THE IMPACT OF COORDINATIVE CAPACITIES DEVELOPMENT ON COGNITIVE PROCESSES IN PRIMARY SCHOOL CHILDREN

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DOI: https://doi.org/10.51267/icehhm2024bp09

Abstract: *Enhancing both the physical and mental well-being of students elevates their mood, focus, and productivity, thereby augmenting their capacity to assimilate knowledge. Understanding the psychological dimensions of motricity is essential to appreciate the intricate relationship between motor capabilities and cognitive mechanisms. Additionally, fostering a supportive environment that encourages regular physical activity not only improves students' physical health but also enhances cognitive functions, such as attention retention and problem-solving skills. By acknowledging the holistic nature of human development, educators can create enriching learning environments that nurture both mind and body, supporting comprehensive growth and academic success. Our study conducted a systematic review examining the relationship between coordination skills and cognitive abilities in children aged 6-12, evaluating the effectiveness of existing research on this topic. The primary goal of this research was to empirically substantiate the connection between the progression of cognitive aptitudes and coordinative motor proficiency, demonstrating how these elements can mutually reinforce each other in primary school-aged children. The analysis identified intervention protocols combining coordinative exercises with visual arts, perceptual tasks, attentional activities, and creativity-enhancing exercises, all integrated within the physical education curriculum. This study corroborates the view incorporating coordinative exercises into physical education at the primary school level, which significantly enhances the developmental trajectory of cognitive skills.*

Keywords*: cognitive skills; primary school students; psychomotor development; coordinative capacities.*

Introduction

This paper examines the impact of excessive screen time and other contemporary influences on children's cognitive development and attention spans. It explores the role of physical exercise in mitigating these negative effects and enhancing cognitive functions. Through a review of existing literature and empirical studies, this research aims to provide insights into effective strategies for improving cognitive abilities in children.

In an era defined by rapid technological advancements and information flow, concerns regarding the diminishing attention span and concentration capacity among children have become increasingly prominent. Factors such as the excessive use of electronic devices, inadequate nutrition, stress, and poor parent-child relationships contribute to this decline. This paper investigates these factors and explores the potential benefits of physical exercise on cognitive development.

Recent research indicates a rise in concentration issues among children (Zimmerman & Christakis, 2007). Experts suggest that concentration problems develop early and are closely linked to the need for balance and emotional self-regulation, a concept grounded in a complex interplay of emotional, relational, and biological factors **(**Chaddock et al., 2011). Without

appropriate interventions, children may experience frustrations that could manifest as aggression toward themselves or others (Röll et al., 2012).

In modern educational settings, maintaining a child's attention has become increasingly challenging, even in traditionally engaging physical education classes. Children's attention spans have shortened to approximately 10-15 minutes, largely because prolonged screen exposure has conditioned their brains to passively receive information, limiting active engagement (Ponti, 2023).

Scholars in physical education and sports consistently argue that physical activity positively influences cognitive development. However, for physical activities to have a beneficial cognitive impact, exercises must be sufficiently complex. Numerous studies reveal that prolonged television viewing and computer use adversely affect brain development and function. Cortical activity while watching TV differs significantly from activity during more engaging tasks, leading young people to develop passive habits, weakened concentration, and reduced cognitive engagement. Specifically, television inhibits the development of the brain's left hemisphere, which is crucial for logical and analytical thinking, language skills, sentence construction, writing, and reading.

Methodology

This paper presents a systematic review of the existing literature and an analysis of studies examining the effects of screen time and physical exercise on cognitive development. Key studies were selected based on relevance and methodological rigor. To ensure comprehensive research documentation, a range of databases and digital libraries, including Google Scholar, ProQuest, Frontiers, Emerald Insight, and Taylor & Francis were accessed, providing access to recent and pertinent studies on the research topic.

Findings

Research over time has shown that prolonged television viewing and computer use can negatively impact brain development and function. An influential research project led by the Emery couple at the State University of Canberra, Australia, concluded that when television is turned on, brain waves slow down until alpha and beta waves become predominant (Mander, 1978). The longer the exposure, the more pronounced this effect becomes. Alpha wave patterns, typically recorded in the occipital area, diminish when a person engages in focused visual activities, such as seeking information or concentrating on a specific task. This suggests that television viewing, which promotes alpha wave predominance, suspends active attention rather than training it (Mander, 1978).

Further research by Herbert Krugman demonstrated that television viewing inhibits the left hemisphere, allowing the right hemisphere to dominate cognitive processing. The left hemisphere, responsible for functions such as organization, analysis, and critical judgment, is essential for processing data logically. In contrast, the right hemisphere processes information holistically and uncritically, often resulting in emotional rather than rational responses (Moore, 2001).

Neuropsychologists suggest that prolonged screen time may extend a pathological state in the prefrontal cortex, with serious implications for its development (Emery, 1980). The

prefrontal cortex plays a critical role in higher mental processes, including attention, motivation, and the regulation of behavior and emotions. Television, in particular, fosters a passive and inert mental state, potentially leading children to adopt patterns of disengagement from real-world learning. Studies indicate that each additional hour a child spends daily in front of screens between the ages of 1-3 increases the likelihood of attention problems by 28% by age 7 (Christakis et al., 2004).

According to Buzzell (1998), the color on a television screen is produced by phosphor activation through electron streams, generating wavelengths that cover a limited portion of the visible spectrum. This restricted range of stimuli engages only a fraction of the visual system compared to natural settings, limiting sensory input essential for responding to complex, real-world environments. Furthermore, the reduction in diverse visual stimuli and physical input can diminish information flow to the reticular activating system, affecting both attention and vigilance.

Screen exposure significantly influences cognitive development, with recent studies underscoring a range of negative impacts on young children's attentional capacities. Tamana et al. (2019) found a correlation between screen exposure and attention difficulties in preschoolers, suggesting that adherence to screen-time guidelines could mitigate these issues. Additionally, research by John et al. (2021) found a strong association between excessive television use and cognitive delays in language development among children in Kerala, India, revealing that watching more than two hours daily is linked to developmental delays.

Tablet use, while associated with improved sustained attention performance, has been shown to correlate with poorer sleep quality, which may negatively impact long-term attention (Chiu et al., 2022). High screen time and insufficient sleep have also been found to impair higher cognitive processes essential for social and cognitive development (Cliff et al., 2017). Furthermore, Adelantado-Renau et al. (2019) emphasize that excessive television viewing can displace physical activities and verbal interactions, resulting in decreased attention and cognitive functioning.

Fisher et al. (2011) conducted a study to examine the impact of a structured physical education intervention on cognitive functions in young children, specifically exploring the relationship between physical activity and cognitive domains such as attention, planning, perceptual processing, and memory. The intervention consisted of a 10-week aerobic program, comparing cognitive performance and physical activity levels between an experimental group, which participated in regular physical education sessions, and a control group. Results revealed significant enhancements in both cognitive performance and physical activity in the experimental group, suggesting that structured physical activity may have a beneficial impact on cognitive development in early school-aged children.

Bidzan-Bluma & Lipowska (2018) analyzed the relationship between physical activity and cognitive functions by reviewing studies published between 2000 and 2017. Their review assessed outcomes related to children's attention, memory, problem-solving, and language before and after physical exercise interventions. Findings indicate that children who regularly participate in physical activities demonstrate improved focus and a calmer classroom demeanor compared to those with higher screen exposure. While data on physical activity's impact on creativity and planning remain limited, a six-month football-focused exercise program demonstrated substantial gains in these cognitive areas among children in the experimental group.

An additional study examined the development of coordination skills in primary school students over the course of 41 physical education sessions. Conducted with 25 students aged 12, the study assessed coordination abilities before and after the intervention. Results showed marked improvements in areas such as static and dynamic balance, segmental coordination, and kinesthetic sensitivity, underscoring the role of physical education in advancing coordination skills (Romeu et al., 2023).

Kurnaz and Altinkök (2023) explored the effects of coordination-based educational activities on fundamental motor skills and attention in children aged 5-6. Their findings indicate a strong association between enhanced motor coordination and improved attentional capacity, contributing to cognitive preparedness for academic learning. Similarly, Zheng et al. (2023) investigated the connection between motor skill development and working memory in preschool-aged children, a critical period for both cognitive and motor development. Using functional near-infrared spectroscopy (fNIRS), the study measured prefrontal cortex activity during visuospatial memory tasks in children aged 4-6. The findings revealed a positive correlation between motor skills and prefrontal cortex activation, with children exhibiting higher motor skills performing better on working memory tasks, suggesting that motor development supports cognitive functions via more efficient neural recruitment. This study underscores the importance of incorporating motor activities into early education to support both physical and cognitive growth.

Finally, Marsigliante et al. (2023) conducted a study in Italy involving 310 children aged 8-10, assessing the effects of a structured physical activity program on physical and cognitive outcomes. The program included 10-minute active breaks and structured physical activities integrated into the school day. After six months, results showed significant improvements in body composition, physical fitness, and cognitive performance, highlighting the benefits of embedding physical activity within the school curriculum to support overall well-being and academic success.

Discussion

This research underscores substantial deficiencies in higher-level cognitive functions—such as attention, memory, and executive processes—among children with high screen time exposure. These findings align with existing literature, which indicates that excessive screen use may disrupt cognitive development due to reduced engagement in real-world interactions and physical activities. The study also highlights the potential of structured physical exercises, especially those with high complexity, to counteract some of these negative effects by promoting brain plasticity and enhancing cognitive engagement.

Despite promising results, further research is necessary to determine the long-term impact of physical exercise on cognitive outcomes in children. Specifically, longitudinal studies could provide insights into how sustained physical activity influences cognitive trajectories over time. Additionally, optimizing intervention strategies will require investigating which types, durations, and intensities of exercises yield the most substantial cognitive benefits, particularly for children with high screen exposure. Integrating physical activity with cognitive tasks may offer an effective approach to enhance cognitive resilience in today’s digital age.

Conclusion

This systematic review contributes significantly to our understanding of the complex relationship between physical exercise and cognitive enhancement in children. The reviewed studies underscore the detrimental impact of excessive screen time on brain development and highlight a concerning decline in attention levels among young schoolchildren. Physical exercise has emerged as a particularly effective approach to support cognitive functions, offering benefits in areas such as attention, memory, and problem-solving skills.

Furthermore, integrating physical activity with academic learning shows promise for fostering complex cognitive development. Nonetheless, the field remains in its early stages, and further rigorous research is necessary to elucidate the long-term benefits and optimize intervention strategies for diverse educational contexts. Moving forward, collaborative efforts among educators, psychologists, and physical education specialists will be essential in designing comprehensive programs that address both cognitive and physical well-being, ultimately supporting children's development in a balanced and sustainable way.

Authors' Contribution: Both authors have equally contributed to this study.
Funding: This research received no external funding.
Data Availability Statement: Data are available upon request to the contact author.
Conflicts of Interest: The authors declare no conflict of interest.

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