STUDIA UBB EDUCATIO ARTIS GYMN., LXXI, 2, 2026, pp. 31-46
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.71(2).13

Improving Coordinative Capacity in Fourth-Grade Physical Education Lessons Through the Application of Movement Games

Mihaela BUTNARIU[1]*, Sorina Elena PETRESCU[2], Monica-Ionela STANCU[3]

Article history: Received 2026 March 18; Revised 2026 May 14; Accepted 2026 May 16; Available online 2026 June 30; Available print 2026 July 30

ABSTRACT. *Introduction:* The present article aims to highlight the effectiveness of using movement games as the primary means for improving coordinative capacity in fourth-grade students during physical education lessons. In the context of school physical education, the development of coordinative capacities at early school age represents a priority, and movement games - through their playful, varied, and motivating character - prove to be an extremely valuable didactic tool for achieving this objective. *Purpose:* The purpose of the present research is to improve coordinative capacity in fourth-grade physical education lessons through the application of movement games. *Methods:* The following research methods were used in conducting the experiment: study of specialized literature, pedagogical observation method, experimental method, testing method and control probes, statistical-mathematical method, and graphical and tabular method. The research was conducted at Gymnasium School No. 51 in Bucharest, Sector 2, on a sample of 50 students (20 girls and 30 boys) belonging to the primary cycle in classes IV A (control group) and IV B (experimental group), with ages between 10 and 11 years. *Results:* The results obtained in the final evaluation revealed significantly superior performances of the experimental group compared to the control group across all four tests used to measure

[1] Department of Physical Education and Sport, Faculty of Science, Physical Education and Informatics, National University of Science and Technology Politehnica Bucharest, Pitesti University Center, Pitesti, Romania
[2] Secondary School No. 51, Sector 2, Bucharest, Romania
[3] "Maica Domnului" Secondary School, Sector 2, Bucharest, Romania
* Corresponding author: mihaela.butnariu@upb.ro

coordinative capacity, thus demonstrating the superior efficiency of applying movement games in physical education lessons compared to the exclusive use of classical exercises. *Conclusions:* Through play, a complex and integrated development of students' physical, cognitive, social, and emotional skills was achieved; play proved to be an effective method for developing coordinative capacities; activities that included movement games were attractive and highly appreciated by the children, due to the positive emotions generated by competition.

Keywords: *coordinative capacities, students, movement games, physical education lesson*

INTRODUCTION

The role of physical education in primary education is to ensure the harmonious development of the body, to improve health status, to increase morpho-functional indices, to equip students with as diverse as possible knowledge, skills, and motor abilities, and to shape their character and moral profile, expressed through qualities such as willpower, courage, self-control, punctuality, and respect for opponents. Physical education and school sports represent activities of major importance, considering the tasks and objectives they fulfill within the instructional-educational process.

Viewing the multilateral development of children and young people, society in line with its needs determines an educational ideal from which the educational goals and objectives are born. The integrated part of the educational system along with the structure and its contents of the physical education, is part of a broad framework called to meet the requirements and determinations by the complexity of the formative act, having the student's center (Savu & Pehoiu, 2018). Motor quality skill (coordinative ability) is important in physical education in secondary school because it develops fundamental motor skills, improves coordination of movements, develops confidence in one's own abilities, supports the learning of complex sports, strengthens cognitive skills, promotes an active and healthy lifestyle, forms a positive social environment within physical activities, especially those in teams, which involve coordination and collaboration, encourages teamwork, mutual respect and communication, fundamental aspects in the development of interpersonal relationships and social skills of students (Chirazi et al., 2025). Motor skills are vital and essential parts of everyday lives not only in children. But especially at this age teachers should focus on improvement in this area (Rechtik et al., 2019). Motor

coordination (MC) is an essential skill underpinning precise and controlled movements, contributing significantly to daily functioning and overall performance. The developmental trajectory of MC in children is intricately shaped by a spectrum of factors encompassing age, gender, and physical activity engagement. Delving into the complex interrelation of these variables holds the potential to unravel nuanced developmental trends and offer targeted avenues for interventions aimed at augmenting motor proficiency in the pediatric population (Canli et al., 2023). Motor skill competence is important for children's physical and social development. Regular physical education classes may not fully support the improvement of specific motor abilities. Although different training approaches are used in schools, their effectiveness in enhancing fundamental motor skills remains of practical interest (Gökşin et al., 2025).

The periods before puberty are nevertheless to be used particularly intensively for appropriate stimuli (especially with regard to coordination and speed). It is sensible to influence the maturing functions and has been proved that coordination can be trained particularly well at this age (Hirtz & Starosta, 2002). Spatio-temporal orientation, together with movement combination and coupling, and with kinesthetic, balance, motor reaction, movement transformation and rhythm differentiation form the coordinative abilities (Pehoiu, 2010). Early acquisition of spatial-temporal orientation and balancing skills is necessary for optimal motor performance, as these abilities are highly valued in sports and technical activities (Tanasă & Abalaşei, 2024).

Movement games represent an important means through which numerous general and specific competencies are developed among students in primary education. The use of movement games in physical education lessons has been investigated by numerous authors over time (Dobrescu, 2019; Stun et al., 2024; Mardiansyah et al., 2024; Topalska & Rumenov, 2025; Marwan & Rohayati, 2025; Akay et al., 2025). A global decline in levels of movement competence and physical activity in children presents the urgent need to look at how to reverse this trend. The Movement Oriented Games Based Assessment (MOGBA) is an intervention designed to improve children's complex movement skills, based on principles of motor development and assessment theories (Rossum et al., 2025).

It is necessary for active methods to be used during physical education lessons, allowing the pupils the opportunity to actively participate in the training process. Of the diversity of means that are at the teacher's disposal, the movement game is one of the most attractive solutions for stimulating the pupils to exercise. Being subordinated to the instructional objectives, through its contents and rules, the movement game is also a means and a method that needs to be promoted in the structure of the physical education lesson (Dobrescu,

2016). Alecu et. al (2025) proposes that movement games be integrated into the curriculum to foster the cognitive and socioemotional development of children by leveraging the exceptional benefits these games offer. The formative and educational potential of movement games can support the development of children's emotional intelligence, leading to better adaptation to the demands of the school and social environment. Thus, students not only develop physically but also enhance their psychological well-being, self-confidence, and self-esteem. Like other activities specific to this discipline, their practice positively influences the quality of education. We recommend that movement games serve as elements through which specific competencies can be developed in primary school students. Their structure aligns with the learning objectives designed for this age group.

PURPOSE OF THE RESEARCH

The purpose of the present research is to improve coordinative capacity in fourth-grade physical education lessons through the application of movement games.

HYPOTHESES

If we clearly define the specific concepts related to the improvement of coordinative capacities among primary school students, we will be able to identify the most effective means of intervention, such as movement games. These games not only stimulate the development of coordination, balance, and body control, but also maintain a high level of involvement and motivation among children. Through an appropriate approach to these concepts and the use of concrete and attractive methods, physical education can become an essential instrument in the harmonious development of students.

We assume that the use of the proposed movement games within physical education lessons will lead to a significant improvement in coordinative capacities among fourth-grade students. By implementing these movement games, students will develop essential motor skills in an enjoyable and efficient manner. These activities will not only improve students' physical performance but will also increase their interest and engagement in physical education lessons, thus contributing to harmonious physical development and the formation of healthy lifestyle habits.

MATERIALS AND METHODS

Study Design

During the experiment, which involved both practical and methodological aspects, the following research methods were used: the study of specialized literature, the pedagogical observation method, the experimental method, the method of tests and control trials, the statistical–mathematical method, as well as graphical and tabular methods.

Ethical Approval and Consent

The hereby study was conducted in accordance with the fundamental ethical principles set out in the Declaration of Helsinki and national regulations on the protection of minors involved in research. The research protocol was approved by the management of Secondary School No. 51, Sector 2, Bucharest, under No. 488 dated February 24, 2025.

Participants

The research was conducted at Secondary School No. 51 in Bucharest, Sector 2, on a sample of 50 students (20 girls and 30 boys) from the primary education cycle, belonging to classes IV A (control group) and IV B (experimental group), aged between 10 and 11 years.

Procedure

The main research method used was the pedagogical experiment. For its implementation, the research was carried out in several stages between February and May 2025. Before the beginning of the experiment, the initial assessment was conducted in February, while the final assessment took place in May. In the two stages of the experiment, four specific tests were used to determine the level of coordinative capacities: the "Throwing the ball at a target while standing with the back to it" test, the balance test, the "Square test", and the "Matorin test." The tests were applied uniformly to all students in both the experimental group and the control group.

"*Throwing the ball at a target while standing with one's back to it*"

Test: The materials required for this test are: a measuring tape, six tennis balls, a gymnastics hoop, a medicine ball (1 kg), and a mat. The student stands at the throwing line with their back to the target. The task consists of throwing the ball over the head (over the shoulder) and hitting the target placed

at a distance of 2 meters. After the explanation and demonstration, one trial attempt and five recorded attempts are performed. The results are evaluated as follows: ball landing on the mat - 1 point; hitting the bar of the gymnastics hoop - 2 points; between the hoop and the medicine ball - 3 points; hitting the medicine ball - 4 points. The points obtained are summed and the final score is recorded.

Balance Test

The materials required for this test are a stopwatch and a gymnastics bench. The student stands on an inverted gymnastics bench on one leg (with hands on the hips) and attempts to maintain balance on the apparatus for as long as possible. The time is recorded until the subject touches the ground with the free foot, removes the hands from the hips, or falls off the apparatus. The test result is expressed in seconds and is performed on both the right and the left leg.The results are evaluated as follows: Excellent: >50 s - 50 points; Very good: 40-49.99 s - 40 points; Good: 30-39.99 s - 30 points; Satisfactory: 20-29.99 s - 20 points; Insufficient: <20 s - 10 points.

"*Square Test*"

The materials required for this test are a measuring tape, a stopwatch, and chalk. A square with a side length of 90 cm is drawn on the ground and divided into smaller squares of 30 cm (nine small squares). Two additional squares of the same size are then drawn on opposite sides. The student is required to start from square "0" and, following the numbering, perform jumps with both feet as quickly as possible into the respective squares without skipping a square or stepping on the dividing lines, until reaching square "S". The time required to complete the course is recorded and the number of errors is noted, each error being penalized with one second. The results are evaluated as follows: 5.00-5.99 s - 50 points; 6.00-6.99 s - 40 points; 7.00-7.99 s - 30 points; 8.00-8.99 s - 20 points; 9.00-9.99 s - 10 points.

"*Matorin Test*"

The materials required for this test are chalk and a ruler. From a standing position, a jump with rotation around the longitudinal axis of the body is performed - both to the left and to the right. During the jump, the student must maintain balance, land with the feet together as in the initial position, and achieve the greatest possible rotation angle. The test is carried out on a flat surface where the teacher draws a graduated circle with chalk and measures the angle of rotation for each jump using a ruler. The results are evaluated as follows: Excellent: ≥360° - 50 points; Good: 270°-360° - 40 points; Average: 180°-270° - 30 points; Weak: <180° - 20 points.

During Module 4 of the school year, between March 3 and April 6, 2025, in order to improve coordinative capacity within physical education and sport lessons, classical exercises were used for the control group, while the experimental group performed the movement games proposed by the authors. According to the annual planning of the learning units, Module 4 included 10 lessons dedicated to the improvement of coordinative capacity, of which 8 lessons were allocated to the actual instructional activities and 2 lessons to the final assessment.

The movement games used for the experimental group and the objectives pursued are presented in Table 1.

Table 1. Movement Games Used in the Experimental Group

Lesson	Movement Game	Objectives Pursued
1	Who is more skillful?	Development of body segments
	Touch the boots with the stick	Development of precision and ambidexterity
2	Mischievous cards	Development of balance, spatio-temporal orientation, and segment coordination
	The clock	Development of precision, ambidexterity, and body segment coordination
3	The Bell Game	Development of spatio-temporal orientation
	Ball Duel	Development of balance and precision
4	Intervention team	Development of spatio-temporal orientation
	Jumps over the rope	Development of general coordination
5	The Windows	Development of spatio-temporal orientation
	Hardworking little birds	Development of spatio-temporal orientation
6	Millipede	Development of general coordination
	The Skillful Shooter	Development of ambidexterity and eye-hand coordination
7	Try it	Development of balance
	X and 0	Development of general coordination
8	Exatlon	Development of balance and general coordination

Data Analysis

In order to analyze and interpret the data obtained from the experiment, we used SPSS software, a statistical software platform that offers an easy-to-use interface and a robust range of functions that allowed us to quickly obtain valuable information from the available data. For the coefficient of variability, the following ranges were used for interpretation: less than 10% - very high homogeneity; between 10% and 15% - high homogeneity; 15%-20% - medium

homogeneity; over 20% - low homogeneity. The "p"-value in the significance test was calculated by the statistical software. If the value is less than 0.05, the difference is statistically significant. If the value is 0.05 or above, there is no significant difference.

RESULTS

In the test "Throwing the ball at a target while standing with one's back to it", the following was observed:

- At the initial testing, the mean value obtained by the experimental group - 5.6 - is approximately equal to that of the control group - 5.28. This is demonstrated by the calculated t-value (0.181) and the p-value (0.36), which is greater than 0.05, as determined by applying Student's t-test.
- At the final testing, the mean value obtained by the experimental group - 16.32 - is statistically significantly higher than that of the control group - 10.84. This is demonstrated by the calculated t-value (4.906) and the p-value (0.000), which is less than 0.05, as determined by applying Student's t-test (Table 2 and Figure 1).

Table 2. Test "Throwing the Ball at a Target While Standing with One's Back to It" - Experimental Group and Control Group - Statistical-Mathematical Indicators -

Statistical-Mathematical Indicators		**Control Group (C.G.)**		**Experimental Group (E.G.)**	
Type of testing		Initial Testing	Final Testing	Initial Testing	Final Testing
Average		5.28	10.84	5.6	16.32
Standard deviation		1.42	1.79	1.55	1.73
Coefficient of variability		27.06 %	16.56 %	27.82 %	10.63 %
Minimum value		3	8	3	12
Maximum value		8	14	8	20
Student's t-test	t calculated	8.504		7.591	
	p	0.000		0.000	
Student's t-test Initial Testing E.G+C.G	t calculated	0.181			
	p	0.36			
Student's t-test Final Testing E.G+C.G	t calculated	4.906			
	p	0.000			

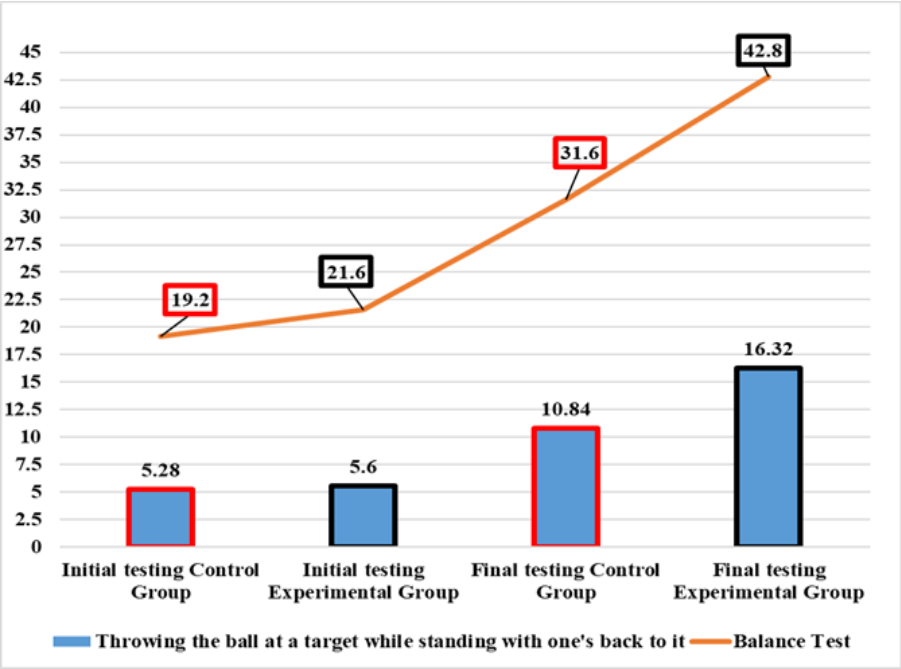

Fig. 1. Test "Throwing the ball at a target while standing with one's back to it" and Balance Test - Control group and Experimental group - Differences between initial evaluations and final evaluations (participants' performance was quantified in points)

In the balance test, the following was observed:

- At the initial testing, the mean value obtained by the experimental group - 21.6 - is approximately equal to that of the control group - 19.2. This is demonstrated by the calculated t-value (0.12) and the p-value (0.24), which is greater than 0.05, as determined by applying Student's t-test.
- At the final testing, the mean value obtained by the experimental group - 42.8 - is statistically significantly higher than that of the control group - 31.6. This is demonstrated by the calculated t-value (9.37) and the p-value (0.000), which is less than 0.05, as determined by applying Student's t-test (Figure 1 and Table 3).

Table 3. Balance Test - Control Group and Experimental Group-Statistical-Mathematical Indicators

Statistical-Mathematical Indicators		**Control Group (C.G.)**		**Experimental Group (E.G.)**	
Type of testing		Initial Testing	Final Testing	Initial Testing	Final Testing
Average		19.2	31.6	21.6	42.8
Standard deviation		7.59	8.50	6.87	6.13
Coefficient of variability		39.55%	26.91%	31.85%	14.33%
Minimum value		10	20	10	30
Maximum value		30	50	30	50
Student's t-test	t calculated	9.37		1.242	
	p	0.000		0.000	
Student's t-test Initial Testing E.G+C.G	t calculated	0.12			
	p	0.24			
Student's t-test Final Testing E.G+C.G	t calculated	9.37			
	p	0.000			

In the "In the Square" test, the following was observed:

- At the initial testing, the mean value obtained by the experimental group - 20.8 - is approximately equal to that of the control group - 18. This is demonstrated by the calculated t-value (0.06) and the p-value (0.12), which is greater than 0.05, as determined by applying Student's t-test.
- At the final testing, the mean value obtained by the experimental group - 41.2 - is statistically significantly higher than that of the control group - 26.8. This is demonstrated by the calculated t-value (9.37) and the p-value (0.000), which is less than 0.05, as determined by applying Student's t-test (Table 4 and Figure 2).

Table 4. Test In the Square - Control Group and Experimental Group - Statistical-Mathematical Indicators

Statistical-Mathematical Indicators	**Control Group (C.G.)**		**Experimental Group (E.G.)**	
Type of testing	Initial Testing	Final Testing	Initial Testing	Final Testing
Average	18	26.8	20.8	41.2
Standard deviation	7.07	8.02	6.87	6.13
Coefficient of variability	39.28%	29.92%	31.85%	14.33%
Minimum value	10	10	10	30
Maximum value	30	40	30	50

Statistical-Mathematical Indicators		Control Group (C.G.)	Experimental Group (E.G.)
Student's t-test	t calculated	7.620	3.066
	p	0.000	0.000
Student's t-test Initial Testing E.G+C.G	t calculated	0.06	
	p	0.12	
Student's t-test Final Testing E.G+C.G	t calculated	8.59	
	p	0.000	

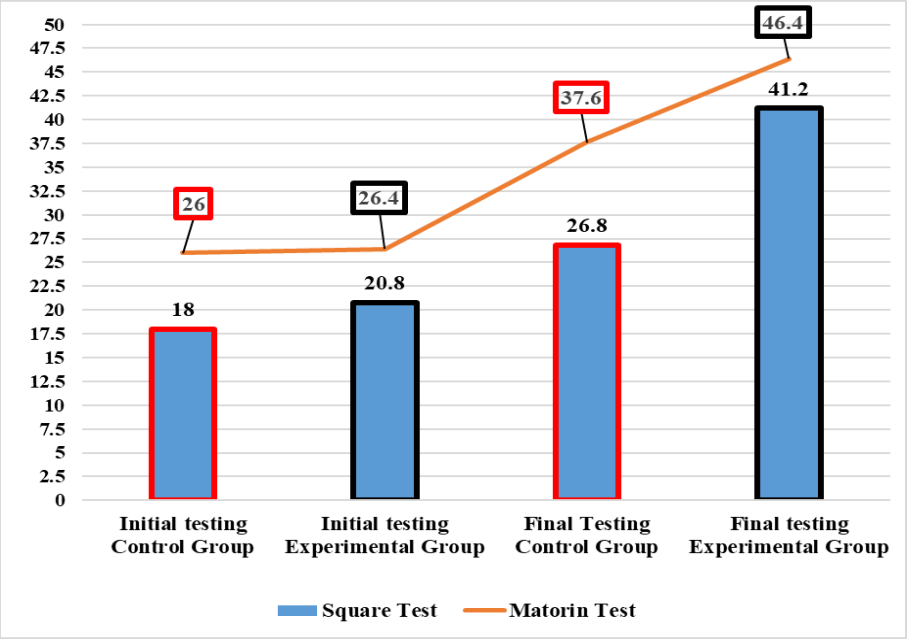

Fig. 2. Test "In the Square" and Matorin Test - Control group and Experimental group - Differences between initial evaluations and final evaluations (participants' performance was quantified in points)

In the "Matorin" test, the following was observed:

- At the initial testing, the mean value obtained by the experimental group - 26.4 - is approximately equal to that of the control group - 26. This is demonstrated by the calculated t-value (0.35) and the p-value (0.713), which is greater than 0.05, as determined by applying Student's t-test.

- At the final testing, the mean value obtained by the experimental group - 46.4 - is statistically significantly higher than that of the control group - 37.6. This is demonstrated by the calculated t-value (3.89) and the p-value (0.000), which is less than 0.05, as determined by applying Student's t-test (Figure 2 and Table 5).

Table 5. Test "Matorin" - Control group and Experimental group - Statistical-Mathematical Indicators

Statistical-Mathematical Indicators		**Control Group (C.G.)**		**Experimental Group (E.G.)**	
Type of testing		Initial Testing	Final Testing	Initial Testing	Final Testing
Average		26	37.6	26.4	46.4
Standard deviation		5	6.63	4.89	4.89
Coefficient of variability		19.23%	17.64%	18.55%	10.55%
Minimum value		20	30	20	40
Maximum value		30	50	30	50
Student's t-test	t calculated	3.917		2.682	
	p	0.000		0.000	
Student's t-test Initial Testing E.G+C.G	t calculated	0.35			
	p	0.713			
Student's t-test Final Testing E.G+C.G	t calculated	3.89			
	p	0.000			

DISCUSSIONS

The systematic integration of playful activities into physical education lessons in the primary cycle emerges as a pedagogical necessity, as also supported by Moisescu & Gürbüz (2017), who position play as the main mediator for refining coordination during the fundamental phase of motor development.

The obtained results confirm the research hypotheses and are consistent with data from the specialized literature, which emphasize the predominant role of playful activities in developing coordinative capacities at early school age (Pesce et al., 2016; Sutapa et al., 2021). The superiority of the experimental group across all four evaluation tests can be explained by the multifactorial and motivating nature of movement games, which simultaneously stimulate multiple components of coordination, in contrast to classical repetitive and less varied exercises. These movement games fostered greater emotional involvement, reduced monotony, and increased adherence to the activity - an essential aspect in the context of fourth-grade physical education lessons.

The systematic implementation of movement games can represent an efficient and accessible didactic strategy for physical education teachers, contributing to improving the quality of lessons and to the formation of higher-quality motor skills. However, the limitations of the study (relatively short duration of the intervention, small sample limited to a single school) suggest the need for future research on larger samples and over extended periods, possibly including additional variables.

CONCLUSIONS

The use of movement games brings countless benefits for children, both from the perspective of physical health (strengthening the cardiovascular system, boosting immunity, fortifying the skeletal system, balancing the endocrine system, and improving posture) and mental health. Movement games help children develop their imagination, creativity, coordination abilities, and spatial orientation.

Throughout Module 4, it became evident that play facilitated a complex and integrated development of students' physical, cognitive, social, and emotional skills; that play proved to be an effective method for developing coordinative capacities; and that activities incorporating movement games were attractive and highly appreciated by the children, thanks to the positive emotions generated by competition. The ludic method transformed the learning process into a dynamic, interactive, and enjoyable experience that stimulated students' interest and engagement. By developing cognitive, social, and emotional skills, this holistic and efficient approach contributed significantly to the improvement of coordinative capacities. Compared to the classical teaching method, the ludic approach offers a more comprehensive and better-adapted form of learning to the diverse needs of students.

Based on the above, we can affirm that hypothesis no. 1 was confirmed, according to which movement games not only stimulate the development of coordination, balance, and body control, but also maintain a high level of involvement and motivation among children.

On the basis of the data and results obtained from the scientific investigations we conducted, we arrived at the following general conclusions, which we present below:

- The movement games were correctly selected and were specific to the chosen theme (development of coordinative capacities);
- The proposed movement games were selected in accordance with the students' age group and level of preparation.

From the interpretation of the statistical data within the experiment, we concluded that:

- In the test "Throwing the ball at a target while standing with one's back to it", the experimental group exhibited high homogeneity compared to the control group, which showed medium homogeneity;
- In the balance test, the experimental group exhibited high homogeneity compared to the control group, which showed low homogeneity;
- In the "In the Square" test, the experimental group exhibited high homogeneity compared to the control group, which showed low homogeneity;
- In the "Matorin" test, the experimental group exhibited high homogeneity compared to the control group, which showed medium homogeneity;
- Across all applied tests, statistically significant differences were observed between the results obtained by the experimental group and the control group in the final testing phase.

In conclusion, we can affirm that research hypothesis no. 2 - according to which the use of the proposed movement games within physical education lessons will lead to a significant improvement in coordinative capacities among fourth-grade students - was confirmed.

AUTHOR CONTRIBUTIONS

All authors have read and agreed to the published version of the manuscript.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to this investigation.

ACKNOWLEDGEMENTS

We would like to thank the management of Secondary School No. 51 in Bucharest for their agreement and support in conducting this research. We would also like to thank the teachers and students for participating in the experiment.

STATEMENT REGARDING THE USE OF ARTIFICIAL INTELLIGENCE TOOLS

The authors disclose that ChatGPT-5.2 was used exclusively to improve the linguistic quality of the article. Artificial intelligence helped to refine the grammar, wording, and academic style in certain sections.

REFERENCES

Akay, B., Ceylan, M., Ayan, S., Dündar, H., & Altun, A. (2025). Trends in the research of children and play. *International Electronic Journal of Elementary Education*, *17*(5), 690-706. https://doi.org/10.26822/iejee.2025.408

Alecu, A., Catanescu, A., Naiba, G. O., Visan, P., & Cojanu, F. (2025). Evaluation of the effectiveness of applying movement games for the development of motor skills in children aged 7-12 years. *Timisoara Physical Education and Rehabilitation Journal*, *18*(34), 1-8. https://doi.org/10.2478/tperj-2025-0015

Canli, T., Canli, U., Taskin, C. & Aldhahi, M. I. (2023). Motor Coordination in Primary School Students: The Role of Age, Sex, and Physical Activity Participation in Turkey. *Children (Basel), 10*(9), 1524. https://doi.org/10.3390/children10091524.

Chirazi, M., Constantin, I. I., & Petrea, R. G. (2025). The dynamics of coordinative abilities according to age, gender and school performance at secondary school level. *Bulletin of the Transilvania University of Brasov.Series IX, Sciences of Human Kinetics, 18*(1), 143-148. https://doi.org/10.31926/but.shk.2025.18.67.1.16

Dobrescu, T. (2016). Aspects regarding the promotion of movement games through the structural components of the middle school physical education lesson. *Gymnasium. Scientific Journal of Education, Sports, and Health,* No. 1, Vol. XVII /2016, 137-148. https://recipp.ipp.pt/bitstream/10400.22/12356/1/Art_Paulo%20Pereira_2016.pdf

Dobrescu, T. (2019). Influences of physical education lesson movement games on the motor behavior of primary school pupils. *Gymnasium, Scientific Journal of Education, Sports, and Health Supplement*, *20*(1),15-28. https://www.researchgate.net/publication/345487011_Influences_of_Physical_Education_Lesson_Movement_Games_on_the_Motor_Behavior_of_Primary_School_Pupils

Gökşin, Ş.Ö, Kırandı, Ö. & Keskin, B. (2025). Contextual application of integrative neuromuscular training: motor skill competence in rural primary school children aged 8–10 years. *Pedagogy of Physical Culture and Sports*, *29*(5), 454–466. https://doi.org/10.15561/26649837.2025.0507

Hirtz, P., & Starosta, W. (2002). Sensitive al critical periods of motor co-ordination development and its relation to motor learning. *Journal of Human Kinetics*, *7*, 19-28. https://johk.pl/wp-content/uploads/2023/02/03_hir.pdf

Mardiansyah, A., Bakhtiar, S., & Syafruddin, S. (2024). Effect of game-based motor coordination (GBMC) on enhancing positive experiences for early talent development in primary school. *Journal of Physical Education and Sport, 24*(8), 2025-2032. https://doi.org/10.7752/jpes.2024.08224

Marwan, I., & Rohayati, N. (2025). The effect of smart kiddo games on fine and gross motor skills in early childhood. *TEM Journal, 14*(1), 684-694. https://doi.org/10.18421/TEM141-61

Moisescu, P. C., & Gürbüz, A. (2017). Developing coordinative abilities through movement games. *Ştiinţa Culturii Fizice, 28*(2), 60–63. https://scf.usefs.md/en/PDF/Revista%20SCF/2-2017/2--2017_8_en.pdf

Pehoiu, C. (2010). Spatio-temporal orientation development during the physical education class, with 5th and 6th form pupils. *International Journal of Educational and Pedagogical Sciences*, *4* (12), 2219 -2228. https://doi.org/10.5281/zenodo.1056086

Pesce, C., Masci, I., Marchetti, R., Vazou, S., Sääkslahti, A., & Tomporowski, P. D. (2016). Deliberate play and preparation jointly benefit motor and cognitive development: Mediated and moderated effects. *Frontiers in Psychology, 7*, Article 349. https://doi.org/10.3389/fpsyg.2016.00349

Rechtik, Z., Miklankova, L. & Pugnerova, M. (2019). Assessment of gross motor skills in primary schools children from the Czech Republic. *Balt J Health Phys Act*., Suppl (2): 22-26. https://doi.org/10.29359/BJHPA.2019.Suppl.2.04

Rossum v.T., Miller, A., Rudd, J., Issartel, J., Goodway J.D., O'Connor, D., Foulkes, J., Kavanagh, J., Morley, D. (2025). The MOGBA randomized controlled trial: Evaluation of a complex movement skill intervention for 8–12 year old children in primary school physical education. *PLoS One, 20*(7), 1-19. https://doi.org/10.1371/journal.pone.0327136

Savu, C.F., & Pehoiu, C. (2018). Particularities of the Education of the Coordination and Acquisition of the Curriculum of Physical Education by Using the Specific Means of Playing Basketball. *Revista Românească pentru Educaţie Multidimensională*, 10(4), 217-227. https://doi.org/10.18662/rrem/83

Stun, D., Sedlacek, J. & Balint, G. (2024). Changes in selected movement abilities through the use of movement games in physical education lessons at the gymnasium level. *Journal of Physical Education and Sport (JPES)*, 24 (issue 12), 2069 - 2076. https://doi.org/10.7752/jpes.2024.12305

Sutapa, P., Pratama, K. W., Rosly, M. M., Ali, S. K. S., & Karakauki, M. (2021). Improving motor skills in early childhood through goal-oriented play activity. Children, 8(11), Article 994. https://doi.org/10.3390/children8110994

Tanasă, A.-R., & Abalaşei, B.-A. (2024). Spatial – temporal orientation and balance ability among primary school students: comparative analysis according to gender. *Revista Românească Pentru Educaţie Multidimensională*, *16* (2), 515-526. https://doi.org/10.18662/rrem/16.2/869

Topalska, R., & Rumenov, Y. (2025). Facilitating the visualisation of moving games by implementing augmented reality in primary physical education classes. *TEM Journal*, *14*(1), 816-822. https://doi.org/10.18421/TEM141-72