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THE IMPACT OF SMARTPHONE USE ON WORKING MEMORY AMONG YOUNG ADULTS

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ABSTRACT

Background: Smartphone use among young adults has raised concerns about potential impacts on working memory, a core executive function essential for learning and academic performance.

Objective: This literature review examines relationships between smartphone use patterns and working memory performance in young adults aged 18–35 years, with a focus on methodological advances in this field.

Methods: A systematic search of PubMed, Google Scholar, PsycINFO, Web of Science, and Scopus identified articles published from 2007 to April 2026. Studies reporting objective or standardized measures of working memory were included that examined media multitasking, screen time, and problematic smartphone use.

Results: Objectively measured normative smartphone use displays minimal consistent association with impaired working memory capacity. However, problematic smartphone use and media multitasking correlate more often with poorer performance, and these associations are frequently mediated by attentional lapses and impulsivity. Methodological advances including objective usage tracking and differentiation between executive function components have yielded more detailed findings than early correlational studies.

Conclusions: The relationship hinges crucially on usage behaviors and measurement exactness. Current evidence does not support claims that moderate smartphone use permanently reduces working memory capacity, even though specific contexts, including problematic use or heavy multitasking, may impair performance.

KEYWORDS

Working Memory, Executive Functions, Smartphone Use, Screen Time, Media Multitasking, Young Adults, Mobile Phones

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Introduction

In recent years, a notable increase in smartphone and other digital device use has been observed. The group most affected by this phenomenon is young adults. Most representatives of this group are still subjects of the educational process (Wacks & Weinstein, 2021). One of the most fundamental components that enable the maintenance and processing of information during learning is working memory (Diamond, 2013). Working memory is one of three basic components of executive functions; the other two are inhibition and cognitive flexibility. Executive functions are a system of processes that enable us to control our behavior and execute complex tasks (Diamond, 2013). These associations led to growing discussion about smartphones and their influence on cognitive functions, especially working memory (Uncapher et al., 2017).

The studies from the first decade of the XXI century were alarming, suggesting a negative influence of smartphone use on cognition and executive functions (Wilmer et al., 2017). However, not all experimental studies were consistent in their results, and the number was insufficient to make an indisputable statement. Most studies originating from this period were based on inconsistent methodological approaches, which could lead to incorrect interpretations of the results (Liebherr et al., 2020; Wilmer et al., 2017). Furthermore, even today, we still don't have enough large, comparable experimental studies on the influence of smartphones. The areas in which the studies remain incoherent are executive function measurement methods and standardized objective measures of smartphone use. Nevertheless, a change in the direction of the results was observed (Hartanto et al., 2023; Toh et al., 2021).

The purpose of this study is to summarize results from studies on the influence of smartphone use on working memory among young adults. The most important question is whether we have a proven pattern of smartphone use that negatively influences concrete components of executive functions, specifically working memory. Furthermore, we focused on the process of conceptualizing methodology in those studies, which we found crucial to their results.

Methodology

The following literature review was created based on a systematic search of PubMed, Google Scholar, PsycINFO, Web of Science, and Scopus databases. Additional articles have been included in the review regarding an overview of bibliographies in primarily found papers. The search included English-language articles published from 2007 to 10.04.2026. Searches used phrases such as: “media multitasking”, “smartphone use”, “cognitive functioning”, “working memory”, “screen time”, “*problematic smartphone use*”, “*smartphone addiction*”, “*internet addiction*”, “*adolescent*”, “*young adult*”, and Boolean operators such as “AND”, and “OR” to optimize research. The inclusion criterion was age between 18 and 35 years. We included the following types of research: original empirical studies, meta-analyses, and systematic reviews that reported results related to working memory. The exclusion criteria were neurological or psychiatric disorders, participant age over 35 years, and the lack of objective or standardized measures of executive functions. From 101 articles meeting the thematic criteria, 24 most relevant for the topic were chosen.

Results

The review includes experimental studies, meta-analyses, and systematic reviews on media multitasking and other forms of excessive smartphone use among young adults, primarily students in their early 20s. The results refer to executive functions, focusing on working memory as a crucial component of the learning process.

Smartphone Use Quantity vs. Working Memory Performance

The studies suggest that there is no evidence that objectively measured screen time, checking, or self-reported normative smartphone use quantity were associated with worse working memory capacity in young adults (Hartanto et al., 2023). Liebherr et al.’s review analogically demonstrated that evidence on the influence of usage frequency on working memory is ambiguous and limited. They suggested that different usage parameters, such as screen time, checking frequency, the type of viewed data, and individual factors, need to be modeled in a standardized manner to understand potential effects on working memory (Liebherr et al., 2020). In some studies, using a smartphone for video games was associated with improvements in working memory (Huang et al., 2017).

Media Multitasking and Working Memory

The meta-analysis from the beginning of the decade showed a negative influence of media multitasking on executive functions (Jeong & Hwang, 2016). However, the studies did not separate components of executive functions, providing a more general representation rather than directly reflecting working memory. Media multitasking back then was also split across different devices; nowadays, mobile phones significantly dominate our attention compared to other media. In an experimental study, heavy media multitaskers performed worse on multiple working memory tasks than light media multitaskers. The results were replicated under conditions of external distraction, presence, and absence. Moreover, lower working memory performance predicted worse long-term memory. The authors interpreted this as less accurate goal-relevant representations in working memory among heavy multitaskers. The difference was associated with a deficit in stimulus differentiation, driven by poorer discriminability rather than decision bias. It can be assumed that the difference was associated with the quality of stored information rather than with the strategy of answering (Uncapher et al., 2016). A study using EEG–pupillometry demonstrated that heavier everyday media multitasking was associated with a predisposition to attention lapses, which, in turn, predicted increased forgetting in an episodic memory task. Although this study focused on episodic memory, it showed that media multitasking can lead to failures of sustained attention, which constrain the quality of memory representations (Madore et al., 2020). Working memory plays a crucial role in episodic memory functioning; its results are strongly correlated. Some studies divide working memory into two different types: visuospatial and verbal, proving that media multitasking is associated with improvement of the latter. They also emphasize that this improvement of working memory capacity comes at the expense of time efficiency. Media multitaskers obtain better scores in the working memory task, but they carry them out longer (Hutasuhut et al., 2024). A statistically significant association between results of working memory assignments and the frequency of reported media multitasking has also been shown. Authors suggest that these correlations can be unstable, depending on the test sample and the measurement method (Seddon et al., 2018).

Problematic Smartphone Use and Working Memory

Reviews on problematic smartphone use in young adults and adolescents reported associations with reduced cognitive control and impaired working memory. Moreover, they reported potential organic representation manifesting in altered prefrontal and cingulate structure and function. However, the authors emphasize limitations in studies involving mixed-age samples and heterogeneous tasks. Nonetheless, these results underline the fact that differences in working memory functioning are more closely associated with pathological or excessive smartphone use patterns than with conventional everyday use (Madore et al., 2020; Rathod et al., n.d.; Wacks & Weinstein, 2021). Liebherr et al. cautioned that current evidence does not warrant an unambiguous conclusion that normative smartphone use is harmful for working memory, and that immediate vs. long-term effects and possible beneficial effects on some working-memory-related processes should also be considered (Liebherr et al., 2020). One study found that, despite the elusive influence of problematic smartphone use on young adults' parents' descriptive ratings, general everyday cognitive functioning was impaired (Tauste-Garcia et al., 2025). In the other study, individuals with problematic smartphone use showed worse reaction times in working memory tasks. However, the authors point out that the same individuals exhibited greater procrastination and lower psychological well-being. Those facts can be interpreted as part of a broader problem with self-regulation and cognitive control, which co-occur with problematic smartphone pattern use (Fabio et al., 2022).

Overall Synthesis

Based on the included papers, everyday normative smartphone quantity in healthy young individuals shows little consistent relation to objective working memory performance (Hartanto et al., 2023; Liebherr et al., 2020). Contrary to problematic use, media multitasking is more frequently associated with poorer performance in working memory or broader cognitive-control difficulties, often mediated by impulsivity or attentional lapses (Madore et al., 2020; Uncapher et al., 2016; Wacks & Weinstein, 2021). It is also worth noting that some studies suggest that worse working memory test results were associated with the presence of a smartphone, not specifically its use (Liebherr et al., 2020). In a later review, this correlation has been called into question, pointing out the need to re-examine the phenomenon in a larger study group (Hartanto et al., 2024). Nonetheless, reviews highlight substantial methodological heterogeneity and emphasize that standard smartphone use may have neutral or even beneficial effects on some working-memory-related processes in specific contexts (Liebherr et al., 2020). Recently, it has been demonstrated that higher screen time was correlated with better working memory-specific abilities, while frequent phone checking was associated with worse general executive function parameters, without any signs of negative influence on working memory (Tauste-Garcia et al., 2025; Toh et al., 2021). It is important to note the difference between the long-term impact of smartphone distraction, which was not confirmed, and its presence during performance, which can result in worse performance on executive function tasks. It is associated with a diversion of attention from examined tasks to notifications, not with permanent changes in working memory (Wilmer et al., 2017).

Discussion

It is clear that many changes have occurred over the last decade in both design and findings regarding smartphones' influence on working memory research. This primarily applies to the methodology (Liebherr et al., 2020; Wilmer et al., 2017). Original experimental studies progressed from simple correlations to more precise models, distinguishing specific components of executive functions (Kong et al., 2023; Liebherr et al., 2020). The use of the general executive functions test can be misleading because some of its components are more closely related to media multitasking, whilst others are only slightly (Kong et al., 2023). As a result of this change, the depiction of that relation becomes more nuanced. It is implemented with the results. The more 'narrow' and single-task-oriented the working memory test is, the easier it is to identify a negative effect of multitasking, while more complex and latent measures are related to a more neutral picture of the relationship. New studies more often use the latent-variable approach and multitask batteries, reducing 'task impurity' and thereby negating the negative effects.

The method of smartphone use reporting also underwent a significant change, from self-descriptions to objective logged data (screen time, check-ins). It has been suggested that subjective reporting can be inconsistent because of memory failure (Ellis et al., 2019). Indeed, numerous studies have shown that the actual time spent on smartphone engagement can vary from the reported time (Hodes & Thomas, 2021). It helped to improve conceptual clarity. Most important is distinguishing normative smartphone usage from problematic smartphone use; another problem with this type of study is the lack of standardized terminology for smartphone use. We can notice that in some studies, authors use terminology accurate for behavioral addiction. It should

be noted that there is insufficient data on the neurobiological or behavioral level to classify problematic smartphone use patterns as behavioral addiction (Billieux et al., 2015). Problematic smartphone use is a research construct not defined in a standardized manner. However, in more recent studies, it has come to replace phone addiction terminology, which seems appropriate to better explain the nature of the problem. It is also worth mentioning that screen time isn't the perfect representation of smartphone use. It does not accurately reflect the type of activity, which can vary from unconstructive scrolling to learning new abilities. Bearing these factors in mind, we can observe that previous studies focused more on problematic or other highly disruptive smartphone use patterns, whereas most recent studies concentrate on typical, moderate smartphone use because of its high prevalence. In studies analyzing extreme groups, such as heavy media multitaskers, negative correlations with working memory were found. However, it diminished when multitasking was implemented as a continuous variable. Furthermore, the heavy media multitaskers group itself is not a standardized construct; in some studies, it is treated as an extreme feature intensity, while in others, it is just above the median (Kong et al., 2023).

Another issue concerning the study group is its selection. Most recent studies among young adults are being conducted within the University community. This fact can also affect study results, as this group may be associated with specific cognitive characteristics and may not be a perfect representation of the whole society. Over the years, the context of the impact under investigation has also changed. Some meta-analyses demonstrating negative correlations between mobile phone use and executive functions are based on samples of participants for whom media multitasking was a new habit. More recent studies based on “digital natives” refute this correlation, which is interpreted as a developmental adaptation (Kong et al., 2023). A universal problem with this type of study is the inability to determine the direction of the relationship. In previous studies, this problem was often indicated. Recent study results suggest that individuals with cognitive limitations may be more susceptible to problematic smartphone use. Participants' personal profiles can serve as an intermediary between media multitasking and working memory. Worse working memory performance among heavy media multitaskers was associated with higher attentional impulsivity. It is possible that this individual feature caused irrelevant information challenges, thereby lowering its representation in working memory (Uncapher et al., 2016). Impulsivity is positively correlated with both media multitasking and worse working memory performance. Attention was also drawn to the role of socioeconomic status, which can influence the results (Cain et al., 2016). In another study, the authors argue that people with weaker inhibitory control may consciously choose to multitask as a ‘manageable distraction’. In this model, it is poor working memory and impulsivity that lead to high levels of media multitasking (Cain et al., 2016). There is a need to examine this dependence longitudinally.

The need to continue investigating this field is supported by the possibility of changes in brain structure and function. Neuroimaging studies show that excessive smartphone and internet use can alter brain activity in regions related to executive functions (dorsolateral prefrontal cortex, frontal, parietal, and occipital lobes) (León Méndez et al., 2024). Working memory depends on the efficiency of the executive networks in the prefrontal and parietal cortex – these same areas are consistently impaired in problematic smartphone use and in cases of excessive smartphone and internet use, which gives a neurobiological and socio-cognitive framework that helps explain why and how smartphone use can affect working memory (Wolf et al., 2025). Despite their limitations, those studies serve as a point of reference and indicate the direction of future research.

Another issue concerning this matter, indicating the need for further investigation, is the fact that despite the study's results, there were reports of a subjective feeling that mobile phones had a negative impact. In the context of subjective perception, the results of Tauste-Garcia et. al. seem particularly interesting. Despite uninterrupted executive function test performance, which can be interpreted as evidence of proper functioning, the parents of young adults with problematic smartphone use reported an impression of deterioration in their functioning. The authors assume that the problem is correlated with the practical implementation of executive function in emotional and behavioral regulation rather than with its direct impairment (Tauste-Garcia et al., 2025). In another article review, authors presented a correlation between time spent on media multitasking and subjective feelings of memory and attention problems. These results did not hold up in executive function tests (Kong et al., 2023).

Mentioned changes do not necessarily have to be linked to a negative impact. The hypothesis of ‘cognitive offloading’ has been put forward, suggesting that some parts of our memory can be transferred into our smartphones, for example, addresses, notifications of events, rather than being stored in our memory (Wilmer et al., 2017). It can change the way our working memory works, not necessarily in a bad way.

Conclusions

The more 'narrow' and single-task-oriented the working memory test, the easier it is to identify a negative effect of multitasking. Complex and latent working memory measures give a more nuanced or neutral picture of this relationship.

Based on the latest data, we can assume that objectively measured normative smartphone use is not associated with a permanent reduction in working memory capacity. Negative effects on working memory are rather noticeable, particularly with media multitasking or other problematic smartphone use, or in specific situations. The discrepancy between older and most recent results is most likely due to more rigorous, systematized methods for measuring working memory and smartphone use.

Nevertheless, this issue still needs to be examined to ensure smartphones do not harm working memory, which could, in turn, reduce the effectiveness of the educational process for young adults.

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