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THE IMPACT OF LONG-TERM SMARTPHONE USE ON COGNITIVE FUNCTION: IN CHILDREN AGED 7–10 YEARS

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A B S T R A C T

This article analyzes the impact of long-term smartphone use (especially in cases of excessive daily screen time) on the cognitive functions—attention, memory, reading skills—and socio-psychological aspects of children aged 7–10 years. The research methodology includes a review of literature, surveys, and analysis of previous scientific studies. The results show that prolonged daily screen exposure may lead to decreased attention, memory problems, and weakened social interactions among children. The conclusion and recommendations propose limiting children’s screen time, encouraging balanced activities, and strengthening parental and school-based monitoring of screen use.

K E Y W O R D S

Smartphone, children, cognitive function, attention, memory, screen time, 7–10 years, social impact.

INTRODUCTION

Over the past decade, smartphones and other personal screen devices have become an inseparable part of children’s lives. The use of screens has become the main tool for play, learning, and communication in the daily routine of young children, leading to a significant increase in daily screen time (ST). For instance, among school-aged children (6–14 years), the average daily ST was found to be approximately 2.77 hours, with **46.4%** of this age group spending **≥2 hours per day** in front of screens. This rate has further increased after the COVID-19 pandemic.

During the COVID-19 period, the average screen time among children increased by about 1.75 hours per day, partly due to lockdowns and remote education. Post-pandemic data show that ST remains higher than pre-pandemic levels. This situation is particularly important for children aged 7–10, as this developmental period is critical for the maturation of cognitive and executive functions such as attention, working memory, and executive control.

Scientific research indicates that screen time can have varying effects on children’s cognitive development. For example, previous studies have found that preschool children with higher overall screen time tend to have lower working memory performance (OR = 0.52; 95% CI: 0.31–0.88), suggesting that maintaining age-appropriate limits on screen time may support working memory. Moreover, the type and content of screen exposure (interactive vs. passive, educational vs. entertainment) act as key moderating factors determining the direction of influence.

Recent reviews and meta-analyses report both negative and, in some cases, positive effects of screen exposure on cognitive, language, sleep, and socio-emotional development. For instance, large-scale studies have identified associations between higher screen time and decreased attention, delayed language development, and sleep disturbances. However, some population-based analyses have shown no consistent or strong overall correlation between screen time and cognitive performance, indicating that outcomes depend on contextual factors such as age, content type, parental supervision, and socio-economic conditions.

Some studies also highlight psychological outcomes: higher screen time has been linked to increased depressive symptoms and other mental health concerns (e.g., small but consistent associations with depression and anxiety indicators). These findings are significant for understanding children's overall well-being and academic performance.

Considering the above evidence and statistical findings, there is a growing need to investigate the specific effects of prolonged smartphone use on the cognitive functioning of children aged 7–10. This is especially important for several reasons:

The ages 7–10 represent a critical period for the rapid development of executive functions and learning abilities;

Screen time has markedly increased since the pandemic;

Factors such as screen type, content quality, and parental monitoring can substantially modify outcomes.

Therefore, this article aims to analyze, based on existing scientific literature and statistical data, how long-term smartphone use affects attention, working memory, executive functions, and socio-psychological well-being among children aged 7–10 years.

Materials and Methods. This article is methodologically based on a systematic literature review approach. Specifically:

• Scientific articles published in recent years on screen time (ST) and mobile device use among children aged 7–10 were selected — for example, the 2024 study "Effect of Frequent Smartphone Use on Children's Cognitive Function" (in the 5–15 age group) and the 2023 review "Impact of Children's Digital Device Usage on Their Cognitive Function."

• Data related to attention, memory, reading outcomes, and social/psychological indicators were extracted from the selected studies, including survey findings, test results, and statistical data linked to screen time.

• The inclusion criteria were as follows: studies focusing on children (preferably aged 7–10), explicit measurement of screen time, and inclusion of analyses connecting it to cognitive or social outcomes.

• Limitations: a full-scale empirical study (e.g., surveys involving 1,000 children aged 7–10) was not conducted within this article; therefore, the results are interpreted as general trends and conclude with a suggestion that "further research is needed."

Results. Screen time (ST)—defined as the total amount of time an individual spends viewing various digital device screens—has become widespread, with many cases exceeding two hours per day.

In recent decades, children's exposure to digital screens—particularly through smartphones and tablets—has increased significantly. For instance, a study involving over 4,500 American children aged 8–11 reported an average daily recreational ST of approximately 3.6 hours.

Many official recommendations advise limiting children's screen exposure to no more than two hours per day, as exceeding this limit may increase risk factors associated with cognitive development and functioning.

Examples include:

• In one study, children whose daily recreational ST exceeded two hours had lower cognitive development scores.

• Another study found that children aged 6–7 with ST ≥ 2 hours/day demonstrated lower performance in IQ, executive functions (e.g., attention, self-control, and inhibitory regulation) compared to peers with shorter ST.

Thus, consistent with the focus of this article, the widespread prevalence of screen exposure exceeding two hours daily among children aged 7–10 may represent a significant factor negatively influencing cognitive function, reading, and mathematical achievement.

Key Notes. This association may follow a **dose–response pattern**—as screen time increases, cognitive performance indicators (e.g., working memory, attention, planning) tend to decline progressively. For example, in a study of one-year-old infants, longer daily screen exposure was associated with delayed problem-solving and communication development.

• Moreover, higher screen time is often linked to other negative factors—such as insufficient sleep, low physical activity, and exposure to non-educational screen content—all of which can further impact cognitive development.

• It is important to note that some studies call for cautious interpretation of screen time's negative effects. For instance, certain research involving children aged 9–12 found no strong correlation between screen exposure and cognitive performance, suggesting that contextual variables may moderate outcomes.

Dose–Response Decline in Reading and Mathematics Achievement. A prospective cohort study (2008–2023) involving 3,322 third-grade and 2,084 sixth-grade students found that for every additional hour of total screen time, the likelihood of achieving higher scores in third-grade reading and math tests decreased by approximately 9–10% (OR ≈ 0.90–0.91; $p \leq 0.003$). A similar decline was observed for sixth-grade mathematics performance. Even when television and digital media exposure were analyzed separately, the negative association remained significant.

• In third-grade students, video game use ("yes" vs. "no") was associated with lower reading performance (OR = 0.77; 95% CI: 0.62–0.94); when stratified by gender, girls showed particularly lower reading and mathematics outcomes. These findings suggest that in the 7–10 age group (grades 3–4), there is a measurable cognitive and academic load linked to screen exposure.

Executive Functions and IQ Indicators. Executive functions — higher-order cognitive processes such as working memory, inhibition (self-control), and cognitive flexibility — are among the strongest predictors of academic success (reading and mathematics) between the ages of 7 and 10. Because the prefrontal brain systems are actively maturing during this period, environmental factors — including recreational screen time (smartphones, tablets, television, games) — may exert particularly strong effects. This approach aligns with the methodological framework of large-scale cohort studies such as the ABCD (Adolescent Brain Cognitive Development) project.

1. Adherence to the 2-hour limit and cognitive outcomes. A large-scale analysis of approximately 4,500 children aged 8–11 found that maintaining recreational screen time ≤2 hours/day, combined

with adequate sleep, was positively associated with "global cognition" scores — a composite of memory, attention, and language subtests. This age group closely corresponds to 7–10 years, indicating a similar direction of association for executive function and IQ-related constructs.

2. Direct association with executive functions. In school-aged children (6–7 years), screen time ≥2 hours/day was linked to an increased risk of difficulties in cognitive and executive functions (in observational studies with confounder control). These findings support applying cautious screen time policies for children aged 7–10.

3. Quality "24-hour behavior profiles" and IQ/Fluid Intelligence. Recent systematic reviews have shown that adherence to screen time recommendations (≤2 hours/day), especially when paired with sufficient sleep, correlates positively with fluid intelligence (a component of IQ) and even with gray matter volume. Although the quality of evidence is moderate to low, the direction of the association remains consistent.

4. Associations with brain structures and attention systems (ABCD data). Neuroimaging analyses from the ABCD study revealed that in 9–10-year-old children, screen media activity (SMA) was related to cortical structural differences. Increased screen exposure was associated with variations in brain regions involved in high-level control and attention. These findings suggest that the neurobiological substrates of executive functions may follow a dose–response relationship with habitual screen activity.

5. Academic outcomes and cognitive measures. Longitudinal cohorts beginning at ages 9–10 have shown that greater screen time correlates with moderate declines in academic achievement, increased behavioral problems, and poorer sleep quality — all of which add cognitive load and may indirectly affect IQ test performance.

Impact on Reading Efficiency (Perception) in Early Grades. Among early school-age children — roughly those aged 7–10 — several studies have examined the effects of screen time on reading efficiency, as reflected through reading, mathematics, and language skills.

• A meta-analysis among school-aged children (6–14 years) found that the average daily ST was approximately 2.77 hours, with about 46.4% of students exceeding 2 hours/day.

• This finding is particularly relevant for the 7–10 age group, as prolonged ST may impair concentration, text comprehension, and perceptual (processing) mechanisms essential for reading efficiency.

• Another key study from Ontario, Canada, found that in elementary school students (grades 3 and 6), increased screen time was associated with lower standardized reading and math test scores. Each additional hour of ST was linked to an approximate 9–10% reduction in the probability of achieving higher levels in both reading and math for third graders.

• These results suggest that perceptual processes — the ability to receive, interpret, and process text, words, and problems — may be directly influenced by excessive screen exposure.

• Overall, systematic reviews indicate that screen time can negatively affect reading-language skills, attention, and cognitive processing. For instance, one review concluded that "although the negative association between screen time and academic outcomes varies, television viewing and video games are most consistently linked to lower performance in language and mathematics domains."

Mechanisms of Influence (in the Context of Perception). Excessive screen time (ST) may gradually replace children's classroom reading activities — this "substitution theory" suggests that time spent

on screens displaces engagement with text, focus, and problem comprehension, ultimately reducing reading efficiency.

In addition, high levels of screen exposure can indirectly impair reading and language proficiency through mediating factors such as sleep disruption, decreased attention span, and weakened executive functions.

• Another mechanism involves visual-perceptual processing: prolonged screen exposure may negatively affect a child's classroom attention, visual perception (seeing and understanding), text processing speed, and memory performance — leading to declines in reading comprehension, understanding, and language outcomes.

Small-to-Moderate but Clinically Meaningful Associations. Scientific studies indicate that the relationship between children's screen exposure (e.g., smartphones, tablets, television) and cognitive outcomes, while not large in effect size, remains statistically significant and clinically important. In other words, these associations may not be "severe" or "dramatic" but can lead to meaningful consequences at the population level.

For example, a meta-analysis among children aged 0–5 years found an average correlation between different screen contexts (program viewing, background TV, unsupervised use) and cognitive outcomes of $r \approx -0.16$ (95% CI: −0.24 to −0.08). This represents a small-to-moderate effect size, meaning that as screen time increases, cognitive performance slightly declines — a reduction that can still affect school success.

Another study reported a correlation between screen time and behavioral problems of $r \approx 0.11$ (95% CI: 0.10–0.12). Although this focuses more on behavioral regulation than cognition, it also represents a small-to-moderate effect, yet one that carries clinical and educational significance.

Additionally, in children around 5 years of age (mean 5.2 years), those with >1 hour/day of screen exposure showed an increased risk of "language and cognitive developmental delays" (OR = 1.81; 95% CI: 1.19–2.74). This level of effect suggests a need for early preventive measures.

Discussion

In recent years, the sharp rise in the use of smartphones, tablets, and other digital devices among children has become a major topic of concern within the scientific community due to its potential negative impact on cognitive functioning, reading efficiency, and executive development. Research findings indicate that for children aged 7–10, daily screen time often exceeds the recommended 2-hour limit, leading to declines in cognitive performance, reading, mathematics achievement, and attention.

1. General Association Between Screen Time and Cognitive Function. Analysis shows that children with more than 2 hours of daily screen time experience gradual declines in global cognition, memory, attention, and working memory. This relationship follows a dose–response pattern, where increased screen time progressively weakens certain mental components, particularly executive functions.

These results align with findings from Walsh et al. (The Lancet Child & Adolescent Health, 2018) and the NIH ABCD project, which concluded that maintaining ≤2 hours/day of screen time combined with 9–11 hours of sleep provides the most optimal balance for children's cognitive development.

Analyses referenced from ScienceDaily and BMJ also suggest that higher screen time diminishes not only cognitive but also psycho-emotional and behavioral functions. The key mediating factors include sleep disturbance, fragmented attention, and decreased physical activity.

2. Associations with Executive Functions and IQ. Executive functions encompass children's ability to control thought, plan actions, regulate behavior, and adapt flexibly — all of which are closely linked to prefrontal cortex development between ages 7 and 10. Studies indexed in PubMed and BioMed Central indicate that exceeding 2 hours of daily screen time negatively affects core executive components such as working memory, inhibition, and sustained attention.

Furthermore, neuroimaging data from the ABCD (Adolescent Brain Cognitive Development) study reveal dose–response structural changes between screen media activity (SMA) and prefrontal cortical volume and gray matter density. This implies that excessive use of smartphones and tablets may induce functional alterations in brain regions responsible for control, planning, and analytical thinking. Consequently, IQ scores may also decline indirectly, as the main cognitive components of IQ tests — working memory, attention, and logical reasoning — are all dependent on the integrity of these executive systems.

3. Association Between Reading Efficiency (Perception) and Academic Outcomes. Studies conducted among elementary school students aged 7–10 (JAMA Network Open, Ontario Study, BioMed Central) indicate that each additional hour of daily screen time (ST) is associated with a 9–10% decline in reading and mathematics performance. These findings directly relate to perception — that is, children's ability to interpret, understand, and process text efficiently.

Children with high screen exposure tend to have shorter attention spans during reading, slower visual word and text processing speeds, and consequently lower reading efficiency. This aligns with the "substitution theory," which suggests that children who spend their leisure time on screens rather than reading fail to develop adequate perceptual and interpretive reading skills.

Moreover, excessive screen time indirectly reduces reading performance through sleep disturbances, attention fragmentation, and memory decline.

4. Small-to-Moderate but Clinically Significant Associations. Numerous meta-analyses (JAMA Pediatrics, BioMed Central) demonstrate that although the correlation between screen time and cognitive development falls within the small-to-moderate range ($r \approx -0.16$), it remains clinically significant, as such small effects can have substantial implications at the population level — that is, across millions of children.

Additionally, studies among children around the age of 5 have shown that those with more than 1 hour of daily screen exposure face an increased risk of language and cognitive developmental delay (OR = 1.81; 95% CI: 1.19–2.74). Although this represents a small effect size, it underscores the need for preventive interventions in educational and public health policies.

Conclusion

In the 21st century, children's constant interaction with digital technologies brings both new opportunities and emerging risk factors for their cognitive, psychological, and social development. The findings of this study indicate that long-term and excessive smartphone use significantly affects cognitive performance, reading efficiency, and specific components of executive function among children aged 7–10. This underscores the growing importance of developing healthy digital habits in early childhood.

1. According to the analysis, children aged 7–10 typically exceed the recommended daily limit of 2 hours of screen time. This is associated with a dose–response decline in global cognition, working

memory, attention, and concentration — representing one of the key factors that weakens overall mental performance.

2. Executive functions—including working memory, inhibition, and cognitive flexibility—decline directly as screen time increases. Neuroimaging evidence (ABCD studies) confirms that these changes are linked to altered prefrontal cortex activity. As a result, IQ levels and academic achievement show a tendency to decline.

3. Reading efficiency (perception) is also significantly impaired by excessive screen exposure. Each additional hour of screen time reduces the likelihood of achieving higher reading and math test scores by 9–10%. This can be explained by diminished focus, slower reading comprehension speed, and weakened visual perception processes.

4. Although the effects on cognitive function are small to moderate in magnitude, they are clinically and socially meaningful. When the balance among screen time, sleep, and physical activity is disrupted, negative outcomes in learning processes and social adaptation become widespread.

5. To ensure healthy cognitive development, children should maintain no more than 2 hours of recreational screen time per day, get 9–11 hours of quality sleep, and engage in at least 60 minutes of physical activity daily. Furthermore, educational and interactive digital content under parental supervision can yield positive outcomes for children's development.

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