

THE ROLE OF COORDINATIVE CAPACITIES IN DEVELOPING ATTENTION IN PRIMARY SCHOOL CHILDREN: A SYSTEMATIC LITERATURE REVIEW

Maria Cristina DRĂGUȘIN^{1*}, Virgil TUDOR¹, Ana TRÂNCAN²

¹ National University of Physical Education and Sports, Bucharest, Romania

² Secondary School No. 2, Romania

*Corresponding author: dragusin.cristina15@yahoo.com

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Abstract. Attention represents a fundamental cognitive ability that plays a crucial role in the learning outcomes of primary school children. Over the past decade, a growing number of studies have examined the relationship between coordinative motor activities and the improvement of attentional skills during primary school years. This paper offers a systematic review of the existing literature investigating the influence of coordinative capacities on the development of attention in children aged 6 to 12. The present review examines a selection of 20 peer-reviewed articles published between 2012 and 2025, which investigate physical education programs and intervention strategies that include components like balance, rhythmic movement, spatial awareness, and coordination activities. The analysis reveals a consistent trend across studies, indicating that coordinative activities are positively linked to enhancements in attention, especially in areas such as sustained concentration, selective focus, and mental flexibility. The findings also point to a neurocognitive explanation for this connection, as coordinative activities appear to engage brain regions responsible for executive control. The reviewed literature supports the value of well-structured and age-appropriate physical education programs that incorporate coordinative elements, beyond general physical fitness. Through this analysis, the review reinforces the perspective that educational strategies should address both motor and cognitive dimensions of child development. It also highlights the importance of interdisciplinary collaboration between physical education professionals, educational psychologists, and classroom teachers in developing movement-based approaches to support attentional growth. Future research is encouraged to further investigate and standardize such intervention methods across various learning environments.

Keywords: coordination; attention; primary school; physical education; executive functions.

Introduction

The connection between physical activity and cognitive development in children has received increasing attention over the past decade, particularly regarding how coordinative motor exercises enhance attention and executive functions (Gallotta et al., 2012; Donnelly et al., 2016).

Coordinative capacities are defined as the ability to efficiently control and organize complex motor actions through the integration of sensory information, perception, and motor planning, enabling the individual to adapt movement precisely to task demands (Fels et al., 2015; Schmidt et al., 2017).

Attention, as a core component of executive functioning, plays an important role in the learning processes of primary school-aged children. It supports sustained attention, the ability to focus on relevant information, and mental flexibility, all of which are important for academic success and effective adaptation to everyday situations (Cameron et al., 2016). Coordinative motor activities such as balancing, moving through space, or following

rhythmic patterns help improve attention by engaging motor planning and integrating movement with sensory information (Gallotta et al., 2015; Kokštejn et al., 2012).

Also, motor coordination is often linked to other areas of development, like emotional involvement, motivation, and being ready for school (Polevoy, 2022). Several studies suggest that children with better coordination skills tend to show more effective learning behaviors and perform better in school (Kokštejn et al., 2012; Cameron et al., 2016). Fernandes et al. (2016) found that children with better motor coordination also demonstrated higher academic achievement and improved cognitive skills, including attention and information processing. These findings highlight the importance of creating physical education programs that incorporate coordination-specific tasks to support not only physical but also cognitive growth.

The findings of this review support previous evidence indicating that coordinative exercises are more effective than standard physical education in improving attention. Similar to Budde et al.'s findings, short and focused coordination exercises seem to bring clear benefits for thinking and attention, probably because they involve complex movements that also challenge the brain. These activities may boost brain functions related to attention and self-control, which helps explain their positive effects.

Daily participation in structured coordinative activities during physical education classes has been shown to significantly enhance sustained attention and perceptual discrimination in school-aged children (Chou et al., 2023).

These findings are consistent with previous research suggesting that coordination exercises can have a positive effect on children's attention and task accuracy (Gallotta et al., 2015). The observed improvements in attention among children aged 7–9 following the rope-skipping intervention may be linked to the engagement of brain areas involved in both motor coordination and attention control, particularly the cerebellum and prefrontal cortex (Henschke & Pakanm, 2023). Children aged 7–9 who engaged in fancy rope-skipping exhibited marked improvements in selective attention, likely due to the combined demands on coordination and cognitive processing (Deng et al., 2024).

Building on these observations, our review suggests a slightly more optimistic perspective. While we acknowledge the variability in study designs and measurement tools, several recent investigations point to more consistent links between coordination-based physical activities and improvements in attention and task engagement, both of which are essential for academic performance. Unlike van der Fels et al. (2015), our synthesis indicates that certain motor components, especially those involving dynamic balance and spatial awareness, may have a more direct impact on classroom behaviors related to focus and cognitive control.

A structured balance training program led to simultaneous improvements in motor coordination and attention, supporting the hypothesis that equilibrium tasks directly influence cognitive engagement (Hedayatjoo et al., 2020).

Expanding on the educational implications, some studies show that short, daily coordination exercises, especially those involving movements on both sides of the body, can bring real cognitive benefits for school-aged children. Even without adding academic content, these simple routines help improve attention span and concentration, making them easy to apply in a regular classroom setting.

Targeted perceptual-motor training significantly improved children's attention and motor skills, particularly among those with learning difficulties, highlighting its utility even in mainstream educational settings (Punar & Şevgin, 2024).

In addition, several studies reviewed here reported better results in areas like focus, working memory, and self-control after children took part in structured coordination-based activities. Chang et al., (2022) demonstrated that coordinative movement routines can enhance attention regulation and mental control, suggesting broader applicability for school-based interventions, study focused on children with ADHD. These findings support the idea that such physical exercises can play an important role in helping students stay engaged and manage tasks more effectively during learning.

Coordinative ability training programs have demonstrated positive effects on adolescents' attention and executive functions, suggesting their relevance beyond early childhood (Di Cagno et al., 2021). Pesce et al. (2016) found that when children participated in physical activities combining structured coordination drills with elements of play, such as obstacle courses or movement games, they showed notable improvements in attention and self-regulation. These cognitive gains were linked not only to the motor demands of the tasks but also to the increased engagement and enjoyment children experienced during play-based movement. Previous research also suggests that physical activities involving balance, coordination, and midline crossing can strengthen executive functions, such as attention control and flexible thinking, in children aged 4 to 12 (Diamond & Lee, 2011).

Supporting this perspective, the systematic review by Ihme et al. (2019) highlights the important role of motor coordination, especially activities that include bilateral movements and rhythm, in the development of executive functions. Their findings show that the mental and physical complexity of these tasks is closely linked to better attention control and flexible thinking, particularly in the early years of schooling.

These neurocognitive mechanisms are further supported by Deng et al. (2024), whose findings suggest that rope-skipping and similar coordinative activities may engage both cerebral hemispheres and activate executive control systems. This aligns with Donnelly et al. (2016), who emphasized that cognitively demanding physical activities can stimulate brain regions responsible for higher-order cognitive functions, thus enhancing attentional capacity.

Additionally, the review reinforces the hypothesis that children with higher motor coordination tend to perform better academically, especially in tasks requiring sustained attention and cognitive adaptability. Research by Kokštein et al. (2012) and Cameron et al. (2016) suggests that executive functions mediate this relationship, while Gallotta et al. (2012, 2015) demonstrated that coordination-based exertion has immediate positive effects on cognitive performance, further substantiating the connection between physical and academic outcomes.

Finally, beyond their impact on cognitive skills, coordination exercises may also support attention by enhancing motivation and emotional engagement. According to Polevoy (2022), children often show greater enthusiasm and focus during physically challenging activities. This increased involvement can promote better self-awareness and control, which in turn contributes to improved attention in learning environments. Pan et al. (2015) reported that a structured physical-exercise program focusing on coordinative movements led to significant

gains in children's motor proficiency as well as core executive functions, particularly working memory and inhibitory control.

The aim of this review is to systematically synthesize recent literature published between 2012 and 2025 that investigates the relationship between coordinative capacities and attention in primary school children. By looking at both experiments and studies that show connections, this paper aims to give a clear, evidence-based view of how coordination exercises can help children pay better attention and how this could be useful in teaching, teamwork between different specialists, and planning school activities.

Methods

A systematic literature research was conducted across PubMed, Web of Science, Proquest, Elsevier and Google Scholar databases for peer-reviewed articles published between January 2012 and May 2025, using keyword combinations such as "motor coordination," "attention," "executive function," "children," and "physical activity," with inclusion criteria targeting studies written in English, involving participants aged 6 to 12, and examining the effects of coordinative motor activities (e.g., balance, bilateral movement, spatial orientation) on attentional outcomes measured through quantitative methods, while excluding papers focused on preschoolers or adolescents, non-coordination interventions, and non-empirical publications, resulting in a final sample of 20 eligible studies.

A systematic literature search was performed according to the PRISMA 2020 guidelines. The databases PubMed, Web of Science, ProQuest, Elsevier, and Google Scholar were queried for English-language, peer-reviewed articles published between January 2012 and May 2025. Keyword combinations included "motor coordination", "attention", "executive function", "primary school", and "physical activity".

Inclusion criteria: (1) participants aged 6–12 years, (2) interventions or studies assessing coordinative capacities (e.g., balance, rhythm, bilateral coordination, spatial awareness), (3) quantitative evaluation of attentional outcomes, and (4) school-based or laboratory-based studies on typically developing children.

Exclusion criteria: (1) preschool or adolescent populations, (2) non-coordination interventions (e.g., pure aerobic training), (3) qualitative or theoretical papers, and (4) studies on clinical groups unless used as comparative data.

Study Quality and Risk of Bias

Quality assessment followed a modified Downs and Black checklist, evaluating reporting clarity, internal validity, and confounding control. Risk of bias was categorized as *low*, *moderate*, or *high* depending on sampling methods, randomization, blinding, and outcome reliability. Disagreements were resolved through consensus among the authors.

PRISMA Flow Diagram

A total of 1,134 records were initially identified. After removing duplicates and applying inclusion/exclusion criteria, 20 studies were retained for the final synthesis. The PRISMA flow diagram (Figure 1) summarizes the study selection process.

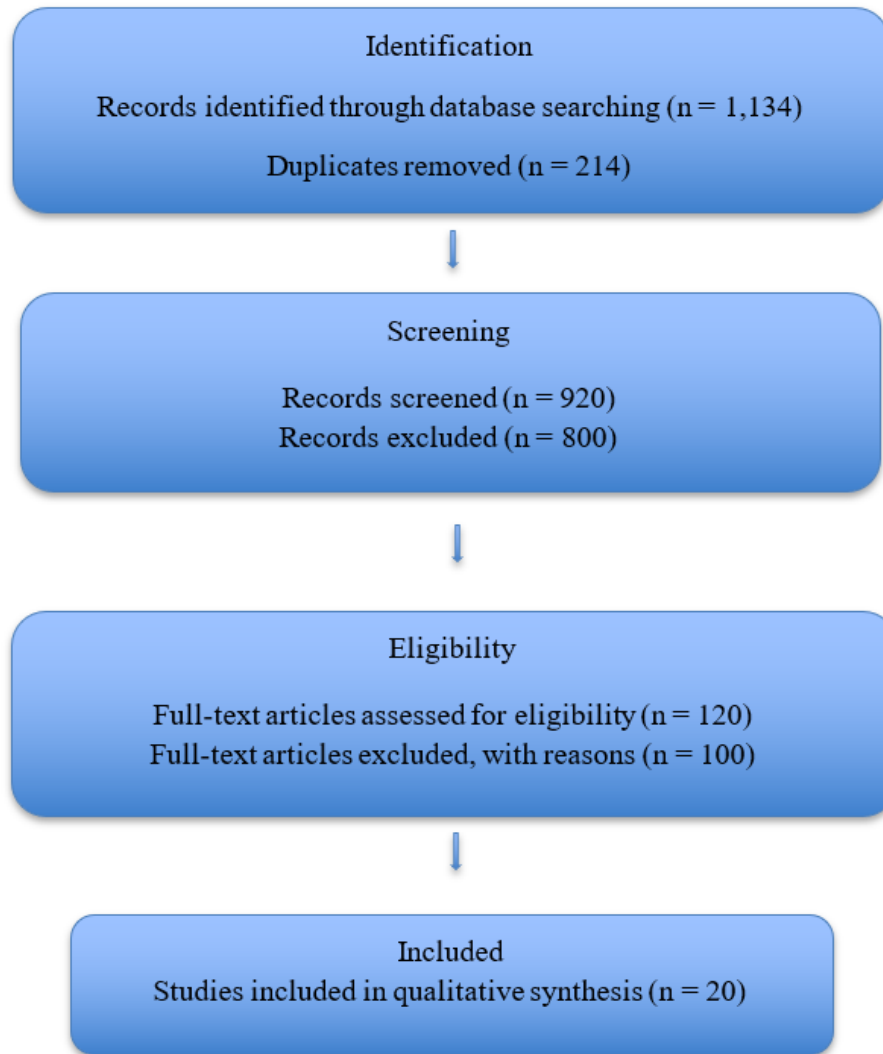


Figure 1. PRISMA flow diagram

Results

Analysis of the 20 eligible studies revealed consistent positive associations between coordinative activities and attention development. Most interventions used balance training, rhythmic movement, or bilateral coordination tasks. Improvements were observed in sustained attention, selective focus, and cognitive flexibility. The main characteristics and findings of the reviewed studies are summarized in Table 1.

Table 1. *Summary of reviewed studies (2012–2025)*

Author(s), Year	Sample (Age/Group)	Type Intervention Focus	of /	Cognitive Outcomes	Key Findings

1. Gallotta et al., 2012	8–10 years	Varied exertion types during PE	Attention capacity	Moderate, coordinative activity improved attention and focus
2. Kokštejn et al., 2012	6–10 years	Correlational study on coordination & PA	Attention, physical activity	Higher coordination linked with better attention control
3. Diamond & Lee, 2011	4–12 years	Review of EF interventions	Executive functions, attention	Motor-based tasks enhance EF and flexible thinking
4. Pan et al., 2015	7–11 years	Physical exercise program (ADHD sample)	Working memory, inhibition	Motor coordination training improved EF and focus
5. Fels et al., 2015	4–16 years	Systematic review of motor–cognitive links	Cognitive skills	Coordination predicts academic and EF outcomes
6. Gallotta et al., 2015	8–10 years	Coordinative training in PE	Attention performance	Enhanced attentional performance post-intervention
7. Fernandes et al., 2016	7–11 years	Motor coordination tasks	Academic achievement, attention	Coordination strongly correlated with cognitive skills
8. Donnelly et al., 2016	7–12 years	Cognitively engaging PA	Executive function, academic performance	Physically active children showed better EF
9. Pesce et al., 2016	6–10 years	Play-based coordination activities	Attention, self-regulation	Mixed motor–cognitive play enhanced EF and focus
10. Schmidt et	8–11 years	Motor ability	EF, academic	Strong motor–

al., 2017		assessment	success	executive function link
11. Ihme et al., 2019	6–10 years	Systematic review	Executive functions	Coordination-based tasks improve EF and attention
12. Miklánková et al., 2019	6–9 years	Gross motor skill evaluation	Cognitive competence	Coordination positively associated with academic success
13. Hedayatjoo et al., 2020	8–11 years	Balance training	Attention, coordination	Dual improvement in balance and focus
14. Di Cagno et al., 2021	10–12 years	Coordinative ability training	Executive functions	Increased attention and flexibility
15. Guillamón et al., 2021	7–10 years	Motor coordination assessment	Academic performance	Motor coordination predicts attention and literacy
16. Chou et al., 2023	9–11 years	Coordinative PE program	Sustained attention, perception	Improved focus and perceptual discrimination
17. Henschke & Pakan, 2023	8–12 years	Motor execution & imagery	Brain activation	Coordination activates prefrontal–cerebellar networks
18. Deng et al., 2024	7–9 years	Fancy rope-skipping	Selective attention	Bilateral coordination improved selective attention
19. Punar & Şevgin, 2024	8–10 years	Goal-directed perceptual-motor training	Attention, motor skills	Significant cognitive and motor gains
20. Polevoy, 2022	8–9 years	Coordination ladder training	Reaction, focus	Improved coordination and adaptive

				motor control
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Discussion and Conclusion

The findings of this systematic review confirm that coordinative capacities, including balance, bilateral integration, and spatial awareness play a significant role in the development of attentional processes in primary school children. Evidence consistently supports that structured, cognitively engaging physical activities not only enhance motor skills, but also stimulate executive functions and attentional control. Consequently, educational strategies should be designed to integrate both motor and cognitive development, promoting coordination-based physical education as a complementary tool for academic success.

Limitations include methodological variability among studies, small or non-representative samples, and differences in measurement tools across educational and cultural contexts and differences in measurement tools across countries. Few investigations report long-term outcomes or standardized coordination protocols.

Furthermore, the implementation of such programs requires active interdisciplinary collaboration among physical education specialists, classroom teachers, and educational psychologists to ensure that interventions are developmentally appropriate, engaging, and sustainable.

Future research should aim to standardize methodologies and extend investigation into diverse educational settings to better understand long-term effects.

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