

EFFECTIVENESS OF RELAY RACES AND MOVEMENT GAMES IN DEVELOPING SPEED IN BEGINNER STUDENTS

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Abstract. Speed is one of the fundamental motor qualities that plays a decisive role in athletic performance and physical education. The present study aimed to investigate the effectiveness of relay races and movement games in improving speed among beginner high school students practicing athletics. The research involved 15 beginner students (11 boys and 4 girls), aged 14–15 years, who participated in a structured experimental program conducted over 14 weeks, with five training sessions per week. The intervention integrated relay races, movement games, sprint exercises, and reaction-based activities specifically designed to develop reaction speed, acceleration, and running speed. Participants were evaluated before and after the intervention using three performance tests: the 30 m sprint, the 50 m sprint, and a reaction speed test. The collected data were processed using descriptive statistical methods to compare the initial and final performances. The results indicated significant improvements in all evaluated speed parameters, confirming the effectiveness of the proposed training program. The findings suggest that relay races and movement games represent attractive and efficient pedagogical tools for developing speed while increasing students' motivation, active participation, and engagement in athletics lessons. Therefore, these methods can be successfully integrated into physical education classes and beginner athletics training programs to optimize motor performance.

Introduction Speed is one of the fundamental motor qualities, playing a decisive role in athletic performance and in the motor development of children and adolescents. It is defined as the ability of the body to perform motor actions in the shortest possible time while maintaining movement efficiency and technical accuracy [3,13]. In athletics, speed is expressed through reaction time, acceleration, maximum running speed, and movement frequency, all of which are essential

components for achieving high performance in sprint events and many other sports [1,8,15].

The development of speed is influenced by numerous biological, neuromuscular, and methodological factors, including age, biological maturation, neuromuscular coordination, muscle fiber composition, and the appropriate selection of training methods and means [4,5,16]. During adolescence, well-structured training programs adapted to the developmental characteristics of young athletes can lead to significant improvements in running speed and overall motor performance while also enhancing coordination and technical efficiency [2,7,11]. Relay races and movement games are considered effective teaching strategies in sports instruction because they integrate sprinting, rapid reaction, coordination, and competitive elements into an engaging and motivating learning environment. These activities encourage active student participation, increase motivation for physical effort, and reduce the monotony associated with traditional speed training methods [12,13]. Recent studies have demonstrated that the use of dynamic games and relay races contributes to improvements in reaction speed, acceleration, coordination, and overall motor performance among children and adolescents [6,9,10,14].

Materials and Methods

The study was based on the hypothesis that the systematic use of relay races and movement games during physical education lessons would significantly contribute to the development of speed as a motor quality among beginner ninth-grade students. It was assumed that implementing a structured experimental program over a period of 14 weeks, with five physical education lessons per week, would lead to significant improvements in reaction speed and running speed compared with the participants' initial performance.

The purpose of the study was to investigate the effectiveness of relay races and movement games in developing speed among beginner ninth-grade students enrolled in non-sports-profile classes at the Sports High School of Suceava.

To achieve this purpose, the following objectives were established: To assess the initial level of speed using athletics-specific performance tests; To design and implement an experimental program based on relay races and movement games; To improve reaction speed, acceleration, and running speed through age-appropriate training activities; To compare the results obtained during the initial and final assessments in order to determine the participants' progress; To statistically process and interpret the collected data in order to verify the research hypothesis and formulate methodological recommendations.

The research was conducted at the Sports High School of Suceava on a group of 15 students (11 boys and 4 girls), aged between 14 and 15 years, enrolled in non-sports-profile ninth-grade classes. The study followed an experimental design and was carried out over a period of 14 weeks, with five physical education lessons per

week. The experimental program included relay races, movement games, sprint drills, acceleration exercises, and reaction-speed activities adapted to the participants' age and level of physical preparation. The study was conducted over two school terms, between January and April 2026, approximately 14 weeks. The activities were organized with a frequency of five physical education lessons per week, each lasting 50–60 minutes, in accordance with the curriculum and organizational framework of physical education classes in a Sports High School.

To accomplish the research objectives, several methods commonly used in physical education and sports science were employed. The theoretical documentation method provided the scientific background through the analysis of specialized literature. Pedagogical observation was applied throughout the intervention to monitor students' participation and the quality of exercise execution. The pedagogical experiment represented the main research method, while performance assessment was conducted before and after the implementation of the experimental program.

Speed performance was evaluated using three athletics-specific tests: the 30-m sprint, which assessed reaction speed and acceleration; the 50-m sprint, which assessed running speed; and a reaction test based on auditory and visual stimuli. Each sprint test was performed twice, and the best result was recorded, while the reaction test consisted of three trials.

The collected data were statistically analyzed using the arithmetic mean, standard deviation, coefficient of variation, quartiles, the differences between the initial and final assessments, and Cohen's d effect size, which was used to determine the magnitude of the experimental program's effect. The results were presented in tables and figures to facilitate the interpretation and comparison of participants' performance before and after the intervention.

Table 1. Structure of the Experimental Program Based on Relay Races and Movement Games for Speed Development

Module	Period	Operational Objectives	Main Training Activities	Training Volume and Organization
Module I – Development of Reaction Speed and Acceleration	Weeks 1–7	Improve reaction speed to auditory and visual stimuli. • Enhance acceleration over short distances. • Develop coordination and spatial orientation.	Sprint drills over 10–20 m; starts from different positions (lying, sitting, squatting); relay races involving baton exchange or partner touch; movement games (<i>Start on the Signal, Moving Colors, Number Race, Catch the Signal, Hunter and Rabbits</i>); rapid changes of direction and reaction exercises using different auditory and visual signals.	Five sessions per week; 50–60 minutes per session. Each lesson included a warm-up (10–15 min), the main part (30–40 min), and a cool-down (5–10 min).
Module II – Development of Running Speed	Weeks 8–14	Increase maximum running speed. • Consolidate acceleration and coordination. • Improve the ability to change direction rapidly and encourage	Sprint drills over 30–50 m; relay races with slalom running and low hurdles; sprint exercises involving changes of direction; applied movement games (<i>Catch the Tail, Last One Eliminated, Competitive Paired Sprint, Surprise Start</i>); complex relay races combining	Five sessions per week; 50–60 minutes per session. Running distances (30–50 m), execution speed, and exercise complexity were progressively increased

Module	Period	Operational Objectives	Main Training Activities	Training Volume and Organization
Final Evaluation		competitive engagement.	sprinting, slalom running, and rapid turns. Training intensity and exercise complexity increased progressively throughout the program.	according to the participants' adaptation.
	Week 14	Assess participants' progress. • Verify the research hypothesis.	Administration of the final performance tests: 30-m sprint, 50-m sprint, and reaction speed test. A final competitive relay race and movement games were also organized to evaluate the students' overall speed performance, coordination, and participation.	The initial and final test results were compared using descriptive statistical indicators (arithmetic mean, standard deviation, coefficient of variation) and Cohen's d effect size to determine the effectiveness of the experimental program.

Results

To verify the research hypothesis and evaluate the effectiveness of the experimental program based on relay races and movement games, the participants' results obtained during the initial and final assessments were analyzed and compared. Motor performance was evaluated using three specific speed tests: the 30-m sprint, the 50-m sprint, and the reaction speed (rapid-start) test. The collected data were statistically processed using the arithmetic mean, standard deviation, coefficient of variation, quartiles, and Cohen's d effect size. These statistical indicators enabled the assessment of group homogeneity and the evaluation of the effectiveness of the experimental program in improving speed performance.

30 m SPRINT TEST – BOYS

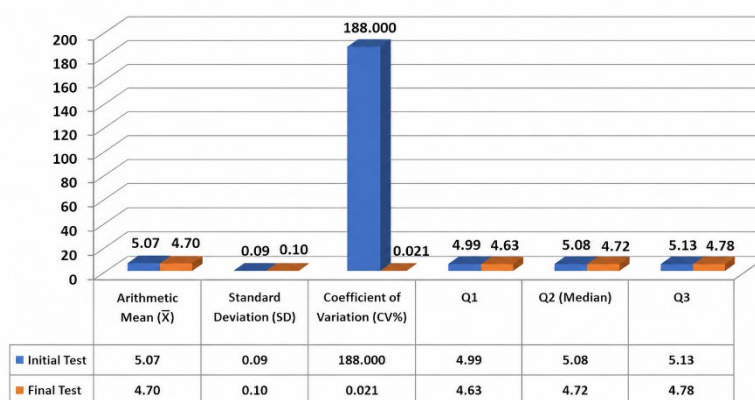


Fig. 1. Comparison of the 30 m Sprint Test Results in Boys (Initial vs. Final Assessment)

50 m SPRINT TEST – BOYS

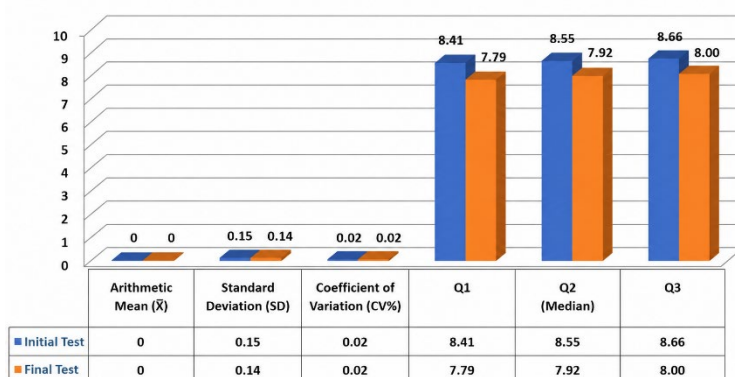


Fig. 2. Comparison of the 50 m Sprint Test Results in Boys (Initial vs. Final Assessment)

Table 2. Statistical Analysis of the Rapid-Start Reaction Speed Test (Boys)

	Performance Level	Initial Test n (%)	Final Test n (%)	Difference
Very Good		0 (0.0%)	8 (72.7%)	+8
Good		8 (72.7%)	3 (27.3%)	-5
Satisfactory		3 (27.3%)	0 (0.0%)	-3
Total		11 (100%)	11 (100%)	—

The analysis of the 30-m sprint test results revealed a significant improvement in reaction speed and acceleration. The initial mean performance of the group was 5.07 s, which decreased to 4.70 s following the implementation of the experimental program, corresponding to an average improvement of 0.37 s. The low values of the standard deviation and coefficient of variation indicate that the group exhibited a relatively homogeneous level of motor performance both at the beginning and at the end of the study. Furthermore, the obtained Cohen's d value (3.76) indicates a very large effect of the experimental program on speed development.

Similarly, the results of the 50-m sprint test demonstrated a substantial improvement in running speed. The initial mean time was 8.54 s, whereas the final mean decreased to 7.90 s, representing an average improvement of 0.64 s. The Cohen's d value calculated for this test (4.32) confirms the high effectiveness of the training methods incorporated into the experimental program. These findings suggest that the systematic use of relay races and movement games significantly contributed to the development of acceleration and maximal running speed.

Regarding the rapid-start reaction test, most participants improved their performance from the "Good" to the "Very Good" category, indicating enhanced responsiveness to both auditory and visual stimuli. This qualitative improvement further supports the effectiveness of the experimental program in developing reaction speed, an essential component of sprint performance.

30 m SPRINT TEST – GIRLS

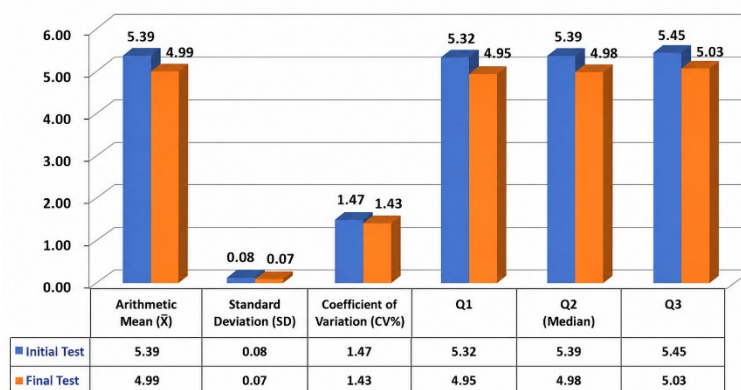


Fig. 3. Comparison of the 30 m Sprint Test Results in Girls (Initial vs. Final Assessment)

50 m SPRINT TEST – GIRLS

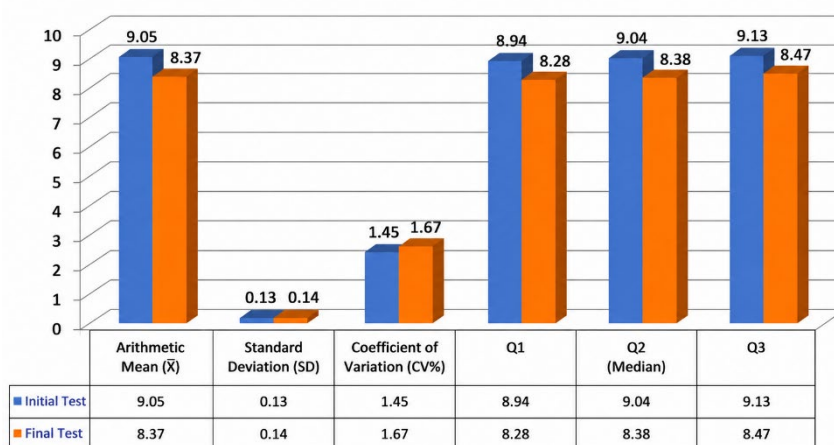


Fig. 4. Comparison of the 50 m Sprint Test Results in Girls (Initial vs. Final Assessment)

Table 3. Statistical Analysis of the Rapid-Start Reaction Speed Test (Girls)

Performance Level	Initial Test n (%)	Final Test n (%)	Difference
Very Good	0 (0.0%)	2 (50.0%)	+2
Good	2 (50.0%)	2 (50.0%)	0
Satisfactory	2 (50.0%)	0 (0.0%)	-2
Total	4 (100%)	4 (100%)	—

For the girls' group, the analysis of the results demonstrated clear improvements in both speed tests. In the 30-m sprint, the initial mean time was 5.39

s, while the final mean decreased to 4.99 s, representing an average improvement of 0.40 s. The statistical indicators showed a high degree of group homogeneity, as reflected by the low coefficients of variation in both the initial and final assessments. The calculated Cohen's d value (5.33) indicates a very large effect of the experimental program on the development of reaction speed and acceleration in the female participants.

In the 50-m sprint, the initial mean time was 9.05 s, whereas the final mean improved to 8.37 s, corresponding to an average improvement of 0.68 s. The Cohen's d value (4.97) further confirms the high effectiveness of the experimental intervention and highlights the positive impact of relay races and movement games on the development of running speed.

The results of the rapid-start reaction test also demonstrated a noticeable improvement in the participants' reaction ability and responsiveness to different stimuli. The girls progressed from the "Satisfactory/Good" performance levels at the initial assessment to the "Good/Very Good" levels at the final assessment, indicating enhanced reaction speed and motor responsiveness following the implementation of the experimental program.

Discussions

The results of the present study confirm that relay races and movement games are effective methods for improving speed in beginner students. Significant improvements were observed in the 30 m sprint, 50 m sprint, and rapid-start reaction test, supporting the effectiveness of the 14-week intervention. These findings are consistent with those of [14], who reported that movement games and relay races effectively improve speed performance in schoolchildren. Similarly, [10] demonstrated that a 10-week play-based training program significantly enhanced sprint performance and physical fitness in adolescents. Likewise, [6] found that dynamic games integrated into physical education lessons contribute significantly to the development of speed and increase students' motivation and participation.

Conclusions

The results of the present study confirm the research hypothesis that the systematic use of relay races and movement games significantly contributes to the development of speed in beginner students. The 14-week experimental program led to clear improvements in both reaction speed and running speed among boys and girls, as demonstrated by the results obtained in the 30-m sprint, 50-m sprint, and rapid-start reaction tests. Statistical analysis revealed very large effects of the experimental intervention, as confirmed by the high Cohen's d values, while the low coefficients of variation indicated a good level of homogeneity within the study groups. These findings demonstrate the effectiveness of the experimental program and support the use of the proposed methods in the teaching process. Relay races and movement games also contributed to increased motivation, active participation, and greater student interest in physical education activities, promoting speed

development in an engaging and dynamic learning environment. Overall, these methodological tools can be successfully integrated into physical education lessons and beginner athletics training programs, representing an effective strategy for optimizing the motor development of beginner students.

References

- [1]. Ababei, C. (2013). *Atletism: Teorie și practică*. Bacău, România: Editura Alma Mater. ISBN 978-606-527-303-0.
- [2]. Bompa, T. O., & Haff, G. G. (2009). *Periodization: Theory and Methodology of Training* (5th ed.). Champaign, IL, USA: Human Kinetics.
- [3]. Cârstea, G. (2000). *Teoria și metodică educației fizice și sportului*. București, România: Editura AN-DA.
- [4]. Demeter, A. (1974). *Bazele fiziologice și biochimice ale dezvoltării calităților motrice*. București, România: Editura Sport-Turism.
- [5]. Dragnea, A., & Bota, A. (1999). *Teoria activităților motrice*. București, România: Editura Didactică și Pedagogică.
- [6]. Dumbravă, A.-R., & Leuciuc, F.-V. (2025). Contribution to the Development of Motor Quality Speed through Dynamic Games in Middle School Students. *The Annals of the "Ștefan cel Mare" University of Suceava. Physical Education and Sport Section. The Science and Art of Movement*. <https://doi.org/10.4316/SAM.2025.0205>
- [7]. Gambetta, V. (2007). *Athletic Development: The Art & Science of Functional Sports Conditioning*. Champaign, IL, USA: Human Kinetics. <https://doi.org/10.5040/9781718224971>
- [8]. Harre, D. (1973). *Principles of Sports Training*. Berlin, Germany: Sportverlag.
- [9]. Ivaniciuc, M., & Vizitiu Lakhdari, E. (2025). Developing the Motor Quality of Speed through Specific Athletics Means in Middle School Students. *The Annals of the "Ștefan cel Mare" University of Suceava. Physical Education and Sport Section. The Science and Art of Movement*. <https://doi.org/10.4316/SAM.2025.0119>
- [10]. Kurnaz, M., Flôres, F., Altınkök, M., Esen, H. T., Silva, A. F., et al. (2024). A 10-week play-based after-school program to improve coordinative abilities and physical fitness capabilities among adolescents: A randomized trial. *Scientific Reports*, 14, 13531. <https://doi.org/10.1038/s41598-024-61275-0>
- [11]. Lloyd, R. S., & Oliver, J. L. (Eds.). (2014). *Strength and Conditioning for Young Athletes: Science and Application*. Abingdon, UK: Routledge, pp. 98–114.
- [12]. Mitra, Gh., & Mogoș, Al. (1980). *Metodica educației fizice școlare* (Ed. a III-a). București, România: Editura Sport-Turism.
- [13]. Pop, C. L. (2014). *Atletism. Metodica probelor de bază pentru studenți*. București, România: Editura ASE. ISBN 978-606-505-843-9.
- [14]. Talaghir, L.-G., Iconomescu, T., & Ciorbă, C. (2017). Study Regarding Movement Speed Development in Primary School Children by Using Motor Games and Relays. *Annals of "Dunarea de Jos" University of Galati. Fascicle XV, Physical*

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Education and Sport Management, 2, 83–89. Available at:
<https://www.gup.ugal.ro/ugaljournals/index.php/efms/article/view/230> (accessed 30
July 2026).

[15]. Weineck, J. (1997). *Optimales Training* (10th ed.). Balingen, Germany: Spitta Verlag.

[16]. Zatsiorsky, V. M. (1995). *Science and Practice of Strength Training*. Champaign, IL, USA: Human Kinetics.