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Developing endurance and self-confidence through the integration of Freestyle Wrestling into physical education lessons

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Abstract

Objective. This study examined the effects of an eight-week freestyle wrestling-based program integrated into physical education lessons on endurance and self-confidence in seventh-grade students

Methods. 40 students were divided into an experimental group ($n=20$) and a control group ($n=20$). Physical endurance was assessed through the Harvard Step Test and Ruffier Test, while self-confidence was evaluated at the end of the intervention using the Coopersmith Self-Esteem Inventory

Results. The experimental group showed greater improvements in cardiovascular endurance and adaptation to effort compared with the control group. In addition, the experimental group obtained significantly higher post-intervention self-esteem scores.

Conclusions. These findings suggest that freestyle wrestling exercises, when adapted to the physical education classes in school, may be a useful method for developing endurance and supporting self-confidence in physical education.

Key words: endurance, physical education, self-confidence, combat sports

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Introduction

According to Popescu & Ionescu (2021), the integration of combat sports into physical education programs represents a valuable pedagogical strategy for developing students' self-confidence. These sport disciplines provide a structured framework in which young people can learn to overcome their physical and psychological limits by facing progressive challenges in a controlled and safe environment, as also suggested by Stan et al. (2021). Through combat techniques, students develop not only fundamental motor skills, but also essential social and emotional competencies, such as self-control, respect, and perseverance, aspects also emphasized by Constantinescu (2021).

The practice of martial arts and combat sports can contribute to the formation of a positive self-image, because each technical progress achieved by the student strengthens the feeling of personal competence, as mentioned by Popescu & Ionescu (2021). The training process in wrestling involves the establishment of clear and achievable objectives, and reaching these objectives may generate satisfaction and intrinsic motivation, according to Rădulescu et al. (2020).

The interaction with training partners can develop communication skills and empathy, while respecting strict rules contributes to the development of personal discipline, highlighted by Gyórik & Béki (2024). The inclusive environment created during these activities allows students to experience success regardless of their initial level of physical preparation (Dubey 2024). Therefore, in order to support the implementation of such programs in the Romanian educational system, it is important to rely on recent scientific research that documents the psychopedagogical benefits of wrestling and combat sports, as also stated by Popescu & Ionescu (2021). Based on these considerations, freestyle wrestling can be approached not only as a competitive sport, but also as an educational means through which students may develop both physical and psychological resources (Peng et al. 2025, Xue et al. 2025). Therefore, the present study focuses on the effects of integrating freestyle wrestling-specific exercises into physical education lessons on seventh-grade students' endurance and self-confidence.

Aim

The aim of this study was to examine whether an eight-week program of freestyle wrestling-specific exercises integrated into physical education lessons could improve physical endurance and self-confidence among seventh-grade students, as assessed through endurance tests and a self-confidence questionnaire.

Materials and method

Participants

The study included 40 seventh-grade students from "S. Illyés Lajos" Secondary School in Sovata, Romania. The participants were divided into two groups: an experimental group and a control group, each consisting of 20 students. The experimental group followed an eight-week program that integrated freestyle wrestling-specific exercises into physical education lessons, whereas the control group continued the traditional physical education program. The basic somatic characteristics of the participants were calculated for each group. In the experimental group, the mean height was approximately 164.2 cm, and the mean body mass was approximately 59.4 kg. In the control group, the mean height was approximately 162.5 cm, and the mean body mass was approximately 58.8 kg. These values suggest that the two groups were relatively similar in terms of height and body mass before the intervention.

All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Study design

This study used an experimental design with a control group, based on initial and final physical assessments. The research was conducted over an eight-week period, from 11 November 2025 to 20 January 2026. The experimental group participated in physical education lessons that integrated freestyle wrestling-specific exercises, while the control group followed the regular physical education program, which included traditional activities such as handball, football, and athletics. Both groups attended two physical education lessons per week, with each lesson lasting 45–50 minutes. Physical endurance was assessed at the beginning and at the end of the intervention using the Harvard Step Test, while self-confidence was evaluated at the end of the study using the Coopersmith Self-Esteem Inventory, administered to both the experimental and control groups. Self-confidence was assessed at the end of the study using the Coopersmith Self-Esteem Inventory for Students (CSEI-S), a standardized self-report instrument designed to evaluate self-esteem in school-aged children and adolescents. For the present study, the Romanian-adapted version of the instrument was used, as the CSEI has been adapted for use in Romania and is intended for children and adolescents aged 9–18 years (Coopersmith 2017).

Testing procedure

All assessments were carried out in the school gymnasium under similar conditions for both the experimental and control groups. The tests were administered by the same evaluator in order to ensure

consistency in the testing procedure. Before testing, the students received clear instructions regarding the execution of each task, and the purpose of the assessments was explained in an age-appropriate manner. The initial physical assessment was conducted before the beginning of the intervention, while the final physical assessment was conducted after the eight-week program. Self-confidence was assessed at the end of the study using the Coopersmith Self-Esteem Inventory.

Harvard step test

The Harvard Step Test was used to assess the students' cardiovascular endurance. The participants performed repeated step-ups on a gymnastics bench for a fixed duration of 2 minutes, maintaining a rhythm of approximately 30 step-ups per minute. Immediately after the effort, the students sat down for recovery, and heart rate values were recorded during three post-exercise intervals: 30–60 seconds, 60–90 seconds, and 90–120 seconds after the end of the test. These three pulse values were used to calculate the endurance coefficient, with better recovery being reflected by a more favorable test result. The Harvard Step Test coefficient was used to assess cardiovascular endurance and recovery capacity after effort. Higher coefficient values indicate better cardiovascular endurance and more efficient post-exercise recovery. Therefore, an increase in the coefficient from initial to final testing was interpreted as an improvement in physical endurance.



Fig 1. Harvard step test

Ruffier Test

The Ruffier Test was included as a simple functional assessment of cardiovascular adaptation to physical effort. The students' heart rate was measured at three moments: before the effort, immediately after the effort, and after one minute of recovery. The test provides an indication of how efficiently the cardiovascular system responds to exercise and returns toward resting values after physical effort. The Ruffier index was calculated using the recorded pulse values, according to the standard formula used for this test. The Ruffier index was interpreted according to the following scale: values below 0 indicate excellent cardiovascular adaptation, values between 0 and 5 indicate good adaptation, values between 5.1 and 10 indicate average adaptation, values between 10.1 and 15 indicate poor adaptation, while values above 15 suggest very poor cardiovascular adaptation to effort.



Fig 2. Ruffier Test

Coopersmith Self-Esteem Inventory

Self-confidence and self-esteem were assessed using the Coopersmith Self-Esteem Inventory, School Form. The questionnaire was administered only at the end of the study to both the experimental and control

groups. The instrument contains 58 short statements, to which students respond with “True” or “False”, depending on how well each statement reflects their self-perception. The items evaluate several dimensions of self-esteem, including general, social, family, and school-related self-esteem, together with control items intended to identify socially desirable responses. Higher scores indicate a higher level of self-esteem.

Training procedure

The experimental group followed an eight-week program based on freestyle wrestling exercises, included in the regular physical education lessons twice a week. Each lesson lasted approximately 45–50 minutes. The exercises were selected according to the students’ age and motor level and were introduced gradually, starting with simple individual tasks and later moving toward partner exercises performed in controlled and safe conditions. The program included balance and body-control exercises, low-stance movements, rolls, crawling tasks, pushing and pulling exercises, grip activities, controlled resistance with a partner, and basic freestyle wrestling movements. Short educational games were also used to make the lessons more engaging and to encourage cooperation, reaction speed, and active participation. Through these activities, the students were encouraged to improve their physical endurance, coordination, courage, discipline, respect for rules, and self-confidence. During each lesson, attention was given to correct execution, safety, respect for the partner, and gradual progression, while any competitive elements were used only for educational purposes and were carefully supervised.

Statistical analysis

The statistical analysis was performed using IBM SPSS Statistics, version 26. Descriptive statistics were calculated for all variables, including minimum, maximum, mean, standard deviation, coefficient of variation, and kurtosis. For the motor tests, paired-samples t-tests were used to compare initial and final results within each group, while independent-samples t-tests were applied to compare the experimental and control groups. For the Coopersmith Self-Esteem Inventory, which was administered only at the end of the intervention, an independent-samples t-test was used to compare the post-test scores between groups. The level of statistical significance was set at $p < 0.05$. Cohen’s d was calculated to estimate the magnitude of the difference between groups for the self-esteem scores.

Results

Descriptive statistics for motor tests

The descriptive analysis from table 1 of the motor tests indicated more favorable changes in the experimental group after the eight-week intervention. In the Harvard Step Test, the mean coefficient increased from 13.88 ± 0.48 at initial testing to 20.38 ± 1.02 at final testing, indicating a substantial improvement in cardiovascular endurance and recovery capacity. The control group showed only a minor increase, from 14.14 ± 0.36 to 14.78 ± 0.27 . A similar trend was observed for the Ruffier Test, where lower scores indicate better cardiovascular adaptation to effort. The experimental group improved from 8.88 ± 0.95 to 6.24 ± 0.96 , while the control group showed a smaller decrease, from 8.24 ± 0.90 to 7.76 ± 1.01 . These results suggest that the freestyle wrestling-based program had a more pronounced effect on students’ endurance and cardiovascular adaptation than the regular physical education program.

Table 1. Descriptive statistics

Test	N	Min	Max	Mean	Std. Dev.	Kurtosis		CV
						Statis tic	Std. Error	
Harvard EG It	20	12.98	14.66	13.88	0.48	-0.94	0.99	3.46%
Harvard EG Ft	20	17.69	22.05	20.38	1.02	1.20	0.99	5.01%
Harvard CG It	20	13.33	14.92	14.14	0.36	1.08	0.99	2.51%
Harvard CG Ft	20	14.21	15.18	14.78	0.27	-0.59	0.99	1.83%
Ruffier EG It	20	7.60	11.10	8.88	0.95	0.31	0.99	10.73%
Ruffier EG Ft	20	4.70	7.70	6.24	0.96	-1.20	0.99	15.45%
Ruffier CG It	20	6.90	9.80	8.24	0.90	-1.18	0.99	10.97%
Ruffier CG Ft	20	5.90	9.30	7.76	1.01	-1.04	0.99	13.06%

Dependent student t test for motor tests

The dependent-samples t-test from table 2 indicated statistically significant improvements in the experimental group for both the Harvard Step Test and the Ruffier Test. The Harvard Step Test coefficient

increased significantly from initial to final testing, $t(19) = -35.29$, $p < 0.001$, while the Ruffier index decreased significantly, $t(19) = 9.86$, $p < 0.001$, indicating better cardiovascular endurance and adaptation to effort after the intervention. In the control group, the Harvard Step Test also showed a statistically significant but much smaller improvement, $t(19) = -7.87$, $p < 0.001$. However, the change observed in the Ruffier Test was not statistically significant, $t(19) = 1.77$, $p = 0.093$. These results suggest that the freestyle wrestling-based program produced more consistent improvements in motor and cardiovascular indicators than the regular physical education program.

Table 2. Dependent student t test

Test/Group	Phase	Mean	Std. Deviation	Lower	Upper	t	df	p
Harvard test EG	It-Ft	-6.50	0.82	-6.88	-6.11	-35.29	19	< 0.01
Harvard test CG	It-Ft	-0.64	0.36	-0.81	-0.47	-7.87	19	< 0.01
Ruffier Test EG	It-Ft	2.64	1.20	2.08	3.20	9.86	19	< 0.01
Ruffier Test CG	It-Ft	0.48	1.23	-0.09	1.06	1.77	19	0.093

Independent student t test for motor tests

The independent-samples t-test from table 3 showed no significant baseline difference between the experimental and control groups in the Harvard Step Test, $t(38) = -1.943$, $p = 0.060$. However, at final testing, the experimental group obtained significantly higher values than the control group, $t(38) = 23.718$, $p < 0.001$, indicating better cardiovascular endurance and recovery capacity after the intervention. For the Ruffier Test, a significant baseline difference was observed, $t(38) = 2.163$, $p = 0.040$, with the experimental group presenting slightly less favorable initial values. At final testing, the experimental group showed significantly better results than the control group, $t(38) = -4.864$, $p < 0.001$, as reflected by a lower Ruffier index. These findings suggest that the freestyle wrestling-based program had a stronger positive effect on cardiovascular adaptation than the regular physical education program.

Table 3. Independent student t test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	p	t	df	p	Mean Difference	Std. Error Difference	95% C.I.	
									Lower	Upper
HarvardI	EG-CG	3.980	0.053	-1.943	38	0.06	-0.26	0.13	-0.53	0.01
Harvard Ft	EG-CG	13.555	0.001	23.718	38	0.00	5.60	0.24	5.12	6.08
Ruffier It	EG-CG	0.000	0.990	2.163	38	0.04	0.64	0.29	0.04	1.23
Ruffier Ft	EG-CG	0.012	0.913	-4.864	38	0.00	-1.52	0.31	-2.15	-0.89

Coopersmith self-esteem inventory interpretation

Self-esteem was assessed at the end of the intervention using the Coopersmith Self-Esteem Inventory. Since the questionnaire was administered only at post-test, the analysis focused on the comparison between the experimental and control groups.

The descriptive statistics in table 4 showed that the experimental group obtained higher post-intervention self-esteem scores than the control group. The experimental group recorded a mean score of 33.00 ± 3.11 , while the control group recorded a mean score of 24.90 ± 4.15 . The coefficient of variation was lower in the experimental

group (9.43%) than in the control group (16.68%), indicating greater homogeneity of self-esteem scores among the students who participated in the freestyle wrestling-based program.

The independent-samples t-test in table 5 confirmed a statistically significant difference between the two groups, $t(38) = 6.98, p < 0.001$, with a mean difference of 8.10 points in favor of the experimental group. The effect size was very large (Cohen's $d = 2.21$), suggesting a substantial between-group difference in post-intervention self-esteem scores. These results indicate that students from the experimental group presented a more favorable self-esteem profile at the end of the intervention compared with students who followed the regular physical education program.

Table 4. Descriptive statistics Coopersmith self-esteem inventory

Group	N	Min	Max	Mean ± SD	CV
EG	20	27	40	33.00 ± 3.11	9.43%
CG	20	16	35	24.90 ± 4.15	16.68%

Table 5. Independent-samples t-test for Coopersmith Self-Esteem Inventory scores

Variable	Group	N	Mean ± SD	Mean Difference	t(df)	p	Cohen's d
Coopersmith score	Experimental	20	33.00 ± 3.11	8.1	6.98 (38)	<0.001	2.21
	Control	20	24.90 ± 4.15				

Discussions

The present study investigated whether an eight-week program of freestyle wrestling exercises, integrated into regular physical education lessons, could influence physical endurance and self-confidence in seventh-grade students. Overall, the results indicate that the experimental group obtained better outcomes than the control group in the motor tests and in the post-intervention self-esteem assessment. The Harvard Step Test and Ruffier Test showed more favorable changes in cardiovascular endurance and adaptation to effort among students who followed the wrestling-based program, while the Coopersmith Self-Esteem Inventory indicated higher post-intervention self-esteem scores in the experimental group.

The improvement recorded in the Harvard Step Test can be explained by the physical structure of the wrestling-based exercises used during the intervention (Francino et al. 2022, Chaliburda et al. 2022). Although the program was adapted for school physical education and did not aim to reproduce competitive wrestling training, it included repeated changes of position, low-stance movements, crawling tasks, pushing and pulling exercises, grip activities, controlled resistance with a partner, and short educational games. These activities involve large muscle groups and repeated effort, which can stimulate both cardiovascular endurance and recovery capacity (Cerit 2025, Saraiva et al. 2023). This interpretation is supported by Stamenković et al. (2022), who concluded that martial arts programs can contribute to the development of physical fitness in preschool and school-aged children, especially cardiorespiratory fitness, strength, speed, agility, coordination, flexibility, and balance. The same authors also emphasized that the experimental groups included in most analyzed studies showed significant improvements from initial to final testing, which is consistent with the trend observed in the present study.

The Ruffier Test results followed a similar direction. The experimental group showed a significant decrease in the Ruffier index, which indicates better cardiovascular adaptation to physical effort. In contrast, the control group showed only a small change that was not statistically significant. This difference may be related to the intermittent nature of wrestling-specific activities. Even in a simplified form, wrestling involves short periods of effort, brief recovery moments, body control under fatigue, and repeated transitions between tension and relaxation (Roklicer et al. 2022, Zheng et al. 2025). These demands are likely to challenge the cardiovascular system more than some traditional physical education activities. Francino et al. (2022) also reported that a structured six-week training program improved wrestling-specific performance in trained wrestlers, supporting

the idea that well-organized wrestling-related exercises can produce measurable physical adaptations. Although their participants were trained athletes and not school students, the study confirms the value of structured wrestling-specific work for improving physical performance indicators.

It is important to note that the intervention used in the present research was not a competitive wrestling program. The exercises were selected and adapted for the educational context, with constant attention to safety, gradual progression, cooperation, and respect for the partner. This distinction is essential, because the effects of combat sports on children and adolescents depend strongly on how these activities are taught. Vertonghen & Theeboom (2010) showed that the social and psychological outcomes of martial arts practice among young people are not uniform and may vary according to several factors, including the type of guidance, the social context, the characteristics of the participants, and the structure of the activity. Therefore, the positive results observed in the present study should not be attributed only to the physical content of wrestling, but also to the way the program was organized and delivered in the physical education lesson.

The motor results also fit with the idea that combat-sport-based activities can support broader motor development in children and adolescents (Kruszewski & Kruszewski 2025, Stamenković et al. 2025). Wrestling requires balance, stability, coordination, spatial orientation, body control, and the ability to react to the partner's movement (Bölükbaşı et al. 2025). Kruszewski & Kruszewski (2025) investigated primary school pupils who participated in wrestling training and focused on static balance under different testing conditions. Their study highlights the relevance of balance control in wrestling and supports the idea that wrestling practice can be linked to important components of motor development. In the present study, these elements were not assessed separately, but they were present in the structure of the exercises and may have contributed indirectly to the improvement of endurance and cardiovascular response.

The self-esteem results are also relevant, especially because the experimental group obtained significantly higher post-intervention scores on the Coopersmith Self-Esteem Inventory than the control group. This result may be explained by the specific learning situations created during the wrestling-based lessons. Students had to work with a partner, respect clear rules, manage controlled opposition, overcome hesitation, and gradually perform tasks that may initially have seemed difficult. Such experiences can increase perceived competence and may help students develop a more positive perception of their own abilities. Lakes & Hoyt (2004) found that a school-based martial arts intervention led to greater improvements in cognitive and affective self-regulation, prosocial behavior, classroom conduct, and mental math performance compared with traditional physical education. Although self-regulation and self-esteem are not identical constructs, both are connected to confidence, emotional control, discipline, and the ability to manage challenging situations (Ying et al. 2025).

The psychological findings are also in line with recent discussions on the role of wrestling and combat sports in educational settings. Peng et al. (2025) argued that physical activity in adolescence supports physical, psychological, and social development, and discussed wrestling as a possible component of the physical education curriculum. Their work is relevant for the present study because it places wrestling within the broader educational aim of improving health, social adaptability, and student development. In addition, Ying et al. (2025) discussed the relationship between combat sports, emotional intelligence, self-esteem, and subjective well-being in university students. Although their sample was older than the participants in the present study, their theoretical explanation is useful because it suggests that combat sports may offer opportunities for skill mastery, challenge management, and goal achievement, which can support self-esteem and positive psychological functioning.

Overall, the results suggest that integrating freestyle wrestling exercises into physical education lessons can be a useful and attractive way to develop endurance and support self-confidence in seventh-grade students. Compared with the regular physical education program, the wrestling-based intervention offered a more varied motor stimulus and created learning situations that encouraged cooperation, courage, discipline, respect for rules, and controlled physical challenge. However, the findings should be interpreted in relation to the relatively small sample size, the eight-week duration of the intervention, and the fact that self-esteem was assessed only at post-test. Future studies should involve larger groups, longer intervention periods, and a complete pre-test-post-test design for both physical and psychological variables.

Conclusion

The results of this study suggest that the integration of freestyle wrestling exercises into physical education lessons had a positive effect on seventh-grade students' physical endurance. After the eight-week intervention, the experimental group showed greater improvements than the control group in both the Harvard Step Test and the Ruffier Test, indicating better cardiovascular endurance and adaptation to effort. The Coopersmith Self-Esteem Inventory also showed significantly higher post-intervention scores in the experimental group compared with the control group. This suggests that the wrestling-based program may support a more

favorable self-esteem profile when it is applied in a safe, structured, and educational context. Overall, freestyle wrestling can be considered a useful and attractive method for diversifying physical education lessons, contributing not only to physical development, but also to students' confidence, discipline, cooperation, and involvement in physical activity. However, future studies should include larger samples and apply the self-esteem questionnaire both before and after the intervention in order to better observe psychological changes over time.

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