

Features of the development of coordination abilities in young schoolchildren

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Abstract

Background and Study Aim The development of coordination abilities in young schoolchildren is crucial for their physical and psychological health, as well as academic success. In the contemporary educational environment, there is insufficient attention to the systematic and targeted development of these abilities through the integration of physical activity into the learning process. The purpose of this study is to develop and test a comprehensive program aimed at developing the coordination abilities of young schoolchildren through the use of rhythmic and choreographic means.

Material and Methods The study involved fourth-grade students (n=40), including 20 girls and 20 boys. All participants were divided into two groups: a control group (CG, n=20) and an experimental group (EG, n=20). Both groups attended two choreography lessons and one physical education lesson weekly. The study lasted 10 weeks. The experiment was conducted in the city of Zmiiev (Kharkiv region, Ukraine), located in a war zone since February 2022. The requirements of the military administration for ensuring the safety of the experiment participants were observed.

Results Data analysis revealed significant statistical differences between the control and experimental groups across all applied tests ($p < 0.05$). In the experimental group of girls, there was a significant improvement in the "Rhythmic Movements of Upper and Lower Limbs" test ($p < 0.01$). These results were consistent with improvements in other coordination ability tests in the experimental group ($p < 0.05$). Improvements in strength ability indicators were observed in both groups. However, no statistically significant differences between the CG and EG were recorded.

Conclusions The study confirmed that a specially designed program with elements of dance and choreography significantly positively affects the development of coordination abilities in young schoolchildren. Such a program contributes to the physical development of children, improves their emotional state, stimulates activity, and develops a sense of responsibility.

Keywords: rhythm, choreography, physical fitness, physical culture, students, lesson

Introduction

In the modern world, the issues of physical development and health maintenance of young schoolchildren are becoming increasingly relevant. Specifically, the development of coordination abilities in children of this age group is an important aspect of a child's overall development. It affects their physical condition as well as their psychological well-being and academic performance. In this regard, the search for effective methods and approaches to the development of these qualities is a subject of interest and research for many specialists in the field of physical education and pedagogy.

Numerous studies have laid the foundation for understanding how to systematically and effectively work on improving children's coordination abilities through various activities [1, 2, 3, 4]. Research conducted in different countries and cultures demonstrates the universality and importance

of developing coordination abilities among younger school-aged children. The study by Rosa Guillamon et al. [5] showed that gender, age, and level of physical activity have prognostic value for coordination of movements for schoolchildren aged six to eight years. Poulsen et al. [6] indicate that the impact of motor incoordination on physical activity and health over a lifetime significantly depends on a combination of internal and external factors, including social and cultural environment. This underscores the necessity of creating a supportive environment to stimulate physical activity among children.

Han et al. [7] emphasize the importance of including specific fundamental movement skills and coordination activities in physical education programs. Ruzbarska [8] highlights the connection between the level of physical fitness and motor coordination. The authors indicate that a lower level of motor coordination may be associated with insufficient physical fitness.

These data and other studies [9, 10, 11, 12]

confirm the importance of early intervention and the development of targeted programs aimed at improving coordination abilities and physical activity among younger schoolchildren to maintain their health and well-being in the long term. Furthermore, these and other studies emphasize the importance of an individual approach and the adaptation of physical exercises to the age and gender characteristics of children. Such an approach contributes to a more effective development of their coordination abilities.

The practice of incorporating choreography and rhythmic in the physical education of younger school-aged children underscores their significance in the educational process. The effectiveness of such an approach lies in the fact that music and movement contribute to the physical and emotional development of children. This creates favorable conditions for increasing interest in physical activity and motivates children for regular exercise. Studies by various authors [13, 14, 15, 16] demonstrate the positive impact of dance programs on the development of coordination abilities and the overall physical fitness of girls. Other research [17, 18, 19] emphasize the importance of rhythmic exercises as an effective means of developing coordination in elementary school children. Fernandes [20] notes the importance of focusing on motor coordination through various physical activities (such as capoeira, dance, and acrobatics) to stimulate cognitive abilities and learning.

It's important to note the results of studies that highlight the unique contribution of various forms of dance activity to the development of younger school-aged children. The study by Androshchuk et al. [21] shows that Slavic choreography has significant potential in developing the creative potential of children through the mastery of folk-stage and ballroom dance. These traditional forms of dance contribute to physical development and play a role in the cultural and aesthetic education of younger schoolchildren. The findings of Rudd et al. [18] confirm that dance programs can have a positive impact on children's cognitive functions: inhibitory control and working memory. This evidences the importance of integrating dance exercises into the educational process to stimulate children's mental development alongside physical development. Another study [19] emphasizes that choreography can contribute to a more effective formation of coordination abilities in younger schoolchildren. This research revealed that targeted pedagogical influence of choreography significantly improves children's abilities in differentiating muscle efforts, spatial orientation, and coordination of movements. This is also key to overall physical development.

Thus, these studies support the idea that choreography and rhythmic are not just forms

of physical activity but also a powerful tool for the comprehensive development of a child. This includes the development of their physical, cognitive, and creative components. Furthermore, the application of choreography and rhythmic in physical education opens new perspectives for the development of physical and emotional qualities in younger schoolchildren. The aim of this study is to develop and test a comprehensive program aimed at developing the coordination abilities of younger schoolchildren through the application of rhythmic and choreography tools.

Materials and Methods

Participants

The study involved fourth-grade students from Zmiiev Lyceum (Kharkiv region, Ukraine), including 20 girls and 20 boys. All participants were divided into two groups: a control group (CG, n=20) and an experimental group (EG, n=20). Parents were informed about the specifics of the study and gave their consent for their children's participation in the experiment. This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University.

Special conditions of the experiment

The experiment was conducted in the city of Zmiiev (Kharkiv region, Ukraine), which is located in a war zone since February 2022. The requirements of the military administration for ensuring the safety of experiment participants were observed. Participants were informed about specific actions during the announcement of alarm signals in the city (loud siren sounds and messages on mobile phones) and already had practical skills for such actions.

Study Design

Classes were conducted online using Meet conferencing. Physical quality testing was conducted offline, adhering to safety requirements, the state of martial law in Ukraine, and in the presence of parents. In both groups, two choreography lessons and one physical education lesson were held weekly. The study lasted for 10 weeks: February-May 2023.

For the experimental group during the study period, 30 lessons were conducted, of which 20 were rhythmic and choreography lessons and 10 were physical education lessons. The rhythmic and choreography sessions were conducted with musical accompaniment and followed the standard lesson structure (preparatory, main, and concluding parts) and included: general developmental exercises; running and jumping exercises; flexibility exercises; posture exercises; acrobatics elements; active games using dance movements; exercises for maintaining static poses (dance positions); elements of slow waltz; cha-cha-

cha; a mix of modern dances (boomsing, disco); exercises were performed using a metronome. The sessions also followed the lesson scheme with "Football," "Basketball," "Swimming" modules and included: general developmental exercises; running and jumping exercises; active games; exercises with objects (balls, small balls); elements of dry swimming (imitation exercises).

For the control group, sessions were conducted according to a standard program. Throughout the research period, 10 choreography lessons and 20 physical education lessons were held, including modules on "Football," "Basketball," and "Swimming."

The following tests were used:

1. test 1 "30 m running (s)" [2];
2. test 2 "Pull-ups (number of times)" [2];
3. test 3 "Sit-ups in 30 seconds" [2];
4. test 4 "Incline Push-ups". Step-by-Step Instructions. Conditions. The bench's height should be 30 cm. Aim for the maximum repetitions possible per attempt, focusing on maintaining proper form and breath control:
 - a) Position yourself in front of the bench.
 - b) Set your hands on the bench's edge, a bit wider than the breadth of your shoulders. Ensure your arms are extended with unlocked elbows. Your feet should be positioned to maintain a straight alignment of both arms and torso.
 - c) Gradually lower your chest towards the bench's edge by bending your elbows, inhaling deeply. Your physique should remain rigid and aligned during this action.
 - d) Propel your torso away from the bench by straightening your elbows, ensuring they remain unlocked. As you elevate yourself, exhale.
 - e) Persist with these movements at a slow and consistent pace.
5. test 5 "Shuttle run (4×9 m)" [2];
6. test 6 Ten "eights" (Kopylov test), sec [22, 23];
7. test 7 "Ruler Drop Test", cm [24, 25];
8. test 8 "rhythmic movements of upper and lower limbs (20 seconds)" [2].

Statistical Analysis

For the analysis and visualization of the obtained data it was used PyCharm Community Edition integrated development environment. The code was written in Python, with a primary focus on using the Matplotlib library for creating charts and diagrams. For processing statistical data, including the calculation of mean values, standard deviations, and determining the statistical significance of the results, Excel was used. Differences were considered significant at a significance level of $p < 0.05$. The Student's t-test was used for comparing data between groups.

Results

The study aimed to assess the dynamics of changes in the level of coordination abilities of fourth-grade students under the influence of educational programs. For this purpose, students from the control group (CG) and the experimental group (EG) were selected. The testing results, conducted in February and May 2023, are presented in Figure 1.

Analysis of the results (Fig. 1) shows significant improvement in the development of coordination abilities among students in the experimental group by the end of the experiment. Significant improvements were recorded in tests related to accuracy, reaction speed, and flexibility. This highlights the effectiveness of the training programs used in the EG. At the same time, some improvement was also observed in the control group. However, it was less pronounced and did not reach statistical significance in a number of tests. This underscores the advantage of the methods used in the experimental group.

The impact of training programs on the development of coordination abilities in girls is presented in Figure 2.

The data (fig. 2) show that at the end of the experiment, changes were observed in the coordination ability indicators of girls in both groups. It is important to note that in tests 5 and 6, the results showed a statistically significant decrease in indicators in the control group, while in the experimental group, progress was observed, especially noticeable in test 8. This may indicate a more effective impact of the training programs used in the EG on the development of coordination abilities in girls compared to traditional teaching methods in the CG.

Discussion

The aim of this study was to analyze the impact of specialized rhythmic and choreography programs on the development of coordination abilities in younger schoolchildren. The obtained results demonstrate significant improvement in the group where these programs were implemented, especially in tests related to accuracy, speed reaction, and flexibility. These findings suggest that rhythmic and choreography classes can have a positive effect on students' coordination abilities.

It's important to emphasize that despite some improvements in the control group the outcomes in the experimental group were significantly better. This indicates that specialized training programs incorporating elements of choreography and rhythmic are more effective in stimulating the development of coordination skills than traditional physical education methodologies. Particularly noteworthy are the results among girls in the

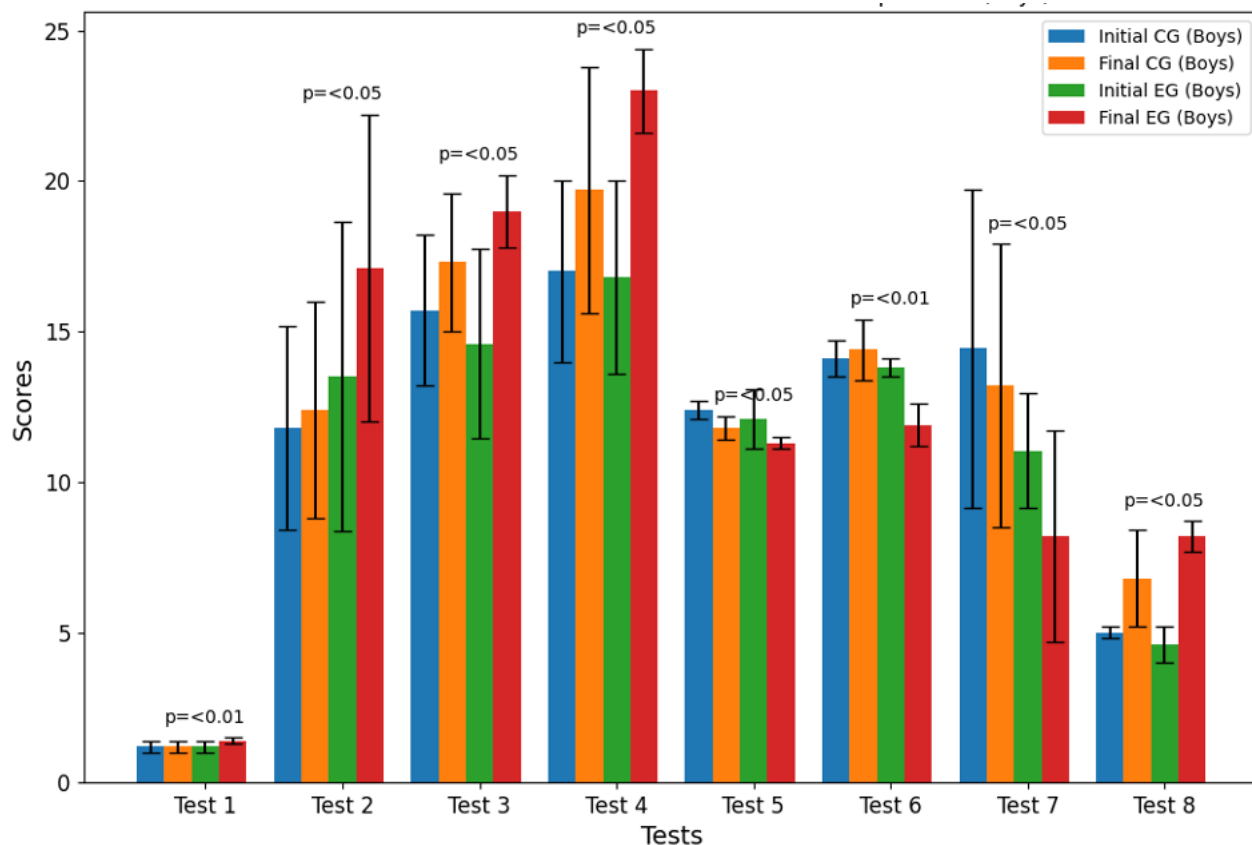


Figure 1. Indicators of the level of coordination abilities of fourth-grade students at the beginning and end of the experiment (Boys)

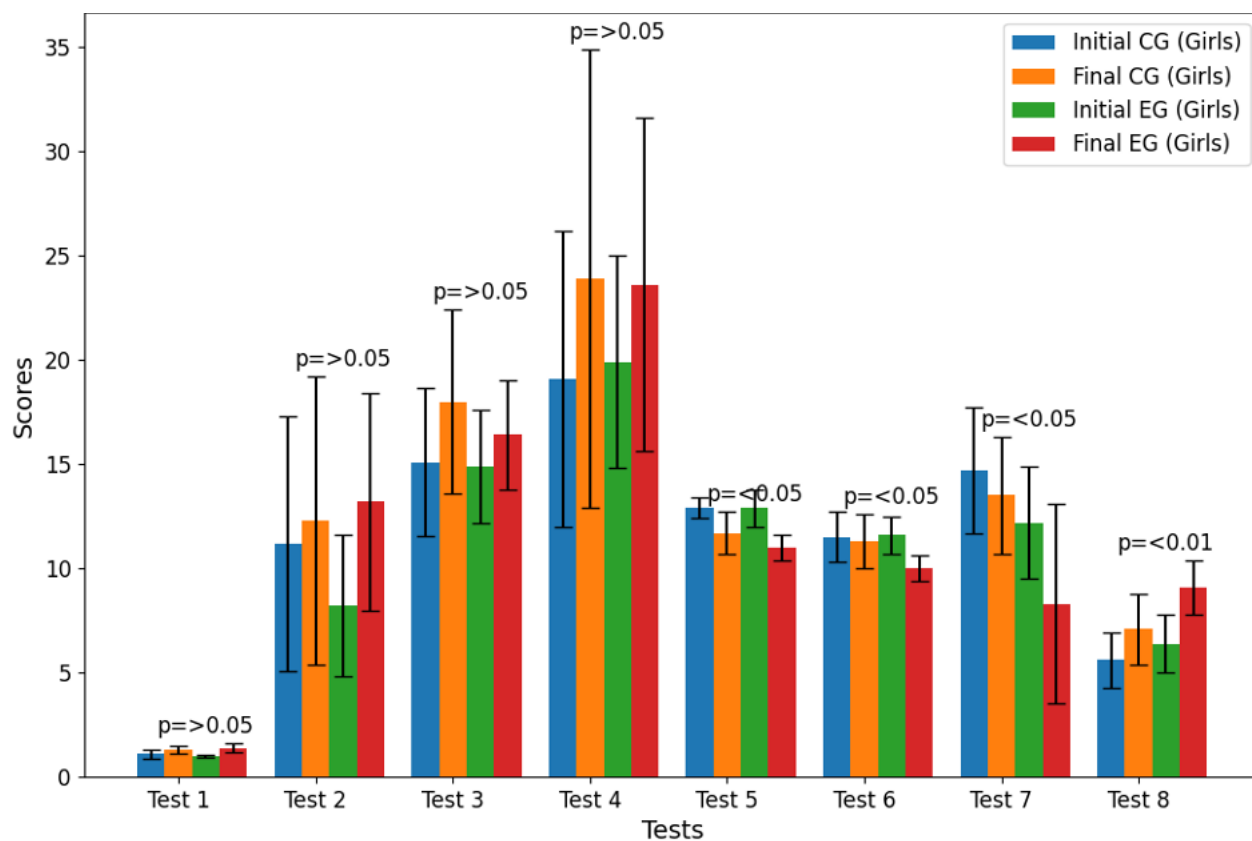


Figure 2. Indicators of coordination ability levels of fourth-grade students at the beginning and end of the experiment (Girls)

experimental group, where significant progress was recorded. A decrease in indicators was observed in the control group in some tests. This may suggest that girls are especially responsive to such activities and derive more benefits for developing their coordination abilities from them.

Comparison with previous studies shows that our results are consistent with the findings of other authors who emphasize the importance of physical activity and specifically dance programs for improving coordination abilities in children. Our study's results find confirmation in the conclusions of other researchers, who also highlight the significance of using choreography and rhythmic in the educational process for younger schoolchildren. Many studies [13, 14, 17, 18, 19, 20, 21] demonstrate the positive impact of dance programs on the development of coordination abilities and overall physical fitness. Specifically, the research by Fernandes et al. [20] and Golenkova et al. [13] underscore the importance of focusing on motor coordination through various physical activities to stimulate cognitive abilities and academic achievements.

This emphasizes the broader consensus in the academic community regarding the beneficial effects of dance and rhythmic activities on children's physical and cognitive development, reinforcing the value of integrating such programs into school curriculums.

These results confirm our assumptions that musical and movement activities can have a comprehensive positive impact on children's development, stimulating physical, emotional, and cognitive aspects. Additionally, data from other studies [14, 17, 26] emphasize that such an approach contributes to creating a favorable atmosphere for increasing interest and motivation towards regular physical exercises among younger schoolchildren.

This highlights the multidimensional benefits of integrating music and movement into the educational process, reinforcing the notion that such activities not only improve physical fitness but also enhance emotional well-being and cognitive function.

The results of other studies [18, 19, 21] also point to the positive impact of choreography on the development of motor skills and cognitive functions in younger schoolchildren. However, our work contributes to this field by providing additional evidence of the effectiveness of specifically designed programs focused on rhythmic and choreography.

It also expands understanding of their impact on various aspects of coordination abilities.

This emphasis on specialized programs tailored to rhythmic and choreography highlights the importance of targeted interventions in physical education. By meticulously designing these programs to enhance coordination abilities, the research underlines the potential for significant improvements not only in physical fitness but also in cognitive and emotional development among younger schoolchildren. This approach reinforces the concept that well-structured physical activity programs can serve as a multifaceted tool for holistic child development.

In conclusion, our study underscores the importance of integrating specialized rhythmic and choreography programs into the educational process for younger schoolchildren. The data presented can serve as a foundation for further research in this field and the development of new methodological approaches to children's physical education, aimed at the comprehensive development of their physical and cognitive abilities.

This call to action highlights the potential for these programs to enrich the educational landscape, suggesting that a more holistic approach to physical education could foster not only physical but also cognitive development. It's a step toward recognizing the broader benefits of physical activity, beyond just physical fitness, to include emotional well-being and cognitive enhancement, thereby contributing to the overall development of children.

Conclusions

The study demonstrated that integrating choreography and rhythmic classes into the physical education program for younger schoolchildren significantly enhances their coordination abilities. The use of these methods positively affects the physical and emotional development of children, increasing their motivation to participate in physical activities. Particularly high effectiveness is observed among girls, underscoring the need to consider gender differences in educational programs. The results affirm the importance of developing and implementing specialized training programs aimed at the comprehensive development of students. Our findings open new possibilities for improving the quality of the educational process in the field of physical education.

References

- Linec' MM. *Basics of the method of development of coordination qualities*. [Internet]. Lviv: 2015 [updated 2023 Jun; cited 2023 Sep 28]. Available from: <https://repository.ldufk.edu.ua>
- Ivashchenko O, Prykhodko V, Cieslicka M. Movement Coordination: Factor Structure of Development in 5th-7th Grade Girls. *Physical Education Theory and Methodology*, 2018;18(1): 38–49. <https://doi.org/10.17309/tmfv.2018.1.05>
- Wu SK, Wong JE, Poh BK. Children's attraction to physical activity and its relation to physical activity level. *Malays J Med Sci*. 2023;30(6):108–119. <https://doi.org/10.21315/mjms2023.30.6.11>
- Striniqi A. Muscles and physical activity; the importance of physical activity in the burning process of food calories; the culture of physical activity among students of middle school. *International Journal of Clinical Medical Research*, 2024;2(1): 37–48. <https://doi.org/10.61466/ijcmr2010005>
- Rosa Guillamon A, Garcia Canto E, Martinez Garcia H. Analysis of global motor coordination in schoolchildren according to gender, age and level of physical activity. *Retos-Nuevas Tendencias en Educacion Fisica Deporte y Recreacion*, 2020;(38): 95–101.
- Poulsen AA, Ziviani JM. Can I Play Too? Physical Activity Engagement of Children with Developmental Coordination Disorders. *Canadian Journal of Occupational Therapy*, 2004;71(2): 100–107. <https://doi.org/10.1177/000841740407100205>
- Han A, Fu A, Cobley S, Sanders RH. Effectiveness of exercise intervention on improving fundamental movement skills and motor coordination in overweight/obese children and adolescents: A systematic review. *Journal of Science and Medicine in Sport*, 2018;21(1): 89–102. <https://doi.org/10.1016/j.jsams.2017.07.001>
- Ruzbarska I. Physical fitness of primary school children in the reflection of different levels of gross motor coordination. *Acta Gymnica*, 2016;46(4): 184–192. <https://doi.org/10.5507/ag.2016.018>
- Kruglov V, Khudolii O. Discriminant Analysis: Age-Specific Features of Motor Fitness of Girls Aged 7 to 9. *Physical Education Theory and Methodology*, 2022;22(3s), S142–S147. <https://doi.org/10.17309/tmfv.2022.3s.20>
- Bozkurt S. Assessment of manual dexterity using the grooved pegboard test in secondary school students aged 11–12 years. *Pedagogy of Physical Culture and Sports*. 2023;27(5):396–401. <https://doi.org/10.15561/26649837.2023.0506>
- Krivyca I, Nesen O, Strelnykova Y, Wnorowski K. Development of volleyball skills in physical education lessons using visual imagery in 10-11-year-old schoolchildren. *Physical Culture, Recreation and Rehabilitation*. 2023;2(1):24–9. <https://doi.org/10.15561/physcult.2023.0104>
- Kryventsova I, Potop V, Prusik K, Samoilov D. Development of coordination abilities of fencers aged 10-12 years living in the territory of martial law. *Pedagogy of Health*. 2022;1(2):34–8. <https://doi.org/10.15561/health.2022.0201>
- Golenkova IuV, Galkina AV. Development of Coordination Abilities in Girls of Senior School Age through Artistic Gymnastics. *Physical Education Theory and Methodology*. 2015;4:39–44. <https://doi.org/10.17309/tmfv.2015.4.1155>
- Kravchuk TM, Golivec' KM. Peculiarities of Use of Dancing Exercises in Physical Education of Female High Schoolers. *Physical Education Theory and Methodology*, 2015;4: 11–16. <https://doi.org/10.17309/tmfv.2015.4.1151>
- Pennington CG, Nelson LP. Physical Activity Contributions of Dancing Classrooms Program on Middle School Students. *The Physical Educator*, 2020;77(2): 230–256. <https://doi.org/10.18666/TPE-2020-V77-I2-9794>
- Sucharitakul S, Phuengngern C, Ketaiam K, Hongyeesibed S. Educational tool kits for basic traditional Thai dancing for learners with visual impairment. *Cogent Arts & Humanities*, 2023;10(2): 2283948. <https://doi.org/10.1080/23311983.2023.2283948>
- Cuvorova TI, Chekhaniuk LO, Karabanova NS. Formation of coordination abilities of younger schoolchildren by means of rhythmic gymnastics. *Molodizhnij naukovijs visnik*, 2011;1:16–19.
- Rudd J, Buszard T, Spittle S, O'Callaghan L, Oppici L. Comparing the efficacy (RCT) of learning a dance choreography and practicing creative dance on improving executive functions and motor competence in 6-7 years old children. *Psychology of Sport and Exercise*, 2021;53: 101846. <https://doi.org/10.1016/j.psychsport.2020.101846>
- Chuprun N, Kravchenko T, Zakopailo S, Bilous O, Polishchuk V, Tsaruk V, et al. The Effectiveness of Choreography in the Formation of the Coordination Skills in First Graders. *International Journal of Applied Exercise Physiology*, 2020;9(1): 52–57.
- Fernandes VR, Ribeiro MLS, Melo T, De Tarso Maciel-Pinheiro P, Guimarães TT, Araújo NB, et al. Motor Coordination Correlates with Academic Achievement and Cognitive Function in Children. *Frontiers in Psychology*, 2016;7. <https://doi.org/10.3389/fpsyg.2016.00318>
- Androshchuk L, Blahova T, Zhyrov O, Martynenko O, Tereshko I. The Development of the Artistic Potential of Pupils of Primary Classes by means of Slavic Choreography. *Czech-Polish Historical and Pedagogical Journal*, 2022;14(1–2): 44–54. <https://doi.org/10.5817/cphpj-2022-003>
- Kyzmenko I, Ostrowski A, Zhuk V. Influence of fitball aerobics on the development of individual coordinating abilities of girls 14–15 years old. *Slobozhanskyi Herald of Science and Sport*, 2022;2(26): 35–40. <https://doi.org/10.15391/sns.2022-2.001>
- Shuba L, Chukhlantseva N, Shuba V. Complex development of physical characteristics of 11–12-year-old boys using basketball elements for physical education. *Journal of Physical Education and Sport*, 2018(2): 739 – 744. [10.7752/jpes.2018.02108](https://doi.org/10.7752/jpes.2018.02108)
- Ferreira S, Raimundo A, Del Pozo-Cruz J, Leite N,

- Pinto A, Marmeleira J. Validity and reliability of a ruler drop test to measure dual-task reaction time, choice reaction time and discrimination reaction time. *Aging Clinical and Experimental Research*, 2024;36(1): 61. <https://doi.org/10.1007/s40520-024-02726-6>
25. Rajapaksha S, Kitulwatte I, Senarathne U, Edirisinghe A, Perera P. The establishment of a population-specific reference value for the ruler drop test for the clinical assessment of reaction time. *Journal of Forensic and Legal Medicine*, 2023;96: 102525. <https://doi.org/10.1016/j.jflm.2023.102525>
26. Ivashchenko O, Skochko Y, Skrobecki J, Wnorowski K. Pattern Recognition: Features of Motor Fitness of 9-Year-Old Schoolchildren. *Journal of Learning Theory and Methodology*, 2022;3(2), 59–64. <https://doi.org/10.17309/jltm.2022.2.02>
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