

**THE IMPACT OF ELECTRONIC GADGETS ON COGNITIVE FUNCTIONS IN
SCHOOL-AGED CHILDREN**

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Annotation: In today's digital world, school-age children are active users of electronic devices (smartphones, tablets, computers). This review analyzes current scientific evidence on the impact of digital technologies on key cognitive functions: attention, memory, executive functions, and language. The review demonstrates the ambivalence of these effects, highlighting both potential risks (digital distraction, decreased concentration, fragmented thinking) and potential benefits (development of visual-spatial skills, access to educational resources). Particular attention is given to factors that modulate these effects, such as content type, duration of use, and the child's age.

Keywords: cognitive development, schoolchildren, digital gadgets, attention, memory, executive functions, neuroplasticity , digital distraction.

Introduction

The penetration of digital technologies into everyday life has reached unprecedented levels. According to research [1], over 95% of children in developed countries have access to smartphones and tablets, and the average time spent in front of screens often exceeds WHO recommendations. The child's brain, which is highly neuroplastic , is particularly sensitive to external influences, making the impact of gadgets on cognitive development one of the most pressing issues in developmental psychophysiology and pediatrics. So, let's consider the impact of gadgets on attention and executive functions . Executive functions are a set of cognitive processes that include working memory, cognitive flexibility, and the ability to inhibit impulsive reactions. They are a predictor of academic achievement.

There are a number of risks for developing cognitive impairment under the influence of electronic devices , such as the phenomenon of "digital distraction" and multitasking. Constant notifications and rapidly changing frames in videos and games form a habit of frequently switching attention in children. A study by Larry Rosen and his colleagues shows that students who are frequently distracted by their phones perform lower on tests of sustained attention [2]. This condition is called "persistent partial attention syndrome," in which a child tends to process information superficially without delving into its essence.

Neurophysiological aspects must also be considered. Studies using fMRI indicate that excessive stimulation from digital devices can impact the development of the prefrontal cortex , the brain region responsible for impulse control and goal-directed behavior [3]. Potential benefits include the fact that certain video game genres, particularly strategy and puzzle games (e.g., Tetris), can train cognitive flexibility, spatial reasoning, and information processing speed [4].

A comparative analysis of the impact of different types of digital activity on attention and executive functions

Activity type	Potential negative impact	Potential positive impact
Passive video viewing (YouTube , TikTok)	Decreased ability to pay attention, habit of quickly	Minor, except for educational content

	changing stimuli	
Multitasking (social media + homework)	Fragmentation of thinking, increased time to complete tasks, increased number of errors	Absent
Strategy video games	Possibility of developing gambling addiction with excessive use	Improving cognitive flexibility, planning and resource allocation
Educational apps and puzzles	Minimal, when used in measured doses	Development of concentration, logical and spatial thinking

The impact of electronic technology on memory and attention is particularly important. Current research points to a shift in memory strategies, such as the "Google effect" or digital amnesia. Betsy's research Sparrow demonstrates a phenomenon in which people tend to forget information that is easily found online. Children, knowing that a fact can be quickly "googled," make no effort to deeply encode it into long-term memory [5]. Episodic memory is also weakened. Constantly capturing life events through photos and videos on a smartphone can weaken natural episodic memory mechanisms, as children rely less on internal mnemonic efforts [6].

The role of gadgets in influencing speech and reading development is enormous, given that replacing live communication with instant messengers and social networks can impoverish vocabulary, especially in children of primary school age. Maria Greenfield and other researchers note that digital communication often lacks nonverbal cues (intonation, gestures), making it difficult to develop pragmatic language skills [7]. When comparing screen reading with paper reading, many meta-analyses, including the work of Maryanne Wolf [1] show that "deep reading" from a sheet of paper is more effective for text comprehension, memorization, and critical thinking. The hypertextual nature of the Internet, replete with links, promotes superficial, "saltatory" (skipping) reading [8, 9].

A hypothetical comparison of levels of text comprehension in different types of reading (based on meta-analysis data)



But we should also consider the positive aspects; the influence of gadgets is neither fatally negative nor unambiguously positive. It is mediated by a number of key factors, such as: content is king (Content is King). Watching educational programs and using interactive learning applications has a different impact than aimlessly scrolling social networks or playing aggressive action games ; 2) the context of using a gadget together with a parent to discuss content (co-viewing) can mitigate many risks and turn the process into an educational one; 3) of course, the age of the child, the brain of a 7-year-old child is more vulnerable to overstimulation than the brain of a 15-year-old teenager. The American Academy of Pediatrics (AAP) strictly limits screen time for children under 2 years of age and recommends no more than 1 hour per day for children 2-5 years old [10], 4) the duration and time of use, the greatest harm is caused by using gadgets at night (suppression of melatonin production and sleep disruption) and exceeding the total daily limit.

In conclusion, the impact of electronic gadgets on schoolchildren's cognitive performance is complex and multifaceted. On the one hand, there is a real risk of developing "clip-based" thinking, weakening concentration, memorization, and deep reading skills. On the other hand, digital technologies represent a powerful tool for developing specific cognitive skills and access to knowledge. The key task for parents, teachers, and doctors is not a blanket ban, but rather skillful mediation: consciously selecting high-quality content, setting clear time limits, and encouraging face-to-face communication and reading paper books. Further research is needed to more accurately understand the long-term impact of the digitalization of childhood on the architecture of the developing brain.

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