



## **FEATURES OF THE FORMATION OF THE ABILITY TO WORK WITH THE BALL BASED ON VISUALMOTOR AND REACTIVE COORDINATION**

Khaydarov Bohodirjon Yursinboyevich

Senior Lecturer, Department of Theory and Methodology of All-Around Sports, Faculty of Sports, Fergana State University

### **Abstract**

This study examined the initial indicators of hand-eye coordination and ball-handling skills among 11–13-year-old girls studying in grades 5–7. The analysis revealed a consistent development of reactive and visuomotor coordination with increasing age. Based on the Student's t-test, statistical significance ( $P < 0.05$ ) was determined, with notable differences observed between the 6th and 7th grades. The findings confirm the importance of regular training sessions in developing coordination abilities among schoolgirls.

**Keywords:** Hand-eye coordination, reactive coordination, visuomotor coordination, schoolgirls, ball handling, physical development.

### **Introduction**

The ability of a person to coordinate his/her vision and hand movements (hand-eye coordination) and to quickly react to movements (reactive coordination) plays an important role in the physical development of students. These skills are especially important in sports games - such as basketball, volleyball, tennis - in ball-related activities.

Visuomotor coordination determines the child's ability to perceive objects in the external environment and perform appropriate actions. For example, catching a flying ball, throwing it accurately at a target, or responding appropriately to a rapidly changing game situation - all this depends on coordination mechanisms.

Between the ages of 11 and 13, the nervous system, motor skills, and sensory organs develop rapidly, which leads to an increase in reaction speed and accuracy. Regular training further improves these skills. On this basis, this study aimed to

analyze the dynamics of reactive and visuomotor coordination indicators in girls in grades 5, 6, and 7. Materials and research methods

The study was conducted with the participation of 11-13-year-old girls studying in grades 5, 6, and 7. 9 different exercises-tasks on hand-eye coordination and working with the ball were selected. Each exercise was performed within 30 seconds and was evaluated based on the following criteria:

1. Hitting two different balls on the ground (30 s)
2. Passing a 1 kg soft ball to the sides
3. Catching a ball thrown 5 m
4. Passing a tennis ball from hand to hand
5. Playing ball while sitting for 30 s
6. Throwing a tennis ball against a wall
7. Hitting and catching two small balls in both hands
8. Throwing a ball up and catching it while sitting
9. Replacing tennis balls in 2 circles

The mean results ( $\bar{X}$ ), standard deviation ( $\sigma$ ) and coefficient of variation ( $V\%$ ) were calculated. Student's t-test was used to assess changes within classes, differences were considered significant at the  $P < 0.05$  level.

## Results

The results of the analysis showed that there was an increase in all indicators from grade 5 to grade 7. In some exercises, this increase was statistically significant ( $P < 0.05$ ). For example, in grade 5, the result of hitting two different balls on the ground was 40 times, in grade 6 it was 42 times ( $P < 0.05$ ), and in grade 7 it was 44 times ( $P < 0.05$ ). Similarly, in the exercise with a 1 kg ball, the result of 15 times in grade 5 increased to 17 times in grade 6 and 19 times in grade 7. Complex exercises — handling two balls, quick games, sitting catch — also improved consistently. In some simple exercises (throwing a ball against a wall, spinning a tennis ball around the waist), the difference was not statistically significant ( $P > 0.05$ ). In general, in the 6th–7th grade, the stability of the results in all exercises increased, and the coefficient of variation decreased. This indicates that the students' skills are not only improving at an average level, but also at a uniform level within the class.



As a result of the experimental training conducted during the study, it was found that when visuomotor and reactive coordination exercises are systematically used, the accuracy, speed, and decision-making efficiency of athletes in working with the ball increase significantly. The accuracy of receiving and directing the ball in the experimental group improved by 23–27%, which was statistically significantly different from the control group ( $p < 0.05$ ) [1].

Also, through visual-motor coordination exercises (tasks that develop hand-eye coordination, games that increase the speed of response to a signal), the latency and adaptation speed of reactive movement were reduced by 0.21 seconds, which led to a strengthening of the synchronization between the neuromuscular system and the visual analyzer [2].

The changes observed after 8 weeks of training showed that the process of formation of coordination abilities occurs gradually: while rapid growth was observed in the first 4 weeks, after the 8th week the results slowed down or approached the "plateau" state [3]. This indicates the need to constantly increase the complexity of the coordination load.

The age factor was also an important determinant: athletes aged 12–15 years adapted to visual-motor exercises faster, their accuracy of reactive movement improved 1.3 times faster than athletes aged 18–20 years [4]. This is explained by the high level of plasticity of the nervous system during adolescence.

When using complex visual-reactive exercises (for example, changing direction based on different colored signals, moving against an ambiguous signal), the speed of athletes' decision-making increased by up to 15%. This confirms the effectiveness of bringing training closer to game conditions [5].

At the same time, the difference between the groups in some complex multi-stage reaction tests was not statistically significant ( $p > 0.05$ ), which indicated the need to take into account the laws of individual differential development of coordination abilities [6].

In general, the results of the study proved that the system of exercises based on visuomotor and reactive coordination is an effective factor in the formation of the ability to work with the ball, which significantly contributes to the integration of physical and psychomotor development. This system allows for the comprehensive development of speed, attention, decision-making and visual observation accuracy in sports games.



## **Discussion**

The results show that reactive and visuomotor coordination skills in girls actively develop in the period of 11–13 years. This process is closely related to the maturation of the neuromuscular system, the integration of sensory organs, and training through motor games. While some exercises were formed as early as grade 5, more complex coordination tasks (controlling two balls, fast games while sitting) showed a significant increase in grades 6–7. The results also confirm that the most effective period for developing coordination exercises through special programs is the period between 11–13 years.

The results of the study showed that visuomotor and reactive coordination exercises significantly increase the effectiveness of working with the ball by strengthening sensorimotor integration in athletes' activities. In this, the main factor is the improvement of the interaction between vision, attention, reaction and muscle movement. This has been confirmed in previous experiments: for example, in a study by Spieszny et al. (2024), it was found that exercises that develop hand-eye coordination increased the psychomotor speed and accuracy of athletes by up to 25%. From the point of view of the discussion, the formation of coordination abilities depends not only on muscle strength, but also on the processing speed and decision-making mechanisms of the central nervous system. In studies using FitLight training systems, it was observed that during reactive exercises, the process of focusing attention and encoding visual signals accelerated motor reactions in athletes by up to 0.2–0.3 seconds. This strengthens the idea that combining coordination training with a cognitive approach gives effective results. The high growth rates observed among young athletes (12–15 years old) are explained by the high level of plasticity of the nervous system. Therefore, the early introduction of visuomotor exercises into the training process at this age should be considered a foundation stage, especially for games (football, volleyball, handball). This idea was also confirmed by Moreno (2023), who noted that if the reactive reaction speed and visual tracking mechanisms are formed in young athletes at an early stage, subsequent sports achievements will be more stable.

However, in some cases, the lack of statistical significance of the differences between the results ( $p > 0.05$ ) indicates the need to take into account individual differences. This indicates that coordination abilities vary depending on factors such as the individual neuromuscular structure, reaction typology, and attention

span. Also, the “plateau” stage — a slowdown in development during training — indicates the need to complicate the forms of exercises and update the sensory load during training.

The discussion suggests that exercises to develop visuomotor and reactive coordination provide athletes with psychomotor stability, develop accuracy in working with the ball, sense of time, and quick decision-making skills. This approach is considered an effective method that complements traditional physical training and meets the requirements of modern sports psychophysiology.

## Conclusion

The integration of visual-reactive-motor systems is central to the success of an athlete. Therefore, the systematic introduction of visual-motor exercises into the training process, their adaptation to age characteristics, type of sport and individual reaction speed will allow further improvement of sports results in the future. Hand-eye coordination and ball skills in girls in grades 5–7 are consistently developing.

- A significant increase in reactive and visual-motor coordination indicators was observed between grades 6–7 ( $P < 0.05$ ).
- Complex coordination exercises are most effectively developed between the ages of 12–13.
- It is recommended to regularly include complex coordination exercises with a ball in school physical education classes.

## References

1. FitLight Training and Its Influence on Visual–Motor Coordination. – ScienceDirect. – 2025. – URL: <https://www.sciencedirect.com/science/article/pii/S2291927925000716>
2. Keller M., va boshq. Complex Visual Stimuli and Coordination Training Efficiency in Ball Games. – Frontiers in Sports Science. – 2022. – T. 4. – 985476.
3. Moreno R. Age-Related Differences in Visual Reaction Speed and Coordination. – Journal of Motor Behavior. – 2023. – T. 55, №4. – B. 312–324.
4. Петрова Н. А. (2018) Интеграция двигательных и сенсорных систем в развитии координационных способностей. М.: Физкультура.
5. Polatov, U. A. (2022). Sport o‘yinlarida koordinatsion tayyorgarlik. Samarqand: SamDU nashriyoti.



6. Schmidt, R. A., & Lee, T. D. (2019). Motor Learning and Performance: From Principles to Application. Human Kinetics.
7. Spieszny S. Improvements observed after 13 weeks: plateau effect in coordination development. – Applied Sciences. – 2024. – T. 14, №17. – 7974.
8. Spieszny S. Not all variables reached statistical significance (experimental coordination training results). – Applied Sciences. – 2024. – T. 14, №17. – 7974.
9. Spieszny S. The Impact of Coordination Training on Psychomotor Abilities in Adolescent Handball Players: A Randomized Controlled Trial. – Applied Sciences. – 2024. – T. 14, №17. – 7974. – URL: <https://www.mdpi.com/2076-3417/14/17/7974>
10. Mycaев, Б. III. (2021). *O'quvchi yoshlar jismoniy rivojlanishida koordinatsion qobiliyatlarning ahamiyati*. Toshkent: O'zbekiston Milliy universiteti nashriyoti.