COMPARATIVE STUDY ON THE DEVELOPMENT OF MOTOR SKILLS THROUGH SWIMMING TRAINING IN PRIMARY SCHOOL CHILDREN

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Abstract: Introduction: Swimming practice during childhood facilitates the achievement of good cognitive, physical and functional performance. At the same time, some developmental stages are completed faster, and a number of physical abilities are developed. Swimming can be found in the school curriculum as part of motor skills specific to some seasonal sports. The lack of material resources in most Romanian schools makes it impossible to practice it within the compulsory physical education lessons provided in the core curriculum.
Materials and Method: The participants were 38 first-grade students aged 6-8 years, who were divided into two groups. Students in the experimental group were in an integrated swimming sports program classroom, and all of them were beginners. The tests used to assess their conditional and intermediate motor skills were: 20 m sprint with a standing start, shuttle run, standing long jump, and a flexibility test.
Results: The results are presented comparatively for the two groups and emphasize the higher motor level of students who participate in swimming lessons, in addition to the compulsory physical education lessons.
Conclusions: Students should benefit from the advantages and opportunities offered by motor activities. Students who practice swimming enjoy multiple benefits. These ones are also confirmed by the hypotheses of the study, according to which there are significant differences in the development of conditional and intermediate motor skills between students who practice additional swimming lessons within an integrated swimming sports program classroom and those who only participate in the compulsory physical education lessons provided in the school curriculum.
Keywords: *physical education, motor skills, swimming, integrated sports classroom*

Introduction

Swimming has been practiced by people since ancient times due to its formative values and the benefits induced regardless of gender and age. As part of the system of means by which the multilateral education of the young generation is achieved, swimming contributes to the strengthening of health, the structural and functional improvement of the body, the development of personality, and the education of motor skills.

Learning to swim since childhood facilitates the achievement of good cognitive, physical and functional performance (Jorgensen, 2017; Machado et al., 2022; Salazar et al., 2016). Students who practice swimming in the first years of school develop a wide range of physical abilities and complete some developmental stages faster than students who do not swim or learn to swim in adolescence.

Moreover, in the early school years, the foundations of personality are laid and important adaptive behaviors are built. Through swimming, the child experiences a wide range of emotions and feelings (Borges & Maciel, 2016), from joy, fear and pleasure to desire and passion to practice this sport. Swimming helps mentally (Nunes, 2020), inducing calmness and relaxation through the countless possible movements that can be performed in water. In biomechanical terms, these movements are similar to those performed on land. At the same time, these movements are different due to the presence of the aquatic environment. Last but not least, children have the opportunity to develop social skills (Salazar, et al., 2016) as well as communication skills, which they can use throughout their lives.

All these arguments represent a solid basis that supports the inclusion of swimming in the school curriculum, in the area addressed to some seasonal sports disciplines. The lack of adequate material resources (swimming pools) in most Romanian schools makes it impossible to practice it within the compulsory physical education lessons provided in the core curriculum.

However, swimming is included in the school curriculum for the practical sports training of students in integrated sports education classrooms. According to the Ministry of National Education (MEN, 2014), this program is focused on competencies that allow solving specific problems through the means of swimming, which have distinct characteristics that are not found in sports practiced on land. These properties are given by the specifics of the effort, the horizontal position in which swimming is performed, the specific aquatic breathing, the permanent pressure exerted by water on the rib cage, and the low bodyweight (Bălan, 2018).

The above-mentioned curriculum mentions the general and specific competencies for swimming, the stage of training and related contents. For integrated sports education – swimming specialization, the curriculum addresses groups of students with different levels of learning specific motor skills: beginners, advanced, elite. The groups have an open character, with students being promoted to higher groups at the beginning of the school year based on each one's level of performance. Practical sports training lessons start in 1st grade, and the volume is 4 hours per week. (MEN, 2014)

For students in mainstream schools, the physical education and sports curriculum has the same structure as the integrated sports education curriculum and aims to develop the training specialization of the primary school student (MEN, 2013; Mihăilă & Paraschiva, 2019). The physical education and sports curriculum provides a flexible offer that allows the teacher to modify, supplement or replace learning activities (MEN, 2013). At the same time, the curriculum enables the teacher to permanently adapt the contents to the age level and the quantity and quality of acquisitions made by students in the previous lesson or lessons (Bălan & Shaao, 2014). The curriculum content is detailed for athletics, gymnastics and sports games, given that these sports disciplines are frequently used in physical education lessons. The curriculum mentions skiing, roller/ ice skating, swimming, chess and sledging, which are considered seasonal sports that can only be practiced under certain conditions. Thus, students attending mainstream education courses cannot benefit from the advantages of swimming as part of the compulsory school activity, but only as part of the extracurricular activities performed in their free time.

Practicing motor activities during childhood plays an essential role in the further development of students and the education of their "taste" for movement. This is built by participating with pleasure in physical education lessons, coupled with the student's involvement in additional sports activities such as practicing a sport within the integrated sports education classes.

The role of motor activities is all the more important as the student is in the period of growth and development, during which numerous and major morphological, physiological, physical, motor and mental changes take place.

The first-grade student is in the first stage of childhood (Predescu & Popescu, 2011), when morphological and physiological changes occur at a varied rate. During this stage, there are no major gender differences related to weight, height and development of the neuromuscular system, nervous system and vegetative sphere. The most significant aspect refers to the weak development of differentiation inhibition and the predominance of excitation, which causes instability and difficulty in concentrating and maintaining attention for a long time (Predescu & Popescu, 2011). Children breathe faster than adults (about 25 breaths per minute) because they need more ventilation to meet oxygen demand. This is due to the fact that a child has a smaller number of lung alveoli compared to an adult. At the same time, cardiac output is higher in children than in adults. As they get older, their cardiac output begins to decrease. Physical activity, body size, ventilation rate and metabolic rate affect cardiac output in one way or another (Sadeeh & Klaunig, 2014), its values being between 8 and 9 liters per minute at 6-8 years of age (Braneț, 2016). The cardiovascular system shows age-specific tachycardia with a resting frequency of 90 beats per minute at 7 years and 84 beats per minute at 8 years (Macovei, 2010). A child can hardly cope with intense demands because their heart has a small volume.

Motor learning ability is remarkable at this age, but opportunities for consolidating new movements are reduced (Dragnea & Bota, 1999). Gross and fine skills continue to consolidate but will refine during middle childhood. Physical development can influence both the practice of physical activity and the ability to interact with the environment. Students learn by imitation because they are attracted to new and unfamiliar activities. Movement is associated with affective, cognitive and social development (Grigoroiu et al., 2023).

The mental development of the student between the ages of 6 and 10 is influenced by the start of school. This period is known as the "golden age" because the student has no responsibilities and can play freely. This period determines the child's identity (Mitrache & Bejan, 2011), and their development progress is important. With the start of school, the student really discovers the group.

Materials and method

The participants were 38 first-grade students aged 6-8 years, who were divided into two groups. The experimental group was made up of 20 students (12 boys and 8 girls) from "Emil Racoviță" National College (CNER), and the control group consisted of 18 students (11 boys and 7 girls) from Middle School no. 85 (SG85), both in Bucharest.

We mention that CNER students were in an integrated swimming sports program classroom, and all of them were beginners. This aspect was important in choosing them to be part of the experimental group because they were in the stage of learning to swim.

For swimming students, the tests took place in the Athletics Hall of the "Lia Manoliu" National Complex, and for students included in the second sample, the tests took place on the sports field or in the gym of SG85.

The initial and final testing sessions were separated by a 6-month period, during which CNER students attended the physical education lessons provided in the school curriculum for grade 1 (2 compulsory lessons per week) and also in 3 swimming lessons per week lasting 60 minutes each, while mainstream school students only participated in the compulsory physical education lessons (2 lessons per week).

The contents of swimming lessons complied with the provisions of the school curriculum for practical sports training in integrated sports education (MEN, 2014), but they also considered the growth and development characteristics of students. The lessons were coordinated by the female swimming teacher appointed by CNER to guide the activity of those students and respected the structure of the school year.

The compulsory physical education lessons for both CNER and SG85 students were coordinated by the physical education teachers assigned to the respective classrooms and took into account the provisions of the first-grade school curriculum.

It should be mentioned that we obtained the consent for student participation in the two tests. At the same time, the provisions in force for studies conducted on human subjects (children) were respected, and the team that coordinated the study received the approval of the Ethics Committee (742/SG/18.07.2023) to carry out the proposed scientific research.

The hypotheses of the study aimed to identify whether there were significant differences in the development of conditional and intermediate motor skills between students practicing additional swimming lessons within an integrated swimming sports program classroom and those who only attended the compulsory physical education lessons provided in the school curriculum.

The scientific research methods used to conduct the study were: documentation, observation, experiment, mathematical statistics, and graphical method.

To assess the investigated motor skills, the team of specialists who coordinated the study used three of the four tests included in the methodology for admission to 1st grade, swimming specialization: 20 m sprint with a standing start, shuttle run (5 x 10 m), and standing long jump. A flexibility test was added because this intermediate motor skill is very important in swimming due to the fact that it facilitates the learning of the specific technique. In the phase of consolidation and improvement of the technique, a good level of flexibility development allows for an efficient swimming technique that requires low energy consumption.

Moreover, we chose the above tests because they best highlight the differences between the two groups of participants. These tests are known and used for integrated swimming sports program classrooms and in the physical education lesson when the goal is to assess conditional or intermediate motor skills.

20 m sprint test with a standing start

Materials required: cones, timer, whistle

The test was used to measure movement speed over short distances. The student started at the teacher's signal and had to cover the distance of 20 m at maximum speed. The start was taken from the standing position, and the route was marked with cones. The test was performed twice, and the best result (expressed in seconds and tenths of a second) was recorded. The test was preceded by a 10-minute warm-up session.

Shuttle run test (5 x 10 m)

Materials required: 2 pieces of wood (witnesses), chalk, timer, 2 cones

Installations: two parallel lines were drawn on flat ground at a distance of 10 m from each other; each line was marked at the ends with two cones; the two pieces of wood (witnesses) were placed after the line opposite the starting line.

At the command "On your marks", the student took the standing position next to the starting line but without touching it. At the teacher's whistle, the student ran to the other line (placed 10 m away), grabbed a piece of wood and ran back to place the witness (without throwing it) behind the starting line, ran back again to grab the second witness and crossed the finish line at speed. The timer stopped when the student's chest crossed the starting line for the second time. Time was measured in seconds and tenths of a second. Each student had two attempts, and the best performance was recorded. If the witness was thrown, the attempt was cancelled. (Tudor, 2013)

Standing long jump

Standing with feet slightly apart next to a line drawn on the ground, the student had to perform a maximum long jump from both feet to both feet, with a strong arm swing (Tudor, 2013).

Flexibility test

Standing on a gymnastic bench with feet together, toes placed at the edge of the bench, arms close to body, torso straight, chin to chest, the student slowly leaned the torso forward without bending the knees until their fingertips touched their toes or reached further (Tudor, 2013). The distance between the edge of the bench and the fingertips was measured with a graded ruler. The performance achieved was recorded in centimeters. The result was marked with a minus sign if the fingertips did not exceed the edge of the bench.

Results

To facilitate understanding, the results are shown separately for the two groups of students. For all four tests, the first results are those obtained by CNER students, followed by the results of SG85 students. At the end, we present the statistical calculations performed and the differences between the two groups of students.

20 m sprint test with a standing start

Figure 1 shows the results obtained by CNER students in the 20 m sprint test with a standing start.

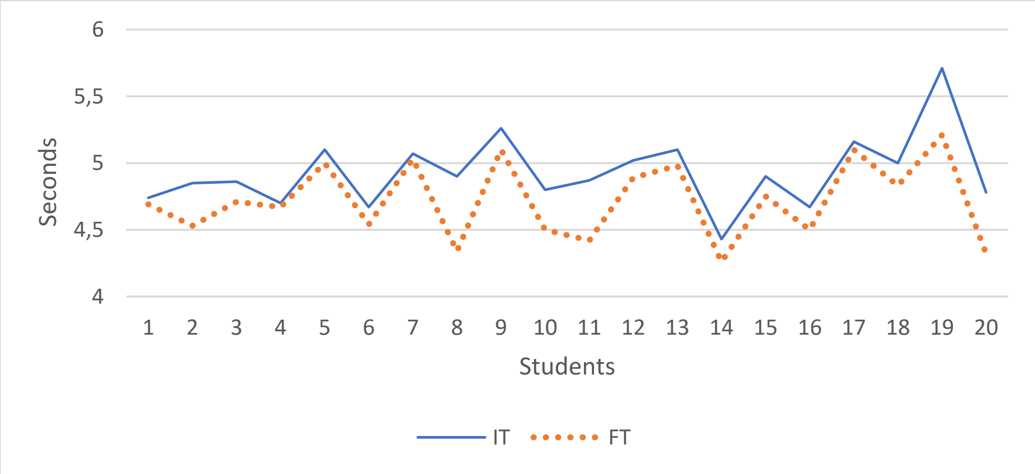

Figure 1. Progress achieved by vocational swimming classroom students in the 20 m sprint test after participation in swimming lessons

Descriptive statistics for the two testing sessions are shown in Table 1 (CNER students). The data highlight the progress made by CNER students between the initial and final testing (IT - FT).

Table 1. Descriptive statistics – CNER students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	4.43	5.71	4.92	27.05	0.05%
FT	4.26	5.21	4.71	28.90	0.06%

Mathematical and statistical analysis (Table 1) reveals that the arithmetic mean obtained by CNER students is lower by 0.21 seconds in the final testing compared to the initial testing. The standard deviation recorded an increase of 1.85. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

For SG85 students, the progress achieved in the 20 m sprint test is shown in Figure 2. Descriptive statistics for the two testing sessions are highlighted in Table 2 (SG85 students).

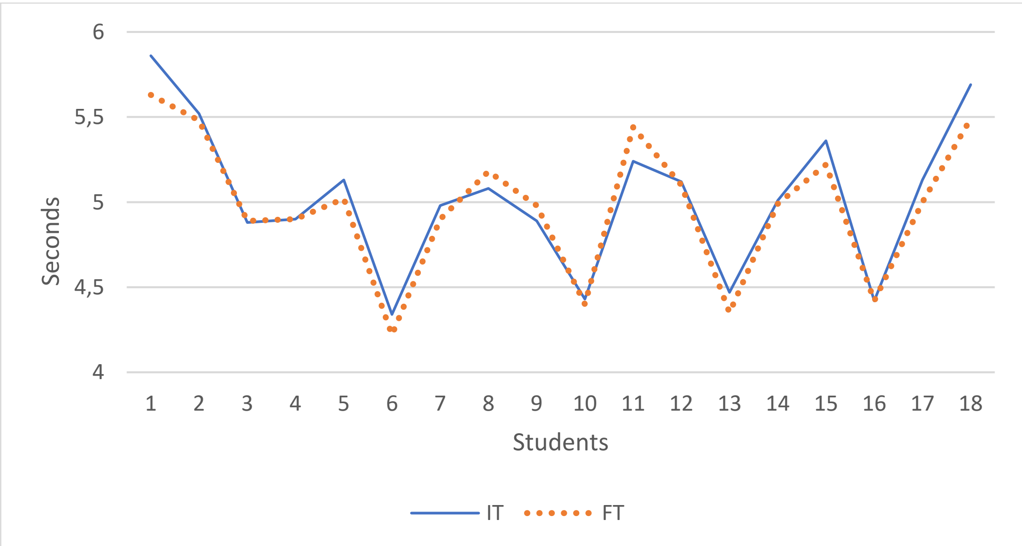

Figure 2. Progress achieved by SG85 classroom students in the 20 m sprint test after participation in physical educations lessons

Table 2. Descriptive statistics – SG85 students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	4.34	5.69	5.01	41.02	0.08%
FT	4.22	5.63	4.97	41.32	0.08%

Mathematical and statistical analysis (Table 2) indicates that the arithmetic mean obtained by SG85 students is lower by 0.04 in the final testing compared to the initial testing. The standard deviation recorded an increase of 0.33. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

Using the Mann-Whitney U test (Table 3), we checked whether there were significant differences in speed development between CNER students and SG85 students.

Table 3. Mann-Whitney U test results for the 20 m sprint test with a standing start

	U	Z	P	r
IT	142.5	-1.08	0.28	0.3
FT	111	-2.0	0.45	0.4

The U-test value was 111 (rank 1 was assigned to the lowest value). Since the calculated U-value was lower than the critical U-value (111 < 112), it could be concluded that there were significant differences in speed development between the two investigated classrooms. Thus, the null hypothesis was rejected.

To measure the difference in intensity between the two groups (Table 3), we calculated the effect size (r). In the present case, the value 0.4 was obtained in the final testing, indicating that the intervention program had a moderate-to-strong impact on speed development.

Shuttle run test (5 x 10 m)

Figure 3 shows the results obtained by CNER students in the shuttle run test (5 x 10 m).

Descriptive statistics for the two testing sessions are shown in Table 4 (CNER students).

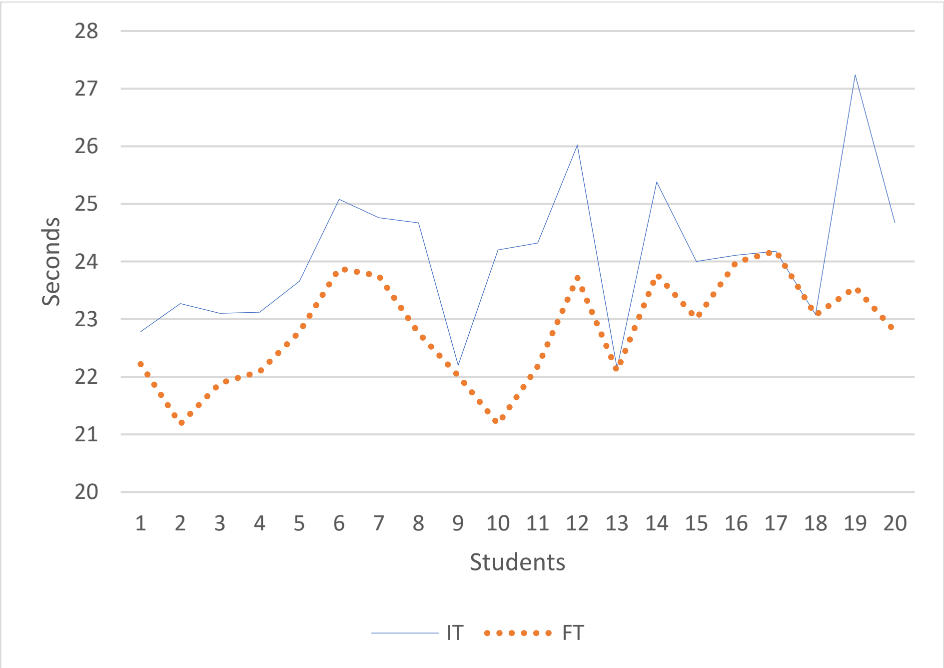

Figure 3. Progress achieved by vocational swimming classroom students in the shuttle run test (5 x 10 m)

Table 4. Descriptive statistics – CNER students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	22.15	27.24	24.14	122.8	0.05%
FT	21.18	24.18	22.80	92.55	0.04%

Mathematical and statistical analysis (Table 4) highlights that the arithmetic mean obtained by CNER students is lower by 1.34 in the final testing compared to the initial testing. The standard deviation decreased by 30.25. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

For SG85 students, the progress achieved in the shuttle run test (5 x 10 m) is shown in Figure 4.

Descriptive statistics for the two testing sessions are highlighted in Table 5 (SG85 students).

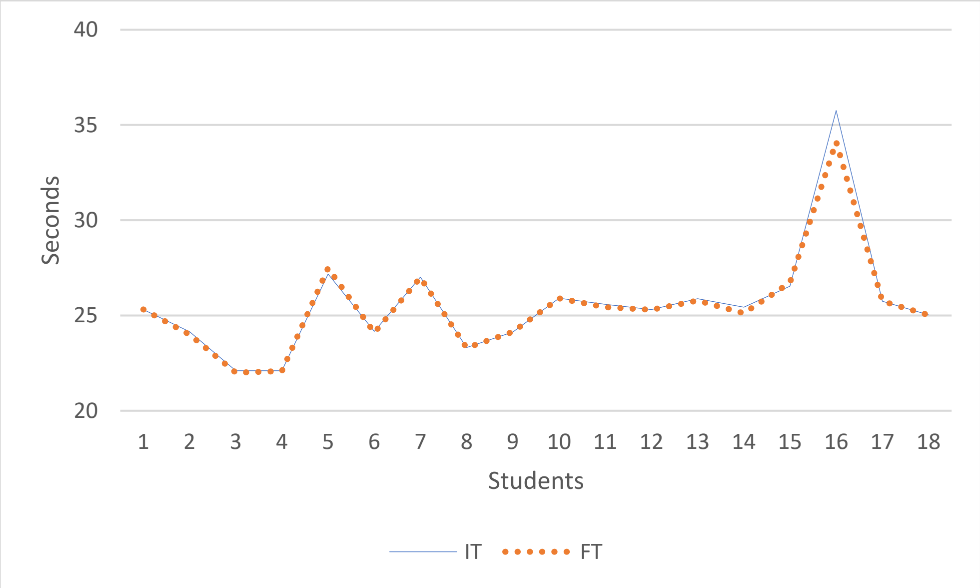

Figure 4. Progress achieved by SG85 classroom students in the shuttle run test (5 x 10 m)

Table 5. Descriptive statistics – SG85 students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	22.10	35.76	25.61	293.4	0.11%
FT	22.00	34.12	25.47	262.9	0.10%

Mathematical and statistical analysis (Table 5) reveals that the arithmetic mean obtained by SG85 students is lower by 0.14 in the final testing compared to the initial testing. The standard deviation decreased by 30.5. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

A comparison between the two groups of students indicated that the arithmetic mean obtained by CNER students improved by 1.34 in the final testing compared to the initial testing, in contrast to the arithmetic mean obtained by SG85 students, which improved by 0.14. Thus, there was a difference of 1.2 in favor of the classroom of students who also participated in swimming lessons. The degree of homogeneity is low for both classrooms.

Mann-Whitney U test results for the shuttle run test are shown in Table 6.

Table 6. Mann-Whitney U test results for the shuttle run test (5 x 10 m)

	U	Z	P	r
IT	106	2.1	0.31	0.4
FT	43	3.9	0.006	0.6

Table 6 shows the effect size (r) calculated to measure the difference in intensity between the two groups. In the present case, the value 0.6 was obtained in the final testing, indicating that the impact of the intervention program was strong to very strong.

Using the Mann-Whitney U test (Table 6), we checked whether there were significant differences between the two samples of students.

The U-test value was 43 (rank 1 was assigned to the lowest value). Since the calculated U-value was lower than the critical U-value (43 < 112), it could be concluded that there were significant differences in the development of coordination skills between the two investigated classes. Thus, the null hypothesis was rejected.

Standing long jump test

The results of CNER students for the standing long jump test (initial testing - final testing) are found in Figure 5, and Table 7 shows descriptive statistical data for the same test and the same students.

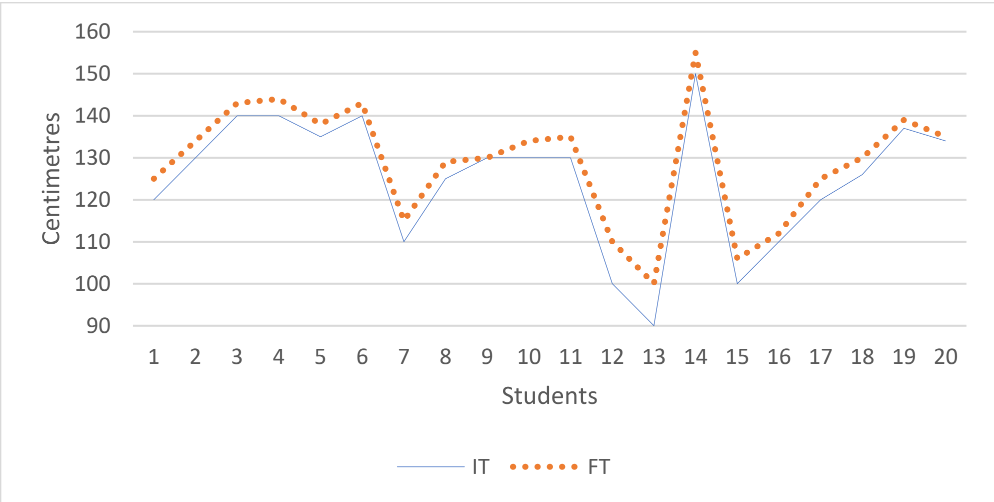

Figure 5. Progress achieved by vocational swimming classroom students in the standing long jump test

Table 7. Descriptive statistics – CNER students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	90	150	124.85	15.72	0.12%
FT	100	155	129.10	14.22	0.11%

The arithmetic mean was higher by 4.25 in the final testing compared to the initial testing (Table 7), which highlighted the progress made by CNER students from one test to another. The standard deviation decreased by 1.5. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

For SG85 students, the progress achieved in the standing long jump test is shown in Figure 6.

Descriptive statistics for the two testing sessions are highlighted in Table 8 (SG85 students).

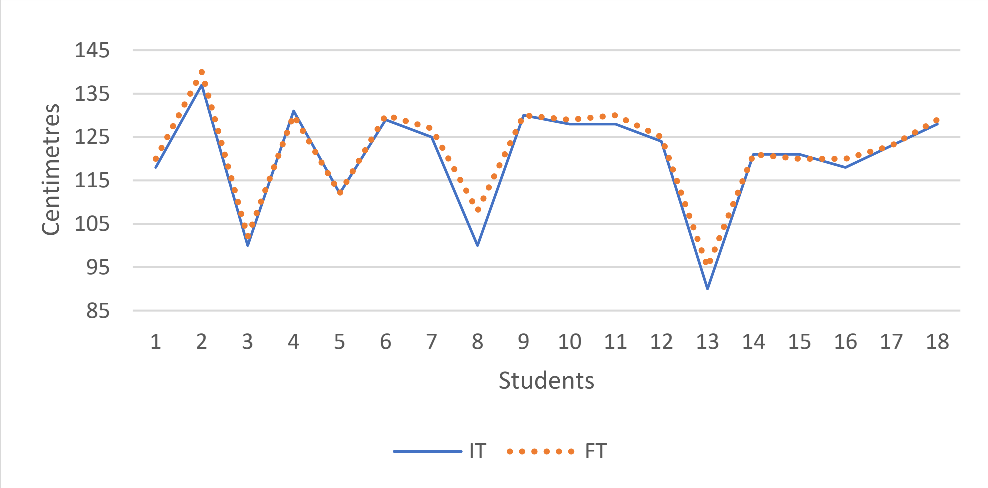

Figure 6. Progress achieved by SG85 classroom students in the standing long jump test

Table 8. Descriptive statistics – SG85 students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	90	137	120.1	12.38	0.10%
FT	95	140	121.7	11.24	0.09%

Mathematical and statistical analysis (Table 8) indicates that the arithmetic mean obtained by SG85 students is higher by 1.6 in the final testing compared to the initial testing. The standard deviation decreased by 1.14. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

If we compare the arithmetic means obtained by the two samples in the final testing (CNER – 4.25 cm versus SG85 – 1.6 cm), we can see a difference of 2.65 cm in favor of the classroom of students who also participate in swimming lessons.

Mann-Whitney U test results for the standing long jump test are shown in Table 9.

Table 9. Mann-Whitney U test results for the standing long jump test

	U	Z	P	r
IT	130.5	1.43	0.15	0.3
FT	111.5	1.98	0.46	0.4

The effect size (r) had the value 0.4 in the final testing, indicating that the intervention program had a moderate-to-strong impact on strength development.

Using the Mann-Whitney U test (Table 9), we checked whether there were significant differences in strength development between students who also participated in swimming lessons and students who only attended physical education and sports lessons.

The U-test value was 111.5 (rank 1 was assigned to the lowest value). Since the calculated U-value was lower than the critical U-value (111.5 < 112), it could be concluded that there were significant differences in strength development between the two investigated classrooms. Thus, the null hypothesis was rejected.

Flexibility test

Figure 7 shows the results obtained by CNER students in the flexibility test.

Descriptive statistics for the two testing sessions are shown in Table 10 (CNER students).

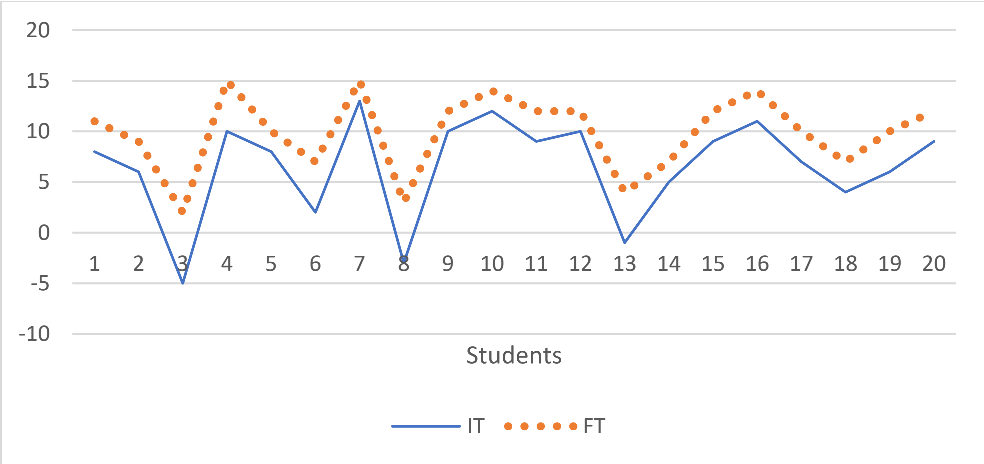

Figure 7. Progress achieved by vocational swimming classroom students in the flexibility test

Table 10. Descriptive statistics – CNER students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	-5	13	6.5	4.92	0.75
FT	2	15	9.9	3.83	0.38

Mathematical and statistical analysis (Table 10) shows better performance for CNER students in the final testing, their arithmetic mean being 3.4 cm higher than in the initial testing. The standard deviation decreased by 1.09. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

For SG85 students, the progress achieved in the flexibility test is shown in Figure 8.

Descriptive statistics for the two testing sessions are highlighted in Table 11 (SG85 students).

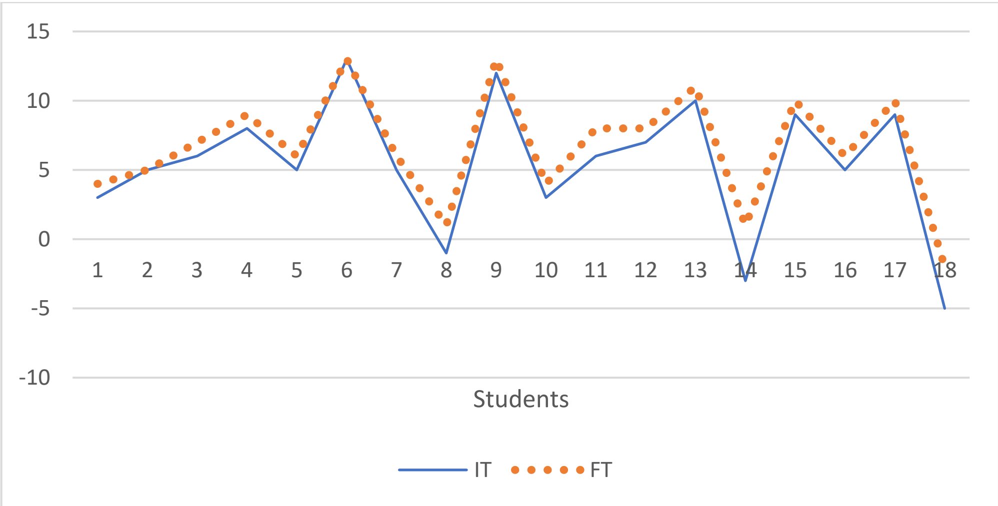

Figure 8. Progress achieved by SG85 classroom students in the flexibility test

Table 11. Descriptive statistics – SG85 students

	Minimum	Maximum	Arithmetic mean	Standard deviation	Coefficient of variation
IT	-5	13	5.38	4.79	0.88
FT	-2	13	6.66	4.11	0.61

Mathematical and statistical analysis (Table 11) reveals a performance improvement of 1.28 cm for SG85 students in the final testing. The standard deviation decreased by 0.68. Since the measured sample is homogeneous in both the initial and final testing, the mean score of the classroom's coefficient of variation is representative.

The arithmetic mean obtained by CNER students improved by 3.4 cm in the final testing compared to the initial testing, while for SG85 students, the improvement was 1.28 cm. Thus, there was a difference of 2.12 cm in favor of the classroom of students who also participated in swimming lessons, in addition to the compulsory physical education lessons.

Mann-Whitney U test results for the flexibility test performed by both samples are shown in Table 12.

Table 12. Mann-Whitney U test results for the flexibility test

	U	Z	P	r
IT	145.5	0.99	0.32	0.3
FT	99.5	2.33	0.19	0.4

To measure the difference in intensity between the two groups (Table 3), we calculated the effect size (r). In the present case (Table 12), the effect size was 0.4, indicating that the intervention program had a moderate-to-strong impact on flexibility development.

The Mann-Whitney test (Table 12) allowed us to check whether there were significant differences in flexibility development between the two samples of students. The U-test value was 99.5 (rank 1 was assigned to the lowest value). Since the calculated U-value was lower than the critical U-value (99.5 < 112), it could be concluded that there were significant differences in flexibility development between the two investigated classrooms. Thus, the null hypothesis was rejected.

Discussions

The study carried out highlights the important role played by swimming in the development of conditional and intermediate motor skills for primary school students. This aspect is supported by the results obtained in the proposed tests, which are known and applied in the current activity of physical education and sports at all levels.

The results achieved by CNER students have considerably improved after their participation in the additional swimming lessons that complement the objectives pursued by the compulsory physical education and sports lessons.

In the present study, the differences between the two groups of students are significant. The arithmetic mean of the results increased for both CNER and SG85 students, but the balance is clearly tilted towards those in the experimental group. Since swimming has proven to be an effective means, it should be practiced by all students, not just those who have chosen to attend integrated swimming sports program classrooms.

There was an obvious decrease in the standard deviation for the shuttle run test (5 x 10 m), the standing long jump test and the flexibility test. The results obtained for the coefficient of variation indicated that both classrooms were homogeneous.

The Mann-Whitney U test calculated for the initial testing showed insignificant U-values in the 20 m sprint test, the standing long jump test and the flexibility test, while in the shuttle run test (5 x 10 m), the U-value was significant.

The Mann-Whitney U test calculated for the final testing indicated a strong association between the 20 m sprint test and the standing long jump test due to close U-values.

In terms of effect size impact, a moderate-to-strong impact was recorded in the 20 m sprint test, the standing long jump test and the flexibility test, while in the shuttle run test (5 x 10 m), the impact was strong to very strong.

Conclusions

Motor activities play a key role in the lives of all people, and students can and should benefit from the advantages and opportunities offered by these activities. Unfortunately, today's students are increasingly "busy" with their tablets, phones, video games, or the TV, and are less involved in sports activities.

The study carried out strengthens the important role of movement in the development of motor skills. Thus, students can practice any sport that complements the effects induced by the means used in the physical education lesson. We believe that swimming is an excellent means that can be practiced by students due to its social, mental and especially motor benefits. These benefits are also confirmed by the hypotheses of our study, according to which there are significant differences in the development of conditional and intermediate motor skills between students who practice additional swimming lessons within an integrated swimming sports program classroom and those who only participate in the compulsory physical education lessons provided in the school curriculum.

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All authors have equally contributed to this study and should be considered as main authors.

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References

Bălan, V., Shaao, M. (2014). Study on Improving the Specific Content of Teaching Physical Education Classes through Movement Games in Primary School. Procedia - Social and Behavioral Sciences, 3rd International Congress on Physical Education, Sport and Kinetotherapy (ICPESK 2013), volume 117, 173-178

Bălan, V. (2018). Activități acvatice și tehnici de salvare – note de curs. Discobolul

Borges, R., Maciel, R. (2016). The influence of swimming on the development of the psychomotric in children of early childhood education. Multidisciplinary Core Scientific Journal of Knowledge, year 1, vol. 9, pp. 292-313. https://www.nucleodoconhecimento.com.br/education/psychomotoric-in-children

Braneț, C. (2016). Repere în antrenamentul atletic al copiilor de 6-9 ani (copii III). Discobolul

Crețu, T. (2016). Psihologia vârstelor. Polirom

Cosma, G., Rusu, L., Păunescu, M., Nanu, C., Nuțoaica Drăgolici, A. (2015). Physical education and sport – psychosocial phenomenon. Journal of Sport and Kinetic Movement, Volume II, No. 26, 90-93

Dragnea, A., Bota, A. (1999). Teoria activităților motrice. Editura Didactică și Pedagogică

Grigoroiu, C., Wesselly, T., Pricop, A., Pelin, R., Braneț, C. (2023). Study on the improvement of psychomotricity components on students in secondary school. Journal of Sport and Kinetic Movement, Volume I, No. 41, 92-102

Jorgensen, R. (2017). Supporting Early Mathematics Learning: Building Mathematical Capital through Participating in Early Years Swimming. Engaging families as children′s first mathematics educators: International perspectives, 217-233. DOI: 10.1007/978-981-10-2553-2_13

Machado, E., Jannuzzi, F., Telles, S., Oliveira, C., Madeira, I., Sicuro, F., Souza, M., Monteiro, A. Bouskela, E., Collett-Solberg, P., Farinatti, P. (2022). A Recreational Swimming Intervention during the Whole School Year Improves Fitness and Cardiometabolic

Risk in Children and Adolescents with Overweight and Obesity. International Journal of Environmental Research and Public Health, Volume 19, Issue 24, 17093. DOI: 10.3390/ijerph192417093

Macovei, S. (2010). Kinantropologie: Particularitățile și capacități motrice în ontogeneză – Note de curs. Discobolul

Mihăilă, C.V., Paraschiva, G.A. (2019). Performance sports education: A survey in thirteen European countries. Discobolul – Physical Education, Sport and Kinetotherapy Journal, Year XV, Volume 58, No. 4, 85-92

Ministerul Educației Naționale (2013). Programa şcolară pentru Educaţie Fizică - clasa pregătitoare, clasa I şi clasa a II-a. Ministerul Educaţiei Naţionale, Anexa nr. 2 la Ordinul Ministrului Educaţiei Naţionale nr. 3418/19.03.2013, Bucureşti

Ministerul Educației Naționale (2014). Programa şcolară pentru pregătire sportivă practică învăţământ sportiv integrat şi suplimentar, clasa I şi clasa a II-a. Ministerul Educaţiei Naţionale, Anexa nr. 2 la Ordinul Ministrului Educaţiei Naţionale nr. 5004/02.12.2014, Bucureşti

Mitrache, G., Bejan, R. (2011). Dezvoltarea motrică și psihomotrică a copiilor de 7-11 ani. Discobolul

Nunes, L.G. (2020). Sports swimming and mental health: Is there a relationship? Pensar en Movimiento: Revista de Ciencias del Ejercicio y la Salud, Volume 18, Issue 2. DOI: 10.15517/pensarmov.v18i2.44034

Predescu, C., Popescu, A.D. (2011). Fiziologia efortului la copii și juniori. Discobolul

Sadeeh, R., Klaunig, J. (2014). Child′s development and respiratory system toxicity. Journal of Environmental and Analytical Toxicology, Volume 4, Issue 5. DOI: 10.4172/2161-0525.1000233

Salazar, C., Lozano, R., Sanchez, A., Vargas, C., Ceballos, A., Murua, J. (2016). Perception of sports and recreational activities in the benefit of life skills in children and teens of Ciudad Juarez, Mexico. Sport Scientific Technical Journal of School Sport, Physical Education and Psychomotricity, Volume 2, Issue 3, 356-378. DOI: 10.17979/sportis.2016.2.3.1524

Tudor, V. (2013). Măsurare și evaluare în sport. Discobolul