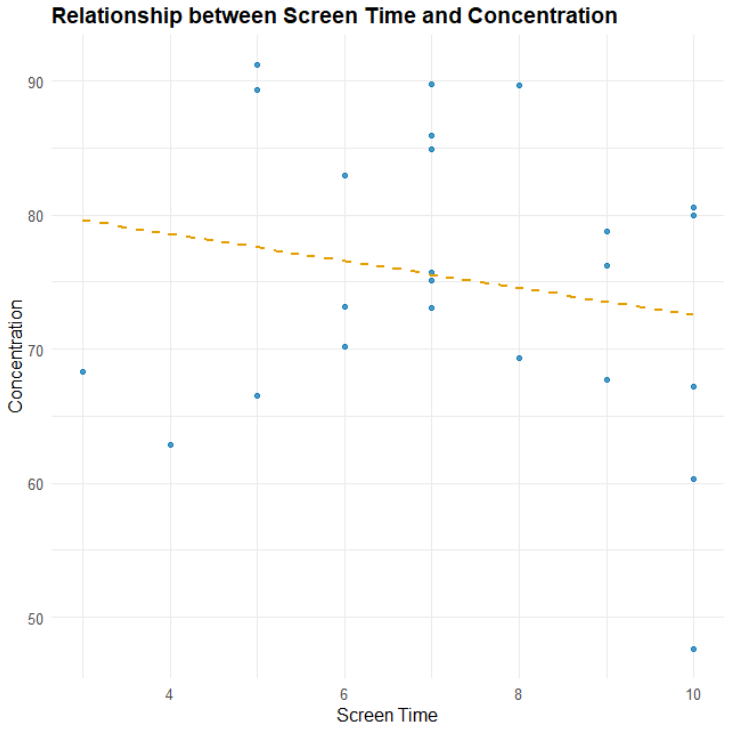


Fig.1.Linear regression on the relationship between screen time and concentration

V. DISCUSSION

In this study, we sought to investigate the association between social media usage patterns, as measured by the total number of hours of social media usage self-reported on the SMUIS scale, and the ability to concentrate, evaluated via the study participants' performance on continuous concentration tasks on the TestMyBrain.org platform. The specific demographic cohort tested in this study embraced 25 female university students. The results revealed no significant correlation between social media usage and continuous concentration ability. This findings aligns with the results previously reported by Baumgartner et al. [41] who also failed to find a significant correlation between multimedia usage and cognitive tests (Digit Span and the Dots-Triangle test); interestingly, however, the authors a significant inverse relationship between scores on the Eriksen Flankers test and media multitasking.

While, similarly to Baumgartner et al.'s [41] investigation, we employed an online test for continuous concentration, thus assessingsimilar cognitive traits, which would have allowed us to expect outcomes similar to those observed byBaumgartner et al.,the measurement methods used in the two studies varied. While Baumgartner et al. [41] used media multitasking as a measure of multimedia use, the presentstudy focused on recording the total number of hours of social media use. The comparability of the two studies was further compromised by the fact that, unlike in the present study that focused exclusively on social media platforms, in Baumgartner et al.'s [41] study,multimedia usewas defined in a very broad fashion, encompassingthus also activities like watching TV, which could have diluted the observed effects.

Furthermore, several previous studies, including the one conducted by Ophir et al. [42], demonstrated a broader range of correlations between multimedia usage and cognitive deficits. On categorizingthe study participantsinto low multi-media (LMM) users and high multi-media (HMM) users, Ophir et al. [42] observed a significant correlation only within the latter group. In contrast, the present study relied on self-reported social media usage hours, and the reported total hours (7.29 hours per week) fell well within the LMM group according to Ophir et al.'s [42] classification. Notably, the usage levels reported in this study were substantially lower than those reported in several previous studies (e.g., Cain et al [29]; see also a discussion of limitations below).

Furthermore, whilethe association between the study participants' social media usage patterns and their ability to concentrate was not significant in our results,we did find a small inverse correlation between social media use and continuous concentration ability, which is well aligned withpreviously published research. For example, Cain et al. [22] demonstrated that performance on cognitive tasks measuring the ability to filter out distractions showed an inverse correlation with multimedia usage.

The present study has several limitations. First, in the present study, smartphone use was evaluated based on a self-report survey (the SMUIS scale), rather than on objective measurements of real smartphone use. Yet,as argued in the literature, such self-reported measures can be subjective and biased, especially in problematic use cases (for instance, via experienced time distortions individuals tend to have while using a smartphone; see [19, 46] for further detail). Indeed, pronounced differences were observed between self-reported estimation of smartphone use and the objective usage time [47]. Accordingly, in future studies, it would be meaningful to compare our findings with those obtained using objective assessment of actual smartphone use.

The second limitation of the present study, also associated with our reliance on the SMUIS scale, is that we adopted a broad understanding of social media platforms and did not specifically explore the impact of specific types of such platforms. Similarly, the modality of content that the study participants reported to engage with (text vs. picture/video) was not accounted for either. Yet, it stands to reason that engagement with social media platforms—ranging from reading lower-paced Facebook posts to watching short TikTok videos—may have differential impact on attention spans, which makes this possibility a promising venue for further research.

Third, in the present study, we investigated the correlation between attention spans and social media usage via smartphone in a sample of exclusively female students. While there are some indications in previous studies that gender may have an effect on selective attention as measured by the flanker task [48], other studies found no differences in selection attention in the two genders [49]. Furthermore, some evidence is available showing thatmale participants are more prone to indulge in excessive smartphone use than their female counterparts [50],which suggests that, in the present study, the effects could have reached statistical significance should we have used a male sample. This warrants further research using the participants of both genders.

Taken together, our findings complement extantresearch on the complex interplay between technology use and cognitive function. The discrepancies between ourfindings and those reported in previous studies could be attributed to differences in measurement methods, the breadth of multimedia activities considered, the varying levels of reported usage across different studies, and the use of self-report measures vs. objective assessment of smartphone use. This suggests that, to gain a better understanding of the potential impact of social media usage on university students' cognitive performance,

further research shouldincludelongitudinal studies and more refined measurement techniques. Ultimately, such efforts wouldcontribute to promoting informed and responsible technology use among student populations globally.

VI. CONCLUSION

The results of the present investigation, which combined a self-report survey and experimental concentration tasks performed by a sample of female university students, did not revealasignificant connection between social media usage patterns and female university students' ability to concentrate.However, our findingsextend the existing body of research onthe complex relationship between technology use and cognitive functioning.Accordingly, our results should be seen in the light of previous research, which has demonstrated such a link at much greater usage levels. One result which stood out was a negative correlation between screen time and the ability to concentrate. While this correlation did not reach statistical significance, this finding is largely consistent with the results previously reported Baumgartner et al. [41], who showed an inverse correlation between results in the Eriksen Flankers test, which evaluates an individual's ability to screen out distractions, and total screen time. Similarly, the results of concentration tests in the present study revealed a weak negative correlation between screen time and the ability to concentrate.Since technological advancements continue to influence our daily lives, our results warrant further investigations, including longitudinal studies and more refined measurement techniques, to gain a more in-depth understanding of the potential impacts of social media usage on cognitive performance.

REFERENCES

[1] S. Sun, X. Wang, and D. Wang, 2023. "Smartphone usage patterns and social capital among university students: The moderating effect of sociability," Child. Youth Serv. Rev., vol. 155(C), p. 197276.

[2] J. Ahn, "Teenagers' experiences with social network sites: Relationships to bridging and bonding social capital," Inf. Soc., vol.28, no. 2, pp. 99–109, 2012.

[3] J.C.Wang, C.Y. Hsieh, and S.H. Kung, "The impact of smartphone use on learning effectiveness: A case study of primary school students," Educ. Inf. Technol. (Dordr), vol. 2, no. 6, pp. 6287–6320, 2023.

[4] A. Brennan and M. Dempsey, "The student voice: The students own views on smartphone usage and impact on their academic performance,"The 12th International Technology, Education and Development Conference, Valencia, Spain, 05-07 March, 2018.

[5] C.Y. Fook, S. Narasuman, N.A. Aziz, S. M.S. Mustafa, and C.T. Han "Smartphone usage among university students," Asian J. Univ. Educ. (AJUE), vol. 17, no. 1, pp. 1–10.

[6] T. Uzunçakmak, S. Ayaz-Alkaya, and A. Akca, "Prevalence and predisposing factors of smartphone addiction, sleep quality and daytime sleepiness of nursing students: A cross-sectional design," Nurse Educ Pract., no. 65, p. 103478, 2022.

[7] B.M. Ladeira, A. L. Modena, E. M. Castro Carletti, D.R. Bigaton, E. B. Pelai, and F.F. Mescollotto, "Pain, smartphone overuse and stress in physiotherapy university students: An observational cross-sectional study," J. Bodyw. Mov. Ther., vol.34, pp. 104–109, 2023.

[8] S. Ryu, H. Jang, and H. Oh, "Smartphone usage patterns and dietary risk factors in adolescents," J Nutr., vol. 15, no. 9, pp. 2109–2116, 2022.

[9] G.X. Li, L. Liu, M.Q. Wang, Y. Li, and H. Wu, "The longitudinal mediating effect of rumination on the relationship between depressive symptoms and problematic smartphone use in Chinese university students: A three-wave cross-lagged panel analysis," Addict. Behav.,vol. 15, p. 107907, 2023.

[10] N. Elamin, J. Almasaad, R. Busaeed, and D. Aljafari, "Smartphone addiction, stress, and depression among university students,"Clin. Epidemiol. Glob. Health, vol. 25, p. 101487, 2024.

[11] Q. Huang, S. Lin, Y. Li, S. Huang, Z. Liao, X. Chen, T. Shao, Y. Li, Y. Cai, J. Qi, and H. Shen, "Suicidal ideation is associated with excessive smartphone use among Chinese college students," Front. Public Health., vol. 9, p. 809463, 2022.

[12] S. Y. Sohn, L. Krasnoff, P. Rees, N.J. Kalk, and B. Carter, "The association between smartphone addiction and sleep: A UK cross-sectional study of young adults," Front. Psychiatry, vol. 2, no. 12, p. 629407, 2021.

[13] T. Ghosh, D. Sarkar, K. Sarkar, C.K. Dalai, and A. Ghosal, "A study on smartphone addiction and its effects on sleep quality among nursing students in a municipality town of West Bengal," J. Family Med. Prim. Care, vol.10, no. 1, pp. 378–386, 2021.

[14] B. Rathakrishnan, S.S. Bikar Singh, M.R. Kamaluddin, A. Yahaya, M.A. Mohd Nasir, F. Ibrahim, and Z. Ab-Rahman, "Smartphone addiction and sleep quality on academic performance of university students: An exploratory research," Int J Environ Res Public Health., vol. 18, no. 16, p. 8291, 2021.

[15] M. Akbari, M. Seydavi, S. Sheikhi, and M.M. Spada, "Problematic smartphone use and sleep disturbance: The roles of metacognitions, desire thinking, and emotion regulation," Front Psychiatry,vol. 14, p. 1137533, 2023.

[16] B. Kaya, "Smartphone addiction and psychological wellbeing among adolescents: the multiple mediating roles of academic procrastination and school burnout," Br. J. Guid. Couns., 2024. https://doi.org/10.1080/03069885.2024.2304208

[17] X.-Y. Wei,L. Ren, H.B. Jiang, C. Liu, H.X. Wang, J.Y. Geng, T. Gao, J. Wang, and L. Lei, "Does adolescents' social anxiety trigger problematic smartphone use, or vice versa? A comparison between problematic and unproblematic smartphone users," Comp.Hum. Behav., vol. 140, 2023.

[18] J. Wang, Q.H. Hao, W. Peng, Y. Tu, L. Zhang, and T.M. Zhu, "Relationship between smartphone addiction and eating disorders and lifestyle among Chinese college students," Front. Public Health, vol. 11, p. 1111477, 2023.

[19] O. Sapci, J.D. Elhai, A. Amialchuk, and C. Montag, "The relationship between smartphone use and students' academic performance,"Learn. Individ. Differ.,vol. 89, pp. 1–9, 2021.

[20] A.C. Karpinski, P.A. Kirschner, I. Ozer, J.A. Mellott, and P. Ochwo, "An exploration of social networking site use, multitasking, and academic performance among United States and European university students," Comp. Hum. Behav., vol. 29, no. 3, pp. 1182–1192, 2013.

[21] E. Levin, and J. Bernier, J.,"Attention span." In S. Goldstein, and J.A. Naglieri (eds) Encyclopedia of Child Behavior and Development. Boston: Springer, 2011.

[22] M. S. Cain, and S.Mitroff, "Distractor filtering in media multitaskers," Perception,vol. 40, no. 10, pp. 1183–1192, 2011.

[23] M.S. Cain, et al., "Media multitasking in adolescence," Psych. Bull. Rev., vol. 23, no. 6, pp. 1932-1941, 2016.

[24] A. Shukla, "Does social media usage influence selective attention," Int. J. Cyber Behav. Psychol. Learn.,vol.12, no. 1, 1–15, 2022.

[25] P. Siddarth,, H. Gaddipati, T.D. Moody, and S.Y. Bookheimer, S. Y. (2020). Brain health consequences of digital technology use. Dial Clini Neurosc, vol. 22, no. 2, pp. 179–187, 2020.
[26] M. Imren, and H. Tekman, "The relationship between media multitasking, working memory and sustained attention,"Uludag University Faculty and Sciences Journal of Social Sciences, vol. 20, no. 37, pp. 1075-1100, 2019 .
[27] H.H. Wilmer, L.E. Sherman, and J.M. Chein, "Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning," Front. Psychol.,vol. 8, article 605, 2017.
[28] M.S. Cain, S.R., and Mitroff, "Distractor filtering in media multitaskers," Perception, vol. 40, pp. 1183–1192, 2011.
[29] M.S. Cain, J.A. Leonard, J.D.E. Gabrieli, and A.S. Finn, "Media multitasking in adolescence," Psych. Bull. Rev., vol. 23, pp. 1932–1941, 2016.
[30] T.E. Webster, and J.Paquette, "'My other hand': The central role of smartphones and SNSs in Korean students' lives and studies," Comp. Hum. Behav., vol. 138, p. 107447, 2023.
[31] G.F. Niu, X.H. Shi, Z.L. Zhang, W.C.Yang, S.Y. Jin, and X. J. Sun, "Can smartphone presence affect cognitive function? The moderating role of fear of missing out," Comp. Hum. Behav., vol. 136, p. 107399, 2022.
[32] J.D. Elhai, J.C. Levine, R.D. Dvorak, and B.J. Hall, "Fear of missing out, need for touch, anxiety and depression are related to problematic smartphone use," Comp. Hum. Behav., vol. 63, pp. 509–516, 2016.
[33] G.W. Small, T.D. Moody, P. Siddarth, and S.Y. Brookheimer, "Your brain on Google: Patterns of cerebral activation during Internet searching," Am J Geriatr Psychiatry, vol. 17, no. 2, pp.116–126, 2008.
[34] L.M. Méndez, I. Padrón, A. Fumero, and R.J. Marrero, "Effects of internet and smartphone addiction on cognitive control in adolescents and young adults: A systematic review of fMRI studies," Neurosci Biobehav Rev.,vol. 159, p. 105572. 2024.
[35] M. Salehi, Z. Abbaspour, A. Molana, and N. Shahini, "Impulsivity, inhibition, and internet addiction in medical students of North of Iran," Front Psychiatry, vol. 13, p. 1002625, 2023.
[36] J.W. Seok, K.H. Lee, S. Sohn, and J.H. Sohn, "Neural substrates of risky decision making in individuals with Internet addiction," Aust N Z J Psychiatry, vol. 49, no. 10, pp. 923-932, 2015.
[37] M. Zivan, S. Bar, X. Jing, J.S. Hutton, R. Farah, and T. Horowitz-Kraus, "Screen-exposure and altered brain activation related to attention in preschool children: An EEG study," Trends Neurosc and Edu, vol.17, 2019.
[38] S. K. Tamana, V. Ezeugwu, J. Chikuma, D. L. Lefebvre, M.D. Azad, T.J. Moraes, P. Subbarao, A.B. Becker, S.E. Turvey, M.R. Sears, B.D. Dick, V. Carson, C. Rasmussen C, "Screen-time is associated with inattention problems in preschoolers: Results from the CHILD birth cohort study," PLoS One, vol. 14. no. 4, p. e0213995, 2019.
[39] M. Liebherr, M. Kohler,J. Brailovskaia, M. Brand, and S. Antons, " Screen time and attention subdomains in children aged 6 to 10 years," Children (Basel),vol. 9, no. 9, p. 1393, 2022.
[40] A.R. Shafiee-Kandjani, Z. Mohammadzadeh, S. Amiri, A. Asghar, P. Sarbakhsh, and S. Salman, "Attention, working memory and executive functions in patients with internet addiction disorder," J Inj Violence Res., vol. 11, no. 4 (Suppl 2): Paper 70, 2019.
[41] S.E. Baumgartner, W.D. Weeda, L.L. van der Heijden, and M. Huizinga,"The relationship between media multitasking and executive function in early adolescents," J. Early Adolesc.,vol. 34, pp. 1120–1144, 2014.
[42] E. Ophir, C. Nass, and A.D. Wagner, "Cognitive control in media multitaskers," Proc. Natl. Acad. Sci. U.S.A., vol. 106, pp. 15583–15587, 2009.
[43] M.A. Jenkins-Guarnieri, S.L. Wright, andB. Johnson, "Development and validation of a social media use integration scale," Psychol. Pop. Media Cult., vol.2, no. 1, pp. 38–50, 2023.
[44] Test My Brain. https://testmybrain.org/about.html (accessed 27 Feb, 2024).
[45] RStudio Team, "RStudio: Integrated development for R," RStudio, PBC, Boston, MA, 2020. http://www.rstudio.com/ (accessed 27 Feb, 2024).
[46] Y.-H. Lin, Y.-C. Lin, Y.-H. Lee, P.-H. Lin, S.-H. Lin, L.-R. Chang, H.W. Tseng, L-Y. Yen, C.C. Yang, and T.B. Kuo, "Time distortion associated with smartphone addiction: Identifying smartphone addiction via a mobile application (App)," J. Psych. Res., vol. 65, pp. 139–145, 2015.
[47] F.C. Ryding, and D.J. Kuss, "Passive objective measures in the assessment of problematic smartphone use: A systematic review," Addict. Behav. Rep., vol. 11, p. 100257, 2020.
[48] A. Shukla, "Does social media usage influence selective attention,"Int Jof Cyber Behav, vol. 22, no. 1, pp. 1–15.
[49] G. Stoet, "Sex differences in the Simon task help to interpret sex differences in selective attention," Psych Res, vol. 8, no. 3, pp. 571–581, 2017.
[50] R. Alnjadat, M.M. Hmaidi, T.E. Samha, M.M. Kilani, and A.M. Hasswan, "Gender variations in social media usage and academic performance among the students of University of Sharjah," J Taibah Univ Med Sci., vol. 14, no. 4, pp. 390–394, 2019.

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