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Sports Games in the Context of Developing Children's Coordination Ability as a Component of Physical Development

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Abstract: *The article explores how sports games and physical exercises influence the development of children's coordination an essential aspect of their physical development. Its relevance is underscored by the current critical state of children's health and the rising number of children with special needs. Today's youth must become healthy individuals, integrating intellectual, moral, vocational and physical education. The article aims to define such concepts as "ability", "coordination" and "coordination ability", analyze existing literature on how physical exercises affect children's coordination and examine the role of kinesiological exercises in enhancing children's motor skills. Research methods include theoretical and systematic analysis of relevant scientific literature. As is known, physical activity plays a crucial role in the effective development of children's coordination ability. This article analyzes those studies that underscore the significance of engaging in activities such as basketball, volleyball, rowing and choreography to improve it. It also examines the advantages of kinesiological exercises. A key insight of this research is that high coordination levels not only foster physical development but also enhance social and cognitive growth, thereby boosting children's learning capabilities and their interactions with peers. Thus, it is vital to incorporate physical exercises into children's routines, considering their age and individual needs.*

Keywords: *ability; game; sports games; physical development; coordination ability; physical exercises; kinesiology.*

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Introduction

Developing coordination ability through sports games across various age groups is essential, representing a critical physical development component. The effectiveness of sports games in enhancing coordination is significantly influenced by the child's level of interest and engagement. Enthusiastic participation in activities increases the likelihood of success and enjoyment in these pursuits. Sports games play a vital role in cultivating health-preserving skills among children. This article is particularly relevant in light of the current concerns regarding children's health and the rising prevalence of children with special needs. Today's generation must develop into healthy, well-rounded individuals, integrating intellectual, moral, vocational and physical education.

This article aims to define such concepts as "ability", "coordination" and "coordination ability", analyze existing research on the impact of physical exercises on children's coordination ability and investigate its specific characteristics in various sports.

To begin with, Bilodid (1972) defines abilities as "innate tendencies towards a particular skill or talent" (Bilodid, 1972, 538). Naumchuk (2013) describes abilities as "personal traits that correspond with the specific requirements of an activity, ensuring its successful performance" (Naumchuk, 2013, 26).

Hurzhyi & Porokhniavyi (2020) consider abilities as "key traits needed for the effective completion of particular tasks; they can be either innate or cultivated by improving talents and are impacted by developmental stages" (Hurzhyi & Porokhniavyi, 2020, 8).

According to Antonova (2007), abilities are seen as "psychological qualities that guarantee success in tasks and communication, helping in the acquisition of knowledge and skills" (Antonova, 2007, 2).

At the same time, Harbuzova (2008) views coordination as "the harmony of actions among different cells, tissues and organs" (p. 38). As noted by Troianovska (2012), coordination ability is "the ability to navigate space, perform precise movements, differentiate, replicate and evaluate spatial, force and temporal aspects of movements, rhythm, balance and the skill to relax muscles voluntarily" (Troianovska, 2012, 114).

Chuprun (2010) believes that "coordination ability involves one's readiness to manage and regulate motor actions optimally; it is intricately connected to the technique of performing motor actions, the capacity to adjust individual parameters, apply these actions in diverse situations and integrate multiple actions" (Chuprun, 2010, 277).

As indicated by Naumchuk (2013), coordination ability is "the capacity to deliberately organize (form, integrate and unify) complete motor actions, adapt established action patterns, or transition between them in response to changing conditions (the ability to swiftly, precisely, effectively, economically and creatively address motor tasks)" (Naumchuk, 2013, 31).

A similar yet distinct explanation is provided by Hurzhyi & Porokhniavyi (2020), stating that "coordination ability refers to one's capacity to effectively synchronize the movements of body parts to address specific motor tasks" (Hurzhyi & Porokhniavyi, 2020, 9).

Motor activity in children as a key to effective development of coordination ability

A detailed theoretical analysis of relevant sources shows that the problem in question has been studied by many Ukrainian and foreign researchers (Alwasif, 2015; Chuprun, 2010; Kolumbet, 2014; Makarenko, 2004; Purcell, 2005; Renson, 2000; Šimonek, 2014; Sydoriak, 2015; Troianovska, 2012).

The need to cultivate a physically healthy nation underscores the significance of examining historical precedents, particularly the work of the esteemed Ukrainian educator Anton Makarenko (2004). He created and applied a comprehensive system for physical education and health enhancement, emphasizing the essential role of teachers in motivating children to maintain and improve their health.

Examining the physical development methods of Makarenko (2004), Sydoriak (2015) stresses the significance the educator placed on sports games. In particular, these games play a crucial role in developing motor skills, reinforcing rule adherence, promoting self-control, encouraging decisive and coordinated actions, regulating emotions and enhancing stress resilience in children.

Kolumbet (2014) offers a comprehensive examination of physiological aspects of coordination, distinguishing between three types: neural, muscular and motor. Motor coordination is assessed through visual, auditory and tactile sensors and the vestibular system, which collectively facilitate the analysis and regulation of movement. Neural coordination involves the synchronized operation of nerve processes, while muscular coordination concerns the balance between muscle tension and relaxation. Kolumbet (2014) also highlights that each type of motor coordination functions within an integrated system. He details various coordination abilities, such as agility, precision, balance, flexibility, mobility, jumping ability, accuracy, rhythm and plasticity. Besides, the researcher outlines

criteria for evaluation, influencing factors and necessary developmental components. To monitor functional changes in the body, Kolumbet (2014) recommends self-monitoring by students, with a pulsometer to assess the heart's response to physical exertion and potentially guide adjustments in physical activity. He emphasizes that sports games (such as basketball, volleyball and soccer) are crucial for developing coordination. Kolumbet (2014) meticulously analyzes the features of coordination, presents methods for its enhancement, sets criteria for evaluating progress and provides practical recommendations. A diverse range of sports exercises instructors use can significantly elevate the development and refinement of coordination ability.

Troianovska (2012) distinguishes between two types of coordination ability indicators: "explicit (absolute) and latent (relative)" (p. 116). Absolute indicators assess the level of coordination abilities independently of one's speed, strength, or speed-strength capacities. In contrast, relative indicators reflect how coordination abilities manifest when these capacities are considered. Troianovska (2012) also differentiates between static and dynamic balance. She describes special coordination ability as the capacity for a child to efficiently control a range of physical movements such as walking, running, climbing, swimming, jumping, gymnastics, acrobatics and throwing. Achieving a high level of coordination ability is crucial for successful learning since it equips children to accurately evaluate and execute spatial, temporal and dynamic movements, even in challenging conditions, and skillfully orient themselves in time and space.

Chuprun (2010) assumes that developing specific and specialized coordination abilities shapes the concept of "general coordination ability". General coordination ability encompasses one's inherent and actualized capacities that determine one's readiness to manage and regulate various motor actions optimally. It is evident during the performance of actual motor tasks. Thus, a higher level of specialized coordination ability correlates with "a higher level of general coordination ability" (Chuprun, 2010, 279).

Alwasif (2015) believes that sports games improve brain function and foster the development of leadership qualities in children. Additionally, physical exercises enhance cardiovascular endurance, neuromuscular coordination, speed, strength, flexibility and accuracy. Well-chosen physical activities also support children's cognitive development and improve their social and emotional skills.

Purcell (2005) emphasizes the importance of introducing children to sports at any age while considering their age-specific needs. Children have

natural motor abilities such as throwing, running and jumping, which are developed even more during preschool years, preparing them for structured sports participation. Participation in sports enhances cognitive, social and emotional development. It is crucial to tailor physical activities to each child, taking into account variations in equipment sizes, game types and time allocated for changing positions.

Children in their toddler years have a limited ability to balance due to the early development of coordinating visual, vestibular and proprioceptive signals. Given their brief attention spans, adults can enhance their learning by providing visual and auditory cues. At this stage, children acquire fundamental motor skills such as running, throwing, tossing and catching balls. In middle childhood (between 6 and 9), motor skills become more refined, posture and balance show significant improvement, while concentration remains relatively weak. Consequently, training sessions for this age group should be brief and designed to minimize competition. Appropriate activities for middle childhood include beginner-level soccer, baseball, swimming, running, ice skating, tennis and gymnastics.

By late childhood (between 10 and 12), motor skills and coordination are significantly improved, allowing children to perform complex physical exercises and engage in advanced game strategies. Coaches now focus more on tactics and strategies, with suitable activities including beginner-level soccer, basketball and hockey. In early adolescence (between 13 and 15), children may experience a decline in coordination and balance and reduction in flexibility due to puberty. Popular sports for this age group include basketball, hockey and athletics. For late adolescence (between 16 and 18), sports play a crucial role in fostering independence, peer connection and social interaction.

Additionally, Dapp et al. (2021) highlight the significant role of motor activity in children's development, positively impacting their emotional, physical, mental, social and cognitive skills. Early development of motor skills is essential, as it can motivate children to engage in specific sports and lead an active lifestyle. A child's coordination ability is intrinsically linked to their level of motor activity.

The role of individual sports in improving children's coordination ability

Moroianu & Dumitru (2013) investigate how basketball affects the coordination ability of children aged between 9 and 12. Their research highlights the importance of basketball, a team-based sport, in improving coordination by enhancing motor skills, promoting positive behaviours and

developing cognitive skills. They indicate that basketball improves attention, memory, thinking, imagination and the ability to synchronize one's movements with those of team players (Moroianu & Dumitru, 2013). The sport involves complex movements, necessitating refined motor skills. The physical activities inherent in basketball contribute positively to the overall physical development of children, improving circulatory and respiratory functions and enhancing emotional well-being through game scenarios. Additionally, tasks such as running, throwing, jumping and hitting the ball promote independence, initiative and the ability to make quick, responsible decisions among boys and girls. However, it is important to introduce children to basketball gradually, beginning with simple exercises and advancing to more complex ones.

Kyrychenko (2016) suggests that the most suitable age for natural and targeted enhancement of coordination ability falls within the range of 12 to 13 years. Accordingly, basketball offers unique opportunities for the comprehensive development of physical and mental qualities since the motor actions and sports exercises involved effectively strengthen physical health.

The advantages of playing basketball encompass improved posture, physical fitness and game tactics that help one navigate various life situations. Indeed, no other activity in life can foster positive character traits as effectively as sports. According to the Early Years Blog by Novak Djokovic Foundation (2015), the following factors illustrate the value of sports: a) honest play nurtures the child's moral qualities, as well as promotes team spirit, cohesion and social interaction; c) sports unite children regardless of nationality, religion and other differences; d) experiencing defeat in a game acts as a motivator and a foundation for success; e) it teaches the child to observe game rules, respect opponents and understand authority; f) sports create an educational environment; g) they help build positive self-esteem; h) sports improve both physical and mental health and serve as a means for stress relief.

Therefore, sports activities contribute not only to physical development but also to intellectual growth.

Tomporowski et al. (2015) offer suggestions for teachers to incorporate findings from recent studies in child development, cognitive science and physical education to design effective motor activities for children. The educational methods rely on an interdisciplinary strategy, incorporating physical activities with suitable guidance for use at home and in practical situations.

Ladyka (2007) highlights the significant advantages of coordination ability for mastering rowing techniques. One of the essential requirements for young athletes is maintaining dynamic balance, which is a crucial and challenging aspect of rowing. Advanced coordination ability enables athletes to maintain balance despite natural elements such as high waves and strong winds, while also managing the speed, rhythm and pace of their movements. Besides, Ladyka (2007) classifies coordination ability into three categories: 1) special coordination (walking, running, swimming, rowing, cycling, skating); 2) specific coordination (jumping, throwing, combat sports); 3) elementary and complex coordination.

A child's motor activity is inherently linked to the functioning of the central nervous system. Therefore, Ladyka (2007) suggests a framework for organizing the motor system based on the following factors:

- The child's ability to perceive and evaluate their movements.
- Understanding the motor activity and the precise way it is carried out.
- Evaluation and management of movement features.
- Muscular and joint sensitivity.
- Motor memory as the capacity of the central nervous system to remember and replicate movements.
- Intra-muscular and inter-muscular coordination.

In addition, Ladyka (2007) proposes a series of physical activities to improve various aspects of movement coordination, rhythm perception, spatial awareness, balance control, muscle relaxation, children's sports relays and aquatic games.

Šimonek (2014) offers an in-depth analysis of the intricacies of playing volleyball, highlighting the critical significance of developing coordination ability during adolescence. The scholar also presents an innovative model to enhance children's coordination ability through volleyball.

Chuprun (2019) introduces an effective approach to developing coordination ability in young students through dance routines. To ensure dance movements are performed correctly, choreography teachers should follow these guidelines: 1) to accumulate motor experience systematically; 2) to incorporate elements from various types of choreography; 3) to foster the targeted development of children's physical abilities; 4) to demonstrate a high level of performance to ensure the successful acquisition of dance techniques; 5) to create favourable conditions for improvisation (Chuprun, 2019, 336).

To enhance coordination ability in children, it is crucial to use learning tools to improve muscle sensation, spatial awareness, timing, rhythm and balance. The development methodology includes selecting a variety of exercises: a) *for balance development* (exercises engaging the vestibular and sensory systems; b) *for timing* (marching in place, marching while moving and performing dance movements with a set number of repetitions); c) *for muscle sensation* (exercises focusing on the relaxation and tension of different muscle groups); d) *for spatial orientation* (figure marching, various types of dance runs and jumps, incorporating dance elements); e) *for rhythm* (exercises integrating movement with music) (Chuprun, 2019).

Limanskaya et al. (2021) analyze the positive effects of sports on a child's motor skills development. Consequently, enhancing coordination ability should be a key focus within the educational process in schools. Additionally, coordination is a key skill for choreographers, allowing them to turn ideas into movement, show fluid and refined motions and express emotions. Furthermore, rhythmic gymnastics exercises closely resemble the movements found in today's choreography.

International research highlights the crucial role of coordination ability in a child's physical development, affecting every aspect of their motor activities. This ability refers to a child's skill in effectively and precisely controlling their body movements, which lays the groundwork for acquiring more complex motor skills. Key components of coordination include balance, reaction time, rhythm, spatial awareness and movement accuracy. High levels of coordination not only support physical growth but also promote children's social and cognitive development, improving their learning potential and interactions with peers.

It is important to analyze relevant international experience and approaches:

1. *European approach*. In several European countries, physical education is a compulsory component of the school curriculum, encompassing a range of sports to enhance coordination ability. For instance, Germany and the Netherlands use specialized methods grounded in play activities to improve children's movement coordination (Höger & Kleiner, 2022).

2. *North American approach*. In the United States and Canada, physical education also holds a significant place in school programmes, where sports serve as a means to develop coordination ability. There is a strong focus on integrating technology, such as video movement analysis, to increase the effectiveness of learning (Gosset, 2024; Scaini & Barrett, 2019).

3. *Asian approach*. In Japan and South Korea, sports form an essential part of the school curriculum, with considerable emphasis placed on developing coordination ability through traditional sports and martial arts. This approach promotes balanced physical development and cultivates discipline in children (Chia & Chiang, 2010).

Hohmann et al. (2021) emphasize environmental barriers and inadequate organization of family sports as significant negative factors. The researcher indicates that a deficiency in motor skills obstructs one's participation not only in games but also in sports overall.

As noted by Smits-Engelsman et al. (2017), daily physical games on the playground, sports activities and other forms of active recreation require well-developed motor skills and good physical fitness. For instance, playing tag incorporates balance, agility and coordination along with aerobic exercise. If the skills needed for these activities are not practised, even effective physical interventions that demonstrate improvements in fitness may not yield lasting benefits once the training concludes, as these skills will not transfer to everyday life. Additionally, if the training is not engaging and enjoyable, children are less likely to persist long enough to see substantial improvements in their physical fitness.

International studies indicate that sports games play a crucial role in developing coordination ability in children. Games that demand quick directional changes, precise movements and swift reactions significantly enhance these skills. Examples of such games include soccer, basketball, tennis, volleyball and many others. Therefore, sports games serve as an effective means of fostering coordination ability in children, which is essential for their overall physical development.

Global experience shows that combining various approaches and methods can greatly enhance the effectiveness of physical education. Developing coordination ability through sports games not only supports physical health but also improves children's social and cognitive skills, making them more adaptable and successful in various aspects of life.

The uniqueness of kinesiology as a science of human movement

Niznikowski et al. (2016) emphasize the unique interdisciplinary field of kinesiology, which encompasses a wide range of knowledge. They stress the significance of physical activity for every individual and explore the relationship between the rhythm of breathing movements. The researcher also underscores the potential for muscle relaxation during such exercises, along with the comprehensive differentiation of human movements, the

symmetry of motor functions and the adaptation of left-handed individuals to the skills of right-handed ones.

Renson (2000) defines kinesiology as the science of physical exercises. The researcher investigates this field and notes that the term was first introduced by Nicolas Dally (1857), who viewed kinesiology as the science of human movement and studied its links to intellect, hygiene and therapy. Dally (1857) had original ideas about this discipline and emphasized gymnastics in his school, recognizing its benefits. He believed that children who practised gymnastics became more active, skilled and flexible.

Krneta et al. (2014) investigate the impact of kinesiological exercises on motor skills of preschool children. Their study involved a group of boys who engaged in a variety of exercises aimed at improving coordination, timing, agility, speed, balance, flexibility, strength, endurance, recovery and cardiovascular health. The activities encompassed creative movements, choreographic routines, tumbling, object manipulation, jumping, throwing and games. The findings suggest that these physical exercises stimulated the children's interest in kinesiological activities, and their regular implementation can enhance coordination skills, which are crucial for physical development. Furthermore, establishing a solid foundation in these skills during early childhood should contribute positively to biological and motor development in later years.

Hudym et al. (2020) indicate that a decline in performance, rapid fatigue and sudden mood changes suggest a decrease in the qualitative criteria of motor activity. Coordination ability is known to be organized into a cohesive structure, where each motor activity corresponds to the functioning of its respective area. For instance, mobility ensures maximum amplitude in rotational and circular movements, while flexibility facilitates proper effort distribution over time and space. Bounciness manifests itself in the ability to exert powerful force when necessary; accuracy involves hitting the intended target; balance contributes to achieving a stable bodily position; plasticity shapes one's unique style and the aesthetic beauty of movements. Therefore, consistently practising physical actions encourages the involvement of motor coordination.

Plazibat et al. (2021) study specific aspects of how physical exercises influence the development of coordination ability among children. They believe that childhood, particularly the ages of 2 to 7, represents the ideal period for cognitive, emotional and motor development. Engaging in consistent and systematic physical activities through play can effectively enhance cognitive and motor skills, including motor coordination, control and balance, while promoting a healthy lifestyle.

Chelnokova et al. (2018) investigate methods for correcting negative psycho-emotional states arising from conflicts within the educational process through kinesiology. They introduce a method involving a sequence of kinesiology exercises. The proposed exercises, such as "Wizard's Hat", are designed to alleviate emotional tension and reestablish the connection between the frontal and occipital lobes of the brain. The "Cross-Lateral Steps" exercise facilitates the alternating activation of the right and left hemispheres, thereby improving coordination and spatial awareness. The "Elephant" exercise engages the entire body system and enables the simultaneous regulation of all sensory centres (kinesthetic, visual and auditory). Moreover, the "Mirror Drawing" exercise promotes interaction between the hemispheres and enhances cognitive functioning.

As stated by Budde et al. (2008), participation in sports games can improve attention and concentration among adolescents. They explain that physical exercises facilitate the formation of a neural connection between the cerebellum and the frontal cortex of the brain, which has a significant effect on a child's cognitive development.

Conclusions

Therefore, the article investigates how sports games and physical exercises contribute to developing children's coordination ability, an essential component of their physical development. The problem in question holds great importance as it is crucial for today's youth to combine mental, moral, vocational and physical education to grow into well-rounded individuals.

The article contains a detailed theoretical analysis of studies by international (Alwasif, 2015; Purcell, 2005; Renson, 2000; Šimonek, 2014) and Ukrainian (Chuprun, 2010; 2019; Kolumbet, 2014; Makarenko, 2004; Sydoriak, 2015; Troianovska, 2012) scholars. Additionally, it clarifies the essence of such concepts as "ability", "coordination" and "coordination ability".

The article demonstrates that physical activity is vital for the effective development of coordination ability in children. It synthesizes findings from various studies that emphasize the significance of engaging in sports such as basketball, volleyball, rowing and choreography for improving children's coordination ability. Additionally, it presents a methodology for fostering coordination ability in younger schoolchildren through choreographic activities and includes a section dedicated to kinesiology exercises.

Thus, it is important to engage children in physical activities, considering their age and individual characteristics, as their active movement plays a direct role in fostering cognitive, social and emotional development.

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