

DEVELOPMENT OF THE MOTOR QUALITY OF ENDURANCE THROUGH ATHLETICS-BASED ACTIVITIES IN PHYSICAL EDUCATION CLASSES

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**Keywords: endurance, motor skills, athletics, physical education,
middle school students, motor development**

Abstract The development of endurance is a fundamental objective of physical education, contributing to the improvement of students' health, functional capacity, and motor performance. The aim of this study was to investigate the effectiveness of an athletics-based training program in developing the endurance of endurance among middle school students. The research hypothesis assumed that the systematic use of athletics-specific exercises during physical education classes would significantly improve students' endurance compared with their initial level. The study was conducted through a pedagogical experiment involving middle school students and included the analysis of specialized literature, pedagogical observation, testing, and statistical processing of the collected data. The level of endurance was assessed using standardized physical tests applied at the beginning and at the end of the experimental program. The results revealed an improvement in the students' endurance indicators, with the final assessments showing better performances than the initial ones, thus confirming the research hypothesis. The findings demonstrate that the systematic integration of athletics-based activities into physical education classes is an effective method for developing endurance and increasing the efficiency of the educational process. Therefore, athletics-specific means represent valuable educational tools for improving students' physical fitness and motor development.

Introduction

Physical education contributes to the harmonious development of students by improving functional capacity, developing endurance, and promoting an active lifestyle. Within the educational process, it aims to enhance motor competence and physical fitness while providing students with opportunities to reach their physical potential and adopt healthy behaviors that support lifelong participation in physical activity [1,2].

Endurance is one of the fundamental endurance, playing a decisive role in maintaining physical effort over prolonged periods and delaying the onset of fatigue during exercise. Its development during middle school is particularly important because this stage of growth is characterized by significant physiological and functional adaptations that favor improvements in aerobic capacity and overall motor performance [3,8].

Due to its practical nature and accessibility, athletics represents one of the most effective means used in physical education classes for developing endurance. Running exercises, relay races, interval running, and dynamic games provide appropriate stimuli for improving cardiorespiratory fitness while simultaneously enhancing coordination, speed, and strength. Furthermore, the variety of athletics-based activities increases students' active participation and motivation to engage in physical education lessons [12].

The scientific literature highlights the importance of developing endurance from the early school years. The author [9] identified cardiorespiratory fitness as one of the most important indicators of physical fitness in children and adolescents. The author [11] demonstrated that higher levels of physical fitness are associated with better motor development and a lower risk of chronic diseases later in life. Similarly, [6] emphasized that well-planned training programs adapted to children's developmental characteristics produce significant improvements in motor abilities and functional capacity.

Specialists in the field of motor activities emphasize the educational value of athletics in the development of endurance. The authors [5] stated that the systematic development of endurance represents one of the fundamental objectives of physical education, while [4] highlighted that athletics-specific exercises allow the progressive regulation of training load and its adaptation to students' age-related characteristics. Furthermore, [3] argued that appropriate planning and organization of training are essential factors for the effective development of endurance. Based on these theoretical and practical considerations, the present study aims to evaluate the effectiveness of athletics-based activities in developing the endurance of endurance among middle school students.

Material-method

The aim of the study was to evaluate the effectiveness of using athletics-specific activities to develop the endurance of endurance in middle school students during physical education and sports classes. The experimental program, implemented throughout Modules III and IV of the school year, was designed to improve students' work capacity, enhance general endurance, and increase their overall physical fitness through athletics-specific exercises and teaching methods adapted to their age characteristics and level of physical preparation. The research hypothesis assumed that the systematic implementation of an experimental program

based on endurance running, relay races, obstacle courses, physical activity games, and athletics-specific exercises would lead to significant improvements in students' work capacity and general endurance. To achieve the aim of the study, the following objectives were established: to review the specialized literature on the development of endurance in middle school students; to identify age-related characteristics and factors influencing endurance development; to design and implement an experimental program based on athletics-specific activities; to assess the initial and final levels of endurance; to analyse and interpret the obtained results; and to formulate methodological recommendations regarding the use of athletics activities in physical education and sports classes. The research was conducted at "Nicolae Labiș" Secondary School, Mălini, Suceava County, Romania, during Modules III and IV of the school year, over a total period of 14 weeks. The study sample consisted of 24 middle school students, including 12 fifth-grade students (7 girls and 5 boys) and 12 sixth-grade students (5 girls and 7 boys). All participants regularly attended physical education classes, were medically fit to participate in physical activities, and presented comparable levels of physical fitness. The following research methods were employed: literature review, pedagogical observation, pedagogical experiment, motor performance testing, statistical analysis, and graphical representation of the results. The literature review provided the theoretical foundation of the research, pedagogical observation was used to monitor students' progress throughout the intervention, and the pedagogical experiment represented the principal method for testing the research hypothesis. The collected data were processed using descriptive statistical methods and presented in tables and graphs. The experimental program included endurance running, moderate-paced running with pace variations, relay races, physical activity games, obstacle courses, and circuit training exercises, all progressively adapted according to the students' age and physical fitness level. Endurance was assessed before and after the intervention using several motor performance tests, including the 600–800 m endurance run, continuous running, an endurance circuit, relay races, endurance-oriented physical activity games, and systematic observation of students' motor behaviour during physical effort. The technical equipment used throughout the study included stopwatches, cones, field markers, whistles, observation sheets, and data recording forms.

Table 1. Experimental Program for the Development of Endurance through Athletics-Based Activities

Program Stage	Duration	Objectives	Athletics-Based Activities	Training Load
Stage I – Adaptation to Physical Effort	Weeks 1–2	To adapt students to physical effort, develop fundamental motor skills, and promote a positive attitude toward physical activity.	Continuous running (5–8 min), 30–60 m runs, mobility exercises, simple relay races, physical activity games, breathing exercises.	Low intensity, full recovery intervals, 3–5 repetitions per exercise.
Stage II – Development	Weeks 3–5	To progressively increase work capacity and improve aerobic endurance.	Continuous running (8–12 min), 100–150 m runs, circuit	Moderate intensity, 2–3 circuits, 4–5

The Annals of the “Ștefan cel Mare” University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131

of General Endurance					
Stage III – Endurance Consolidation	Weeks 6–7	To improve adaptation to sustained effort and consolidate general endurance.	training, obstacle courses, relay races, endurance games. Pace-variation running, 100–200 m runs, advanced circuit training, obstacle relay races, team games.	repetitions, short recovery intervals. Moderate-to-high intensity, reduced recovery time, 3 circuits.	
Stage IV – Endurance Improvement	Weeks 8–12	To further enhance work capacity and develop specific endurance.	Continuous running (10–15 min), interval running, complex relay races, obstacle courses, competitive games, combined running and jumping exercises.	Progressive intensity, 3–4 circuits, 5–6 repetitions, controlled recovery periods.	
Stage V – Consolidation and Final Assessment	Weeks 13–14	To evaluate students' progress and consolidate the acquired motor skills.	Endurance running, combined exercises, final relay races, sports games, and motor performance tests.	Training load adapted to students' fitness level; final assessment performed using the selected motor tests.	

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Results (TNR 12, justify, line spacing 1)

To assess the initial level of endurance development, motor performance tests specifically designed for middle school students were administered prior to the implementation of the experimental program. The intervention was conducted over a period of 14 weeks, corresponding to Modules III and IV of the school year. The results of the initial assessment were recorded and analysed separately for fifth- and sixth-grade students, as well as by sex, in order to determine the participants' baseline level of exercise capacity and endurance. These baseline data served as a reference for comparison with the final assessment results and for evaluating the effectiveness of the experimental program.

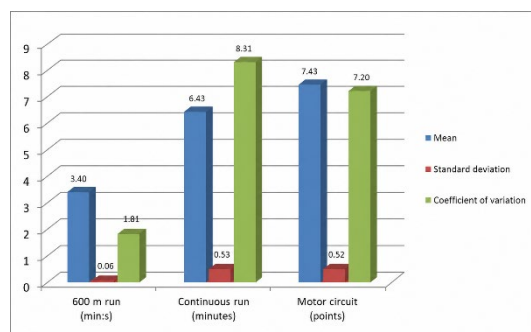


Fig. 1. Initial Assessment Results for Fifth-Grade Girls

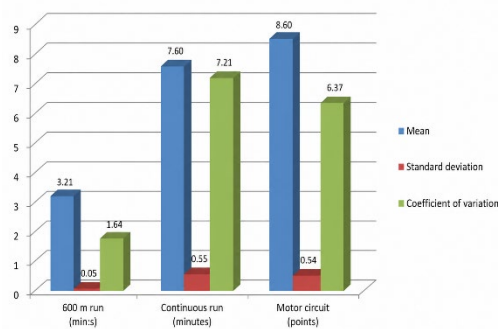


Fig. 2. Final Assessment Results for Fifth-Grade Girls

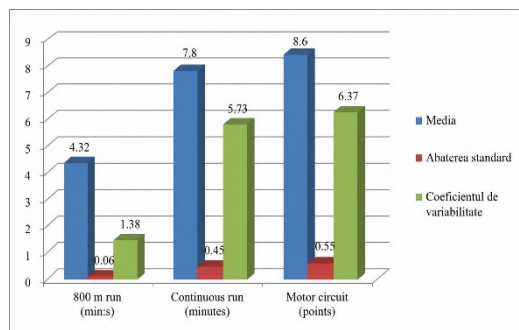


Fig. 3. Initial Assessment Results for Fifth-Grade Boys

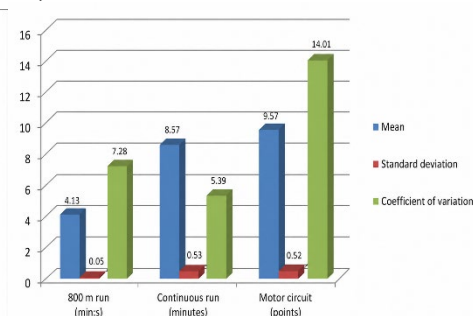


Fig. 4. Final Assessment Results for Fifth-Grade Boys

The analysis of the initial and final assessment results highlights the positive effect of the 14-week experimental program on the development of endurance in middle school students. A comparison of the results obtained before and after the intervention demonstrates that the systematic use of athletics-based activities contributed to improving exercise capacity, general endurance, and the overall level of motor performance. During the initial assessment, the fifth-grade girls achieved a mean time of 3.40 min in the 600 m run, 6.43 min in the continuous running test, and 7.43 points in the motor skills circuit. The low standard deviation values (0.06, 0.53, and 0.52) and coefficients of variation (1.81%, 8.31%, and 7.20%) indicate a homogeneous group with a relatively uniform level of physical fitness. The fifth-grade boys obtained better initial results than the girls, recording a mean time of 3.21 min in the 600 m run, 7.60 min in the continuous running test, and 8.60 points in the motor skills circuit. The standard deviation values (0.05, 0.55, and 0.54) together with the coefficients of variation (1.64%, 7.21%, and 6.37%) also indicate good group homogeneity and a satisfactory level of functional capacity. Among the sixth-grade girls, the mean time recorded in the 800 m run was 4.32 min, while the mean performance in the continuous running test reached 7.80 min, and the motor skills circuitscore averaged 8.60 points. The standard deviation values (0.06, 0.45, and 0.55) and coefficients of variation (1.38%, 5.73%, and 6.37%) demonstrate a well-balanced group with good adaptation to physical effort. The best initial performances were observed in the sixth-grade boys, who achieved a mean time of 4.13 min in the 800 m run, 8.57 min in the continuous running test, and 9.57 points in the motor skills circuit. The statistical indicators (standard deviation: 0.05, 0.53, and 0.52; coefficient of variation: 7.28%, 5.39%, and 14.01%) indicate a relatively homogeneous group with a high level of motor performance. A comparison of the final and initial assessments revealed improvements across all investigated groups. Reduced running times were observed in both the 600 m and 800 m running tests, while performance in the continuous running test and the motor skills circuit improved in every group. These findings confirm the effectiveness of the experimental program and demonstrate that the systematic implementation of

athletics-based activities contributes to the development of general endurance and to the improvement of students' overall physical fitness. The observed improvements can be attributed to the systematic application of the experimental program, the progressive increase in training load, and the use of varied and engaging athletics-based activities, including endurance running, relay races, obstacle courses, circuit training, and physical activity games. The greatest improvements were recorded among the sixth-grade students, particularly the boys, which may be explained by their more advanced biological and functional development.

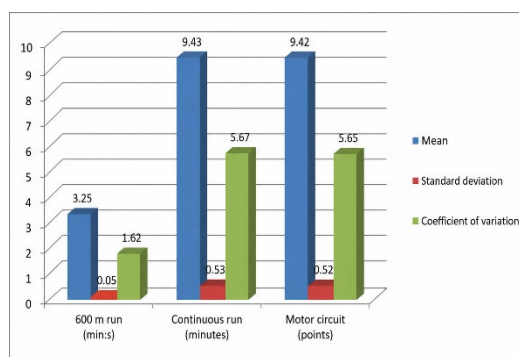


Fig. 5. Initial Assessment Results for Sixth-Grade Girls

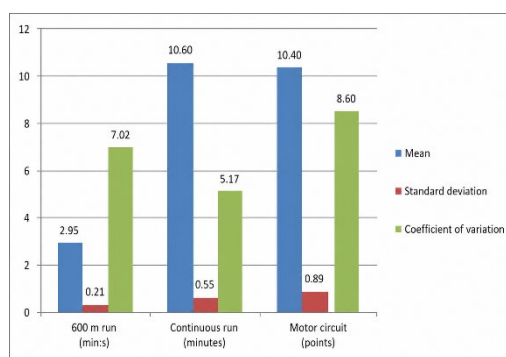


Fig. 6. Final Assessment Results for Sixth-Grade Girls

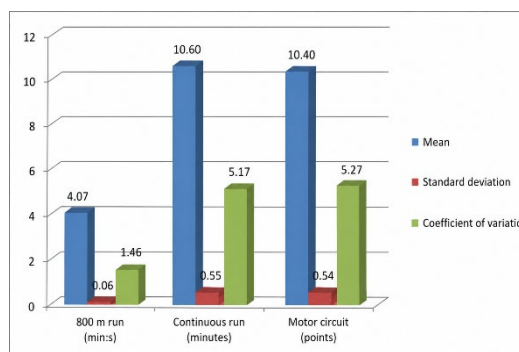


Fig. 7. Initial Assessment Results for Sixth-Grade Boys

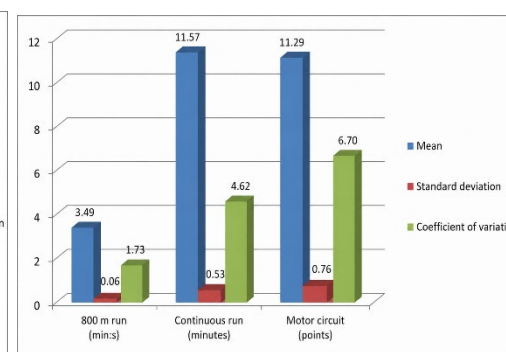


Fig. 8. Final Assessment Results for Sixth-Grade Boys

At the end of the 14-week experimental program, all participants underwent a final assessment using the same motor performance tests administered during the initial evaluation. The purpose of this assessment was to determine the progress achieved in the development of endurance and to evaluate the effectiveness of the experimental program based on athletics-specific activities. Among the fifth-grade girls, the final assessment demonstrated improvements in physical fitness and endurance performance. The mean time recorded in the 600 m run was 3.25 min, while the mean performance in the continuous running test reached 9.43 min, and the mean score in the motor skills circuit was 9.42 points. The low standard deviation

values (0.05, 0.53, and 0.52) and the coefficients of variation (1.62%, 5.67%, and 5.65%) indicate good group homogeneity and confirm the effective adaptation of the participants to the experimental program. The fifth-grade boys showed substantial improvements in all motor tests. The mean time in the 600 m run decreased to 2.95 min, while the mean performance in the continuous running test increased to 10.60 min, and the average score in the motor skills circuit reached 10.40 points. The coefficients of variation (7.02%, 5.17%, and 8.60%) indicate moderate individual differences; however, these values remain within the range of relative group homogeneity and confirm the effectiveness of the applied training program. Among the sixth-grade girls, the final assessment also revealed significant improvements compared with the initial evaluation. The mean time recorded in the 800 m run was 4.07 min, whereas the mean performance in the continuous running test reached 10.60 min, and the average score in the motor skills circuit was 10.40 points. The low standard deviation values (0.06, 0.55, and 0.54) together with the coefficients of variation (1.46%, 5.17%, and 5.27%) demonstrate a high degree of group homogeneity and confirm the positive effects of the experimental program. The best final results were obtained by the sixth-grade boys. They achieved a mean time of 3.49 min in the 800 m run, 11.57 min in the continuous running test, and 11.29 points in the motor skills circuit. The coefficients of variation (1.73%, 4.62%, and 6.70%) indicate good group homogeneity and excellent adaptation to the experimental training program. Comparison of the final assessment with the initial evaluation demonstrated improvements across all study groups. Reduced running times in the 600 m and 800 m tests, increased performance in the continuous running test, and higher scores in the motor skills circuit indicate significant improvements in exercise capacity, general endurance, and overall motor performance. The findings also suggest enhanced motor coordination and improved physiological adaptation to sustained physical effort. The observed improvements confirm the effectiveness of the systematic use of athletics-based activities, including endurance running, relay races, obstacle courses, circuit training, and physical activity games. These activities contributed to the enhancement of students' aerobic endurance, cardiovascular and respiratory fitness, motor coordination, and overall physical fitness. Furthermore, the consistently low coefficients of variation confirm the homogeneity of the study groups and demonstrate that the experimental program produced positive effects in all participants, regardless of grade level or sex.

Table 2. Comparative Analysis of Fifth-Grade Girls' Results

Indicator	Initial Assessment	Final Assessment	Difference
600 m Run (min)	3.40	3.25	0.15
Continuous Running Test (min)	6.43	9.43	3.00
Motor Skills Circuit (points)	7.43	9.43	2.00

Table 3. Comparative Analysis of Fifth-Grade Boys' Results

Indicator	Initial Assessment	Final Assessment	Difference
600 m Run (min)	3.21	2.95	0.26
Continuous Running Test (min)	7.60	10.60	3.00
Motor Skills Circuit (points)	8.60	10.40	1.80

Table 4. Comparative Analysis of Sixth-Grade Girls' Results

Indicator	Initial Assessment	Final Assessment	Difference
800 m Run (min)	4.32	4.07	0.25
Continuous Running Test (min)	7.80	10.60	2.80
Motor Skills Circuit (points)	8.60	10.40	1.80

Table 5. Comparative Analysis of Sixth-Grade Boys' Results

Indicator	Initial Assessment	Final Assessment	Difference
800 m Run (min)	4.13	3.49	0.64
Continuous Running Test (min)	8.57	11.57	3.00
Motor Skills Circuit (points)	9.57	11.29	1.72

The comparative analysis of the initial and final assessment results revealed improvements across all study groups and in all tests included in the experimental program. Reduced running times, increased performance in the continuous running test, and higher scores in the motor skills circuit demonstrate the effectiveness of the experimental program in improving endurance and overall motor performance. Among the fifth-grade girls, the mean time in the 600 m run improved by 0.15 min, while performance in the continuous running test increased by 3.00 min, and the motor skills circuit score improved by 2.00 points. These findings reflect an enhanced ability to sustain physical effort and an overall improvement in motor performance. The fifth-grade boys demonstrated even greater progress. The mean time in the 600 m run decreased by 0.26 min, performance in the continuous running test increased by 3.00 min, and the motor skills circuit score improved by 1.80 points, highlighting substantial improvements in endurance and motor coordination. Among the sixth-grade girls, the mean time in the 800 m run improved by 0.25 min, performance in the continuous running test increased by 2.80 min, and the motor skills circuit score improved by 1.80 points compared with the initial assessment. These changes confirm significant improvements in general endurance and a better adaptation to prolonged physical effort. The greatest improvements were observed among the sixth-grade boys. Their mean time in the 800 m run decreased by 0.64 min, performance in the continuous running test increased by 3.00 min, and the motor skills circuit score improved by 1.72 points. These results indicate a superior development of endurance, motor coordination, and the ability to sustain prolonged physical effort.

Discussions

The findings of the present study are consistent with those reported by [7], who demonstrated that the systematic implementation of athletics-specific exercises in physical education classes leads to significant improvements in endurance and overall exercise capacity among middle school students. The authors emphasized that programs based on running activities, progressive exercises, and athletics-specific training produce significant functional adaptations and contribute to the development of motor performance. Similarly, the findings of the present study are supported by the research conducted by [10], who reported that the systematic integration of athletics-based activities into physical education classes has positive effects on the motor development of lower secondary school students. The author concluded that structured programs based on athletics-specific exercises improve motor performance and contribute to enhancing the overall level of physical fitness.

Conclusions

The findings of the present study demonstrate that the systematic implementation of athletics-based activities during physical education classes had a positive effect on the development of endurance in middle school students. The 14-week experimental program significantly improved students' performance in the 600 m/800 m running tests, the continuous running test, and the motor skills circuit, confirming the effectiveness of athletics-specific activities in enhancing general endurance and overall motor performance. The greatest improvements were observed among sixth-grade students, particularly boys, suggesting that biological maturation and functional development may influence the magnitude of training adaptations. The use of varied athletics-based activities, including endurance running, pace-variation running, relay races, obstacle courses, circuit training, and physical activity games, contributed not only to the development of endurance but also to improved motor coordination, greater exercise tolerance, and increased student engagement during physical education lessons. The results support the research hypothesis and indicate that athletics-based activities represent an effective, practical, and accessible approach for developing endurance and improving the physical fitness of middle school students.

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