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DEVELOPMENT OF CHILDREN'S ATTENTION AND MEMORY IN THE ERA OF DIGITALIZATION

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Abstract: This article analyzes the development of key cognitive functions such as attention and memory in children during the digital era, based on modern psychological theories and applied research. It examines how digital devices, mass media, and interactive technologies influence children's attention regulation, working memory capacity, and information processing speed. Research findings show that excessive use of modern technologies can lead to divided attention, distraction, and increased cognitive load. At the same time, targeted educational games, interactive learning platforms, and specialized therapeutic games (such as EndeavorRx) can enhance children's attention and memory. The article presents analyses of psychological approaches (Piaget, Vygotsky, cognitive load theory), neuropsychological evidence, experimental studies, and modern technological tools for improving attention and memory.

Keywords: children's cognitive development, digitalization, attention, memory, working memory, digital technologies, media multitasking, child psychology, neuropsychology, executive functions, educational technologies, digital environment, attention disorders, attention enhancement.

Introduction

Modern digital media and technologies are deeply embedded in children's lives. For example, it is known that in the United States, the amount of digital information consumed by 8-12 year olds daily is an average of 4 hours and 44 minutes (this is spent only on entertainment content). This large flow of information can divide children's attention and overload working memory, since working memory has a limited working capacity. Therefore, the development of attention and memory is a relevant issue in the field of psychology and education. The following is a discussion of modern theories, empirical research results, and technological approaches to strengthening attention and memory that affect children's cognitive development.

Cognitive development and psychological approaches

Psychological theories help to explain how cognitive functions are formed in children.

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According to the specialized attention networks model, one of such theories, there are two main attention systems in humans: the alerting system and the executive control system. The alert system works to respond quickly to stimuli around it, while the executive control system controls higher-level functions such as memory and error detection. Piaget also believes that children go through different stages of cognitive development, and in the early stages, they learn primarily through play and hands-on experience. If digital devices replace traditional play and communication opportunities for children, this can slow down the development of social and motor skills. For example, too much screen time has been linked to delayed language acquisition in children. Vygotsky's sociocultural theory emphasizes learning through communication and collaboration; digital devices can often be a limiting factor, rather than a complement to physical interaction. Cognitive Load Theory is also important. According to this theory, working memory capacity is limited, and frequent exposure to different information streams reduces the efficiency of working memory. Digital devices often deliver multiple types of information at once, creating a state of "continuous partial attention" in children. As a result, children may have difficulty maintaining sustained attention or achieving deep understanding.

The impact of modern technology on attention and memory

Modern media activities affect children's attention and memory functions in various ways. Studies show that excessive screen time and the use of multiple devices at the same time (media multitasking) can disrupt and distract attention. For example, excessive use of social media has been linked to reduced attention, reduced working memory capacity, and impaired executive functions in children. On the other hand, some video games, games, and educational platforms can improve some cognitive skills in children. For example, specific video games (action games) have been found to shorten reaction times and increase attention span in adolescents because they require quick responses and attention control. In strategic games such as "Call of Duty" and "StarCraft," players must monitor multiple stimuli and make quick decisions; this helps improve the ability to maintain attention in real life.

Mobile devices and screen-based content play a significant role in children's attention span. Several studies have shown that screen time often impairs executive function and memory. For example, when children aged 3–5 spend more time in front of a screen, their attentional system, visual and language centers, is reduced.

In particular, passive video content that does not require face-to-face interaction does not improve children's attention span. A study by Karra found that reading interactive stories improved children's decision-making and visual attention, but watching only film content on a screen did not.

Scientific research and statistical results

Recent studies have also confirmed the negative and positive effects of technology on children's attention and memory. For example, a Canadian research team has recommended that children under the age of 3 be limited to screen time. Studies on Japanese children have shown that watching television increases brown matter in the frontal lobes, while playing video games

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causes changes in white matter. A recent article published in BMC Pediatrics notes that excessive use of social media can lead to social and psychological disorders in children, such as reduced working memory and impaired executive function. At the same time, some games and educational programs are also showing positive results. For example, it has been noted that multitasking in video games has a positive effect on children's overall intelligence.

The following research results are the most famous:

Changes in the child's brain: Children who spend a lot of time on screens at the age of 3-5 have been observed to have weaker connections between the regions that control the attention system.

Working memory and attention: Excessive multimedia activity has been linked to ADHD (Attention Deficit Hyperactivity Disorder) symptoms and attention problems in children.

Benefits of video games: Children who play video games frequently have been shown to have better reaction times and increased attention span.

Modern tools for developing attention and memory

In the digital age, various technological methods and applications have been created that are aimed at strengthening attention and memory. For example, a video game called “EndeavorRx” is an FDA-approved therapeutic tool specifically designed to improve attention control in children with ADHD. Studies have shown that playing such games regularly significantly improves attention and general cognitive skills in children. In addition, interactive educational platforms (e.g. Khan Academy Kids, ABCmouse) provide learning environments for young children that are enriched with game elements; Such platforms help children stay focused on the subject longer.

Reading and listening to stories are traditionally effective ways to develop attention and memory. Studies have shown that listening to interactive stories led by parents and teachers actively engages children’s attention networks and strengthens executive control; passive viewing on a screen does not. These modern tools include memory games. For example, parent-controlled memory games in a digital environment (such as memorization exercises, remembering patterns, i.e. sequences of colors, shapes or symbols) strengthen children’s short- and long-term memory. In addition, apps for developing intelligence and attention are widely available. Meditation and mindfulness apps such as Headspace for Kids or Breathe, Think, Do with Sesame teach children to manage their attention, reduce stress and improve their concentration. Here are some of the technological tools that are useful for children's attention and memory:

EndeavorRx - a therapeutic video game designed to manage attention (approved by the FDA).

Khan Academy Kids, ABCmouse - online platforms that use game elements to teach children to keep them interested in the task.

Memory games - such as "memory matching" games - develop working memory by inviting

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children to memorize different image locations.

Meditation apps (Headspace Kids, Breathe-Think-Do) - offer exercises that teach attention and focus.

Conclusion

In a digital society, children's cognition – especially attention and memory – is a complex phenomenon that requires a comprehensive analysis. Psychological theories (Piaget, Vygotsky, cognitive load theory) show that practical games, social interaction and concentration are important for children's development. At the same time, modern research is finding that excessive use of screens and devices can lead to attention deficit and memory problems in children.

But digital technologies are not always negative: purposeful and educational content can develop attention and strengthen memory. For example, interactive games, educational programs and meditation applications support children's cognitive abilities. The important thing is to manage multimedia tools for children sensibly; under parental supervision, interactive and educational content should be prioritized, and passive screen time should be minimized. In this way, we can combine modern knowledge and methods to improve children's attention and memory in the digital age, ensuring healthy cognitive development.

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