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DIFFERENTIATED TEACHING MODEL FOR THE MOTOR DEVELOPMENT OF MIDDLE SCHOOL STUDENTS

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Abstract: This paper investigates the impact of applying differentiated instruction in physical education classes, by organizing students into value and biological groups, depending on their level of motor and somatic preparation. The study was conducted on a sample of 81 middle school students, assigned to an experimental and a control group, during one school semester. The didactic intervention aimed to adapt the content of the lessons to the specifics of each group, using programmed instruction methods (linear and combined) and differentiated assessment scales.

The results showed improvements in motor performance among students in the experimental classes, especially in the groups with an initial average and low level. Statistical analysis revealed differences between the initial and final measurements in most of the applied tests, confirming the effectiveness of differentiated instruction. At the same time, an increase in group homogeneity and increased motivation among students were noted.

The conclusions support the pedagogical validity of organizing training in value groups and recommend expanding this model on a larger scale, with periodic updating of group composition based on individual progress and lesson topics.

Key words: differentiated instruction, physical education, value groups, motor assessment, method programmed, homogeneity

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INTRODUCTION

This approach is essential to ensure a harmonious development of motor skills and an optimal adaptation of the physical education program to the individual needs of each student (Боднар & Prystupa, 2016).

Differentiation of instruction allows educators to adapt teaching methods and content according to the level of physical development, specific motor skills, and biological stage of students (Rodríguez-Negro et al., 2019). This personalization of learning, centered on students' cognitive, physical, psychomotor, emotional, and social needs, is crucial to optimizing individual progress and maximizing engagement in physical activities (Özbal et al., 2019).

An effective teaching strategy in physical education involves a deep understanding of individual differences among students, including their levels of preparation, interests, and learning styles, in order to personalize the educational process (Colquitt et al., 2017). This individualization of instruction contributes to the full development of each student's potential, recognizing that motor skills vary significantly according to biological maturity, gender, and developmental stages (Rodríguez-Negro et al., 2019).

Careful consideration of the categories of difference in physical education, as perceived and evaluated by students, can provide valuable insights for curricular and methodological adaptation (Bartsch et al., 2022). For example, athletic talents, participation in extracurricular sports activities, and types of sports practiced outside of school are important factors that can influence how students perceive the relevance of different categories of difference within physical education classes (Bartsch et al., 2022).

This highlights the need for physical education to capitalize on diverse physical capacities and provide students with a variety of movement, play, and sports experiences to discover their individual preferred activity (Kirch et al., 2021). This tailored approach aligns with the concept of differentiated instruction, which aims to personalize the learning process by accommodating students' varied readiness, interests, and learning profiles (Colquitt et al., 2017).

This pedagogical strategy enhances student engagement and achievement by adapting instruction, content, and assessment to meet the diverse needs of learners (Goyibova et al., 2025). This is achieved by forming groups based on students' unique characteristics, such as their abilities, interests, and prior knowledge, thereby supporting teaching within these homogeneous groups (Goyibova et al., 2025).

This reality raises fundamental questions regarding the effectiveness of uniform instruction and the need to implement differentiated pedagogical strategies.

In physical education lessons, interventions on students' motor skills must take into account individual characteristics, determined by the dynamic and heterogeneous nature of the class composition. Each student represents a unique entity, with a distinct bio-motor profile, which implies the need for a differentiated approach. However, in current practice, a standardization of the instructional process is often observed: all students perform the same exercises, at the same pace and volume, being evaluated according to identical scales, regardless of their level of training or effort capacity. Such an approach generates inequality in physical demand, compromises the objectivity of the evaluation and reduces the efficiency of the educational act.

Differences in motor development determine a variable capacity for effort: some students can sustain intense and long-lasting exercises, while others have difficulty achieving the minimum requirements of the curriculum. The selection of adapted instructional means becomes essential, allowing both advanced students to progress and those with a low level of preparation to improve their capacity for effort. The application of differentiated instruction, by organizing into value groups, aims to reduce intra-group variability and promote an equitable learning climate.

This method is based on the principle of accessibility of content and individualization of instruction, requiring respect for the bio-motor particularities of each student (Dragnea et al., 2006). Applying this principle does not imply reducing requirements to a minimal level, but rather establishing an optimal threshold of demand, which is stimulating and achievable for each category of students (Dumitrescu, 2011).

The main goal of this research is to optimize the instructional-educational process within physical education lessons at the middle school level, by applying a differentiated instruction strategy that involves organizing students into value and biological groups. This approach aims not only to increase students' motor performance, but also to promote a more objective assessment, adapted to the real level of development of each participant.

To achieve this goal, the research aimed to investigate the educational potential of differentiated instruction, starting with diagnosing the initial level of physical and motor development of students. Based on these data, homogeneous groups were formed, using objective somatic and motor criteria, which substantiated both the planning of teaching activities and the establishment of a differentiated grading system. Educational activities were integrated into the thematic links of the lesson, being built on the basis of mixed themes (motor skills and qualities) and carried out in successive lesson cycles. Through direct observations and descriptive analyses, student involvement, the efficiency of group work, individual progress and the applicability of differentiated scales in practice were monitored. It was also aimed to identify possible implementation difficulties and verify compliance with the principle of accessibility, by adapting the effort to the specifics of each value group.

The working hypothesis formulated is based on the premise that the differences between students, both in terms of somatic development and the level of motor skills, justify the application of differentiated instruction. It is assumed that organizing lessons by homogeneous value groups and adapting the didactic content to the potential of each student will lead to a more efficient educational process and the creation of equitable conditions for individual progress.

MATERIALS AND METHODS

Subjects

The experimental study was conducted on a sample of 81 middle school students, divided into an experimental group (n = 50) and a control group (n = 31). The experiment was conducted at Middle School No. 1 Tileagd, in the second semester of the 2020–2021 school year, between February 8 and June 18. The sample consisted of students in grades 5 and 7, with the experimental group consisting of students in grades 5 A and 7 A, and the control group consisting of students in grades 5 B and 7 B. The choice of these classes allowed for the comparison of the effects of the systematically applied differentiated method on motor development, in relation to traditional instruction. The didactic intervention was integrated into the current physical education class schedule, and all activities were carried out under the supervision of the same teacher, to ensure the homogeneity of the instructional process.

In the experimental group, instruction was conducted using the differentiated method, by organizing students into value groups based on their motor level. In contrast, students in the control group were instructed using traditional methods, without differentiation, using frontal practice at the entire class level.

In the research, the formation of value and biological groups was based on a set of objective criteria, derived from the methodology of sports training and adapted to the particularities of secondary education. The goal was to ensure differentiated, equitable and efficiently calibrated training in relation to the bio-motor potential of each student.

The value grouping was based on the level of general physical fitness, assessed through seven standardized motor tests: standing long jump, vertical jump (Sargent test), chest weight throw, ball throw, speed run (50 m), endurance run (4 minutes) and trunk lift from supine position. For each test, a score from 1 to 10 was assigned, based on the best result recorded among boys and girls. The maximum possible total was 70 points. The ranking allowed the distribution of students into three value groups: group I: high level of physical fitness, group II: medium level, group III: low level. This distribution allowed the adaptation of the volume and intensity of exercises to the real capacities of the students, favoring individual progress and optimizing the effort made.

To complete the motor criterion, biological groups were formed based on somatic data: height (main criterion), body weight and chest elasticity. The statistical benchmarks used were compared with national averages and the corresponding standard deviations (source: biomotric.ro). The classification was made as follows: biological group I: overdeveloped students (above average in height and at least one of the other two indicators), biological group II: students with normal development (values close to the average) and biological group III: underdeveloped students (below the national average in height and at least one other indicator).

In some cases, it was necessary to correct the classification based on the correlation between motor performance and somatic development. Students with high motor performance, but biologically classified in lower groups, were reclassified to ensure a realistic and correct assessment. The same adjustment was also applied in the opposite direction, avoiding overestimating those with good somatic development, but modest motor results.

By using these two types of grouping (value and biological) in parallel, a differentiated evaluation system was developed that takes into account the real potential of the students. Height was considered the main indicator due to its genetic stability, and its correlation with weight and thoracic elasticity provided a complete picture of biological maturity. The differentiated scoring system was structured by groups and genders, calibrating the scales of each test to the specifics of each category, in order to avoid unjustified penalization or favoritism.

This approach has demonstrated not only an increase in the objectivity of assessment, but also a reduction in demotivation, unexcused absenteeism and abusive medical exemptions. It contributes to the creation of a more equitable instructional framework, in which students are assessed according to their potential and availability, thus supporting the principles of inclusive pedagogy and student-centered education. The study was conducted in accordance with the Declaration of Helsinki

Activity by value groups

The students' practice activity in value level groups was carried out in thematic links, depending onby the nature of the lesson themes. We approached mixed (combined) lessons with a theme of motor skills (gymnastics, athletics, sports games) and a motor quality. A leader was established for each group, initially designated by the teacher, then changed and a more involved, more active student, concerned about the progress of the group he is part of, was chosen. Among these leaders, the less active students were also chosen.

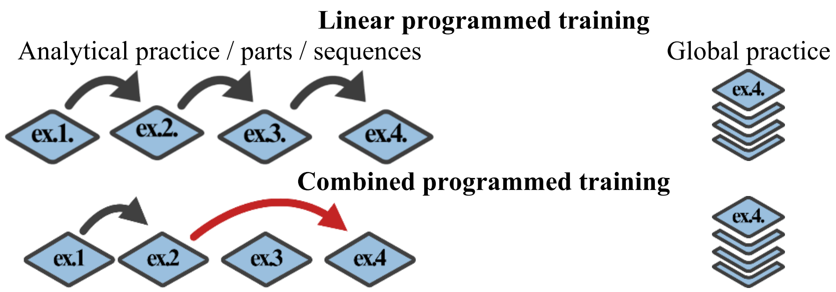

Figure 1. The two variants of programmed training and the method of application

The research was based on the principle that effective learning requires full understanding of the content, an essential condition for conscious assimilation (Orțan et al., 2014). Consequently, along with differentiated treatment, we also used two variants of the programmed instruction method: linear and combined (figure 1), which we believe respects the principle of accessibility and the two variants coincide with analytical and global practice. The degree of difficulty of a motor action can be reduced by practicing the exercise proposed for learning in sequences. Thus, this method is adjusted depending on the level of technical execution, the degree of demand on the body (therefore depending on the feedback received from the students).

In the training process, for value group 1 (with good physical training), we established that learning motor actions should begin with full practice. Only in situations where execution difficulties arise, we resorted to detaching and practicing separately the elements that require increased attention. Therefore, we applied a form of combined training. With value group 3 (the other two value groups are not excluded either, in the situation where frequent mistakes or execution difficulties are observed in several students) we used linear programmed training which consisted in acquiring, in a certain order, a motor skill. It was based on small steps, through a large number of repetitions, with the transition from one technical procedure to another, only if the students managed to execute the motor action correctly. In value groups 2 and 3, we considered two factors: learning time and learning quality, and in value group 3, we focused on global and fluent execution and on the development of the required motor qualities.

We paid special attention to the development of motor qualities in relation to the possibilities of each value group. The specialized literature suggests that a high level of motor qualities shortens the duration of the motor action acquisition. In the effort regulation action, we intervened in two ways: by modifying the effort parameters and increasing the duration of the pauses between repetitions and their nature (passive or active). For example, we used two drive systems (during 4 lessons) for the development of resistance that differ in the volume characteristic (number of repetitions, running time) and intensity of effort (2/4 and 3/4), differently by value groups.

Data analysis and interpretation

The main statistical functions used in the processing of experimental data were: arithmetic mean, standard deviation, standard error of the mean, coefficient of variation and statistical significance testing. Their calculation was performed using the IBM SPSS Statistics 25 program, establishing a significance threshold of $p < 0.05$, which indicates a 5% probability that the observed differences are due to chance and a 95% probability that they reflect real effects. When statistically significant differences were found between the two groups, these were attributed to the influence of the pedagogical intervention, namely the application of the differentiated instruction method by value groups and the adaptation of the contents to the bio-motor particularities of the students.

RESULTS

Performance in the standing long jump showed improvements compared to the initial assessment (figure 2). At the experimental class level, progress was notable: Grade 5 A recorded an average increase of +29.3 cm, while Grade 7 A advanced by +20.76 cm. By comparison, the control classes showed modest improvements of only +2.3 cm in both Grade 5 B and Grade 7 B.

Analyzing the developments by gender, it is noted that girls in the experimental classes achieved significant progress, especially those in the 5th grade A (+23.75 cm) and the 7th grade A (+15.67 cm). In contrast, in the control classes, the values were lower compared to the initial measurements. Boys in the experimental classes also recorded superior results: in the 5th grade A, the average exceeded that of the 5th grade B by +32.53 cm, and in the 7th grade A, the difference compared to the control class was +20.36 cm.

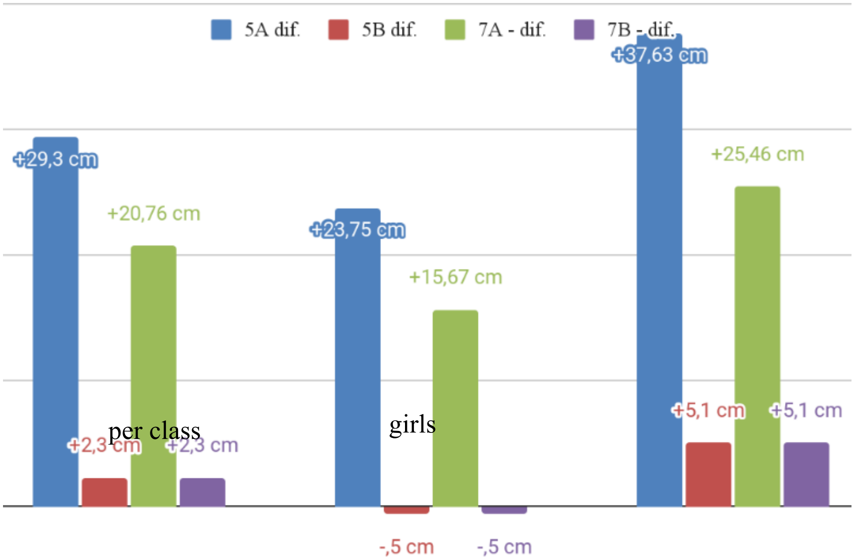

Figure 2. Evolution of standing long jump results between the two measurements

The results for the standing long jump show that value group no. 1 recorded an increase of +31 cm (from 126 cm to 157 cm), group no. 2 progressed by +28 cm (from 118 cm to 146 cm), and group no. 3 advanced by +29 cm (from 101 cm to 130 cm). It is important to note that the final average of value group no. 3 exceeded the initial level of students considered to have good physical training, which reflects the efficiency of the differentiated training program applied.

The coefficient of variability decreased significantly in grade 5A, from 16.78% to 9.89%, indicating an increase in group homogeneity. In grade 7A, homogeneity is considered relative, with values ranging from 10% to 20%. The differences observed between the initial and final means are statistically significant, with t-test values of 10.209 (>2.093) for grade 5A and 8.456 (>2.064) for grade 7A, which confirms the positive impact of differentiated training by value groups within the thematic themes addressed.

In the standing ball throw test, the rate of increase in performance by class indicates a progress of approximately +6 meters within the experimental classes. Thus, class 5 A evolved from 14 meters to 20 meters, and class 7 A from 22 meters to 28 meters. In comparison, the control classes recorded more modest progress: +2 meters in class 5 B (from 15 m to 17 m) and +4 meters in class 7 B (from 26 m to 30 m). It is observed that the progress is more pronounced in the classes that presented lower initial averages, which suggests a greater margin of improvement. Comparing the performances between the experimental and control classes, the difference is +3 meters in favor of class 5 A and +2 meters in favor of class 7 B.

At the level of the three value groups in the experimental classes, the most obvious evolution was registered among the students with a low initial level of physical training. They progressed by approximately +8 meters compared to the initial assessment in February: in the 5th grade A, the average score increased from 9.64 m to 18.22 m, and in the 7th grade A, from 12.97 m to 20.59 m. It is worth noting that the value group no. 3 in the 5th grade managed to exceed the initial average values of the higher groups, recording a final average of 18.22 m compared to 16.59 m and 13.77 m of the other groups.

The homogeneity of the student groups remained low throughout the experiment, with a coefficient of variation ranging from 21.43% to 36.02%. This wide dispersion of results can be explained by the differences in execution capacity, both in girls and boys, as well as by the low level of development of the combined physical qualities involved in this test.

Statistically, the results are significant. The t-test value for both experimental classes was 7.089 (df = 19) and 8.499 (df = 24), respectively, both exceeding the critical value in the Fisher table at a significance level of 0.05. This confirms the existence of a significant difference between the two measurements, attributable in proportion to 95% to the training program applied within the thematic links of the intervention.

In sprinting, we observe that the fastest students are assigned to value group 1, the exception being students in value group 2, in grade 5 A, who record a time 12 hundredths better than value group 1. Analyzing the data before and after the experiment, in the two experimental classes, we note the obvious progress in students in the value group with poor physical training of 1 second and 91 hundredths in grade 5 A and 1 second and 34 hundredths in grade 7, but the times are worse at the initial measurement. In the other groups, the rate of improvement in times is: 1 second and 57 hundredths in value group no. 1 and in group no. 2 by 1 second (both in grade 5), 51 and 37 hundredths in value group no. 2 and no. 1 from grade 7.

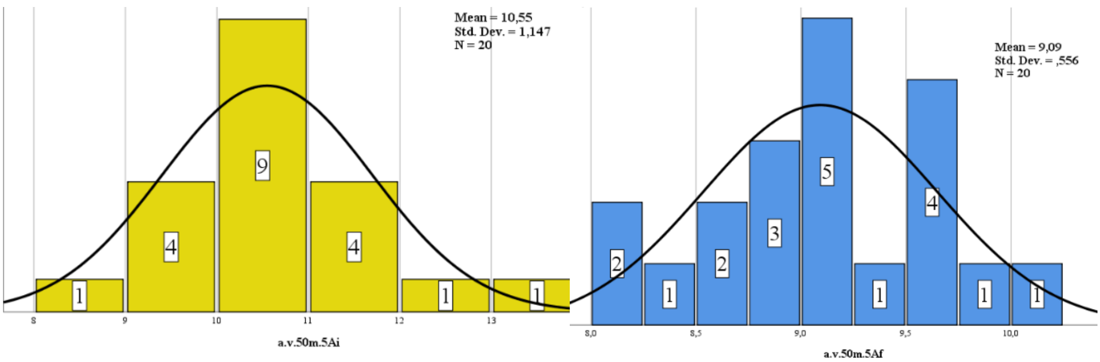

Figure 3. Distribution of results in the 50 m sprint – class Va A. The graph on the left represents the distribution of results from the February measurement and the one on the right represents the June measurement.

From the analysis of figure 3, we observe in the 5th grade, a normal distribution of results, with the results clustering around the mean, only in the second measurement, the data tend to cluster towards better (lower) values (figure 3).

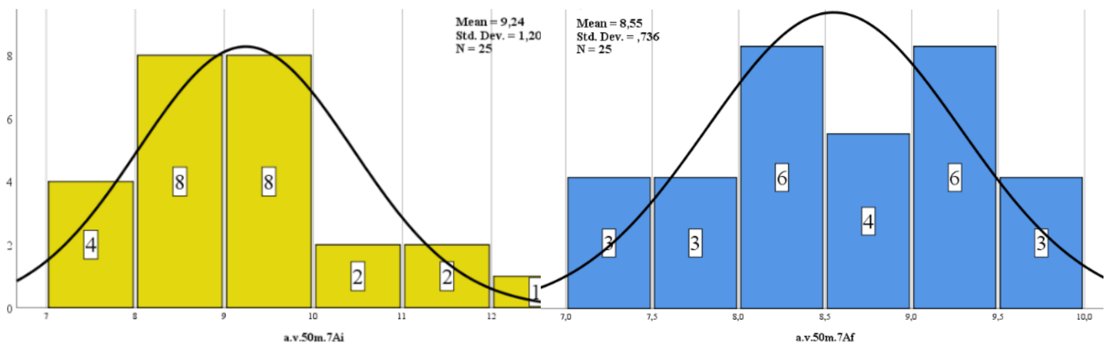

Figure 4. Distribution of results in the 50 m sprint – grade VII A

In the seventh grade, the shape of the distribution (figure 4) is relatively similar, in the first measurement, it presents a slight asymmetry to the left towards the better (lower) values and in the second measurement a distribution and a normal curve of the results, with 13 students with results above the average per class (8.55”) and 12 students below this limit. The value of t calculated, in both experimental classes, is superior to that in Fisher's table at the significance threshold p=0.05, the null hypothesis is rejected, showing us that there is a connection between the evolution of the times recorded with the organization and preparation of the students in the research interval. The coefficient of variability improves and confirms us in the June measurement, a high homogeneity in the experimental classes (6.12% and 8.61%) and the fifth grade B (control - 9.79%) and an average homogeneity in the seventh grade B (14.03%) with an average spread of the results.

The endurance running test assessed cardiorespiratory (aerobic) capacity. Students ran for 4 minutes around a 50 m square, and the distance covered was measured in meters, calculated based on the number of laps completed (1 lap = 50m). The average data recorded in the second measurement per class indicate that in Grade 5 A, the class ran an average of 670 m (approx. +3 laps), for boys 681 m and for girls 662 m; in Grade 5 B, the class ran an average of 650 m (approx. +1-2 laps), for boys 680 m and for girls 620 m; in Grade 7 A, the class ran an average of 670 m (approx. +1 lap), for boys 706 m and for girls 657 m; and in the 7th grade B, the average class ran 669 m (=), for boys 705m and for girls 590m.

Students with poor preparation have a growth rate of 2 times compared to the other value groups but below the calculated average, at the June measurement, it remains below that of those in the higher groups. In the 5th grade A, the statistical-mathematical calculation of the statistical significance (1.493) is below the significance threshold of 0.05 (2.093), in this case the null hypothesis is accepted ($p< 0.05$), which shows that there is no connection between the students' results and the preparatory activity carried out in the lessons. However, in the 7th grade A, the null hypothesis is rejected ($t = 7.077$ and p at 0.05 = 2.064), so there is a significant difference between the average final results and the initial ones. In the experimental classes, homogeneity is high in the 5th grade A (7.81%) and relative in the 7th grade A (12.43%), and in the control classes, there is an average dispersion of the results (14.55%) and low in the 7th grade B (20.22%).

DISCUSSIONS

Comparing the results of the experimental classes with those of the control classes highlights the positive impact of applying differentiated instruction and programming adapted to the value level of the students. The most obvious progress was recorded in value groups 2 and 3, where the lower initial level allowed for a more pronounced development of motor skills. These data support the hypothesis that differentiating the content of lessons contributes to overcoming uniformity and allows the individual development of the motor potential of each student.

In the process of forming and managing the value groups, a number of significant aspects were noted. Initially, dissatisfaction arose among students with high academic performance but with weaker physical training, due to their distribution in lower groups. However, by appointing group leaders and promoting teamwork, an improvement in relations and an increase in internal cohesion was noted. In grade VII A, the large size of the group (25 students) generated organizational difficulties, which were managed, however, by diversifying the practice methods, adapted to the topic of the lesson.

The students showed a high interest in the lessons, being motivated not only by their own progress, but also by the prospect of promotion to a higher group. Those with average or poor physical training required a higher number of repetitions, through analytical practice, to reach the correct and complete execution of motor actions. The pace of progress was variable between groups, but generalized, with the most obvious improvements in the lower groups, a fact justified by the greater potential for recovery and improvement. These differences support the validity of the initial assignment criteria.

Based on the data obtained, we recommend periodic review of the composition of the value groups, preferably twice a year, in accordance with changes in context (e.g. transition between indoor and outdoor activities). Statistical analysis (Student's t-test) confirms the existence of significant differences between the initial and final measurements for most motor tests, indicating the effectiveness of the differentiated method. The only exception is the endurance running test, where the differences were not statistically significant, although individual improvements were observed.

At the end of the intervention, performance increased in all groups, which was reflected in the final ranking of students. For example, in 5th grade A, several students advanced to higher groups, while others, although they regressed in the group, accumulated increased scores compared to the initial assessment. In 7th grade A, there were both regressions and significant advances, highlighting the dynamics of individual evolution. The differentiated grading system allows at any time to position the student both within the group and within the class as a whole. At the same time, it offers an efficient and accessible solution for teachers to realistically assess the motor progress of students.

It is important to emphasize that the grades awarded according to the scales specific to each biological group are not directly comparable between groups, even if the final scores may coincide (e.g. two students from different groups obtain a grade of 10 for different performances). For a more objective assessment of the student's position in the class, without ignoring differences in motor potential, the grading system of the intermediate value group (group no. 2) can be used, which corresponds to the minimum requirements of the national evaluation system in physical education and sports.

CONCLUSIONS

The application of differentiated instruction in physical education classes has demonstrated efficiency in optimizing the motor progress of students, especially in groups with average and poor initial physical training. The results indicate not only an improvement in individual performance, but also an increased mobilization of students in the learning process, reflected by the desire to advance to a higher group and active involvement in the lessons. The distribution by value groups, correlated with differentiated evaluation scales, contributed to the creation of a fair learning environment, adapted to the level of each student.

The proposed system provides physical education teachers with a clear methodological framework, applicable in various school contexts, favoring both individual performance and the development of a climate of collaboration and motivation. Although there were some limitations, such as the difficulty of managing large numbers or the rigidity of maintaining groups in the long term, the overall results support the implementation of differentiated approaches in motor education. It is recommended to expand and periodically adjust the value groups, depending on the progress of the students and the topic of the lessons, in order to maintain a dynamic and efficient educational process.

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