

COMPARISON OF THE EFFICIENCY AND IMPACT OF PHYSICAL EDUCATION ACTIVITIES CARRIED OUT ONLINE AND FACE-TO-FACE ON STUDENTS' RESULTS IN PRIMARY EDUCATION

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Abstract: This paper aims to compare the effectiveness and impact of online and face-to-face physical education activities on primary school students. The study analyzes the motor progress of students following the two instructional methods, focusing on fundamental capacities such as speed, strength, endurance, coordination, and balance. Hypothesis of the paper: It is assumed that the method of conducting physical activities online or face-to-face significantly influences the development of motor skills and physical performance of primary school students, and face-to-face physical education lessons determine superior results. due to direct interaction, immediate correction of technique and increased motivation provided by the physical presence of the teacher and peers. The purpose of this paper is to evaluate and compare the effectiveness of physical education activities conducted online and face-to-face on the development of motor skills (speed, strength, endurance, coordination and balance) of primary school students, highlighting the advantages and limitations of each teaching method. Objectives of the paper: Identifying the impact of physical education activities conducted face-to-face on students' physical performance; Determining the effectiveness of an online lesson in developing students' motor skills; Highlighting the differences in the results obtained through physical education activities conducted online and face-to-face. Analysis of the factors that influence the effectiveness of teaching methods.

Introduction: The Covid-19 pandemic has profoundly changed the way physical education and other areas of education are delivered, and this has had a significant impact on student performance. The study [10] highlighted that the

transition from face-to-face teaching to online learning has introduced new ways of learning, which have had an effect on student outcomes. While distance learning has become increasingly popular, its main purpose has been to create a computer-based educational platform that allows students to access teaching materials online. However, the study [8] noted that, in addition to basic pedagogical skills, teachers need to develop advanced digital skills, such as computer use, internet access and multimedia, to support effective online learning. Studies in the field of physical education have shown that, despite the advantages of hybrid learning, physical education teachers considered this approach to be more demanding than face-to-face teaching. The study [7] highlighted that blended learning was perceived to have a negative impact on social relationships and student motivation, and this was a key factor in assessing the effectiveness of this method. Regarding students' physical activity, another study showed that although regular physical activity is important for children's health, many of them are not active enough, and schools fail to provide them with the necessary opportunities to engage in physical exercise. The iPLAY study, conducted by [5], demonstrated that online delivery of physical activity interventions was effective in improving students' fundamental motor skills and cardiorespiratory fitness. This research highlights the fact that online education can make a significant contribution to promoting physical activity, even in the context of distance education. Several studies, including [3], have concluded that, despite differences in format, online or hybrid learning does not produce significant differences from traditional learning in terms of educational outcomes. Online education has thus become increasingly prevalent in educational programs, and [9] has shown that this learning model is also effective in the field of physical education, helping teachers develop a more inclusive approach to teaching physical activities. Even in the sports field, a recent study explored the use of a computer-based method for predicting athletes' performance. The study investigates approximation functions that allow for accurate performance assessments and contribute to the prediction of future results. This technological approach has been praised for its potential to provide more accurate assessments and optimize training planning [4, 6]. The aforementioned studies highlight both the challenges and opportunities of online physical education, which can support students' academic and physical performance, when implemented correctly, with a focus on the effective use of technology and online educational resources.

Material-method: The hypothesis of the paper: It is assumed that the method of carrying out physical activities (online or face-to-face) significantly influences the development of motor skills and physical performance of primary school students, and face-to-face physical education lessons determine superior results due to direct interaction, immediate correction of technique and increased motivation provided by the physical presence of the teacher and peers. The purpose of this paper is to evaluate and compare the effectiveness of physical education activities conducted

online and face-to-face on the development of motor skills (speed, strength, endurance, coordination and balance) of primary school students, highlighting the advantages and limitations of each teaching method. Objectives of the paper: Identifying the impact of face-to-face physical education activities on students' physical performance; Determining the effectiveness of an online lesson in developing students' motor skills; Highlighting the differences in the results obtained through online and face-to-face physical education activities. Analysis of the factors that influence the effectiveness of teaching methods. Inclusion criteria: primary school students, fit for physical activities, active involvement in the online or face-to-face physical education program; consent from students and parents for participation; constant attendance at lessons. Research methods: specialized literature study method, observation method, experimental method, graphic method, mathematical statistical method. Organization and conduct of the experiment, the research was conducted at the "Vasile Gherasim" Technological High School in Marghinea, with 3rd grade students as participants. The educational environment provided adequate conditions for both face-to-face physical activities and the implementation of the online program, ensuring the comparability of the results. For this study, the third grade was divided equally into two experimental groups: the face-to-face group: 4 girls and 5 boys, who participated in physical activities directly supervised by the professor, and the online group: 4 girls and 5 boys, who followed the physical education program through a digital platform Google Meet. The experiment was conducted over a period of 4 weeks, with lessons scheduled twice a week, each lesson lasting 45 minutes. All students were assessed before the start of the program, to establish the initial level of motor skills. The face-to-face experimental group conducted physical education lessons on the school sports field, under my direct supervision as a teacher, in which I corrected technique and motivated students in real time, and the online experimental group participated in lessons from home, with me as a teacher, connected through the digital platform, providing verbal or visual instructions and feedback. After the 4 weeks, all students were subjected to the same test to measure the progress made.

Table 1. Lesson schedule

Week	Lesson	Objection	Face-to-face group exercises	Online group exercises
1	Lesson 1	Developing speed and coordination	25m timed run (3 repetitions). Quick change of direction run (10 zigzag steps).	Running in place, raising your knees high (3 x 30 seconds). Quick side steps, touching the floor (10 repetitions).
	Lesson 2	Developing upper limb strength	Push-ups (maximum correct repetitions). Static exercises (holding on one leg for 15 seconds).	Assisted push-ups (knees on the floor). Balance on one leg, using a small ball as a support (10 seconds).

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Week	Lesson	Objection	Face-to-face group exercises	Online group exercises
2	Lesson 3	Improving endurance	Continuous running for 1 minute, medium distance (20-30 m). Quick squats (3 sets x 10 repetitions).	Run in place for 1 minute, maintaining a steady pace. Slow squats, keeping your hands extended in front of you (3 sets x 10 reps).
	Lesson 4	Development of coordination and motor skills	Throwing the ball and catching it with both hands (15 repetitions). Zigzag movement between the posts.	Throwing and catching an improvised ball (rolled socks). Lateral movement in a small space, using improvised markings.
3	Lesson 5	Developing speed and overall strength	25m sprint, 2x, 20sec rest. 2. Push-ups, max 30sec.	Jumping in place, alternating legs, for 30 seconds. Assisted push-ups, as many reps as possible in 30 seconds.
	Lesson 6	Developing balance and coordination	Maintaining balance on one leg (15 seconds each leg). 2. Coordination games with the ball.	Balance on one leg, using visual markers. Coordination exercises with a light ball, thrown up and caught.
4	Lesson 7	Improving endurance	2 minutes of continuous running, steady pace. Jumping squats (3 sets x 10 reps).	Jog in place for 2 minutes, keeping the pace. Slow squats, followed by quick raises, 3 sets x 10 reps.
	Lesson 8	Developing strength and motor skills	Push-ups (2 sets x maximum repetitions). Successive jumps on two legs, on a marked route.	Assisted push-ups (2 sets x max reps). Jumps in place, using makeshift markings on the floor.

1. Lesson organization model (valid for both groups), duration: 45 minutes
Warm-up part (7-10 minutes):
 - General dynamic exercises (arm rotations, squats, lunges, jumping jacks).
 - Specific movements to activate the muscles involved in the lesson (light running or mobility exercises).
 Main part (30-33 minutes):
 - Exercises specific to the objectives of the lesson.
 - Attention is paid to the execution technique, and the teacher provides constant feedback (verbally for the online group).
 Recovery part (5 minutes):
 - Stretching and breathing exercises.
 - Slow movements to restore the body.

Results: The "face-to-face" experimental group recorded significant improvements in all physical assessment tests, which highlights the effectiveness of the method used.

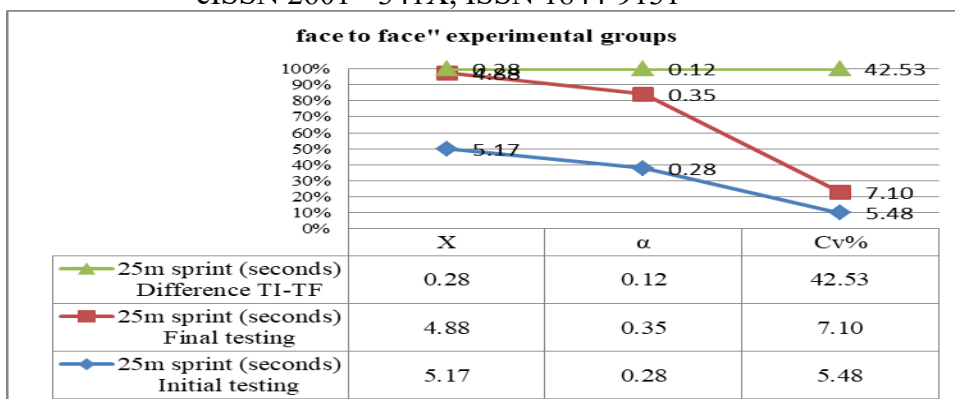


Fig. 1 25m sprint (seconds)

The group's mean score decreased from 5.17 seconds at baseline to 4.88 seconds at the final test, indicating an increase in speed. Progress was consistent between groups, although the coefficient of variation for the TI-TF difference (42.53%) suggests that some students improved more than others.

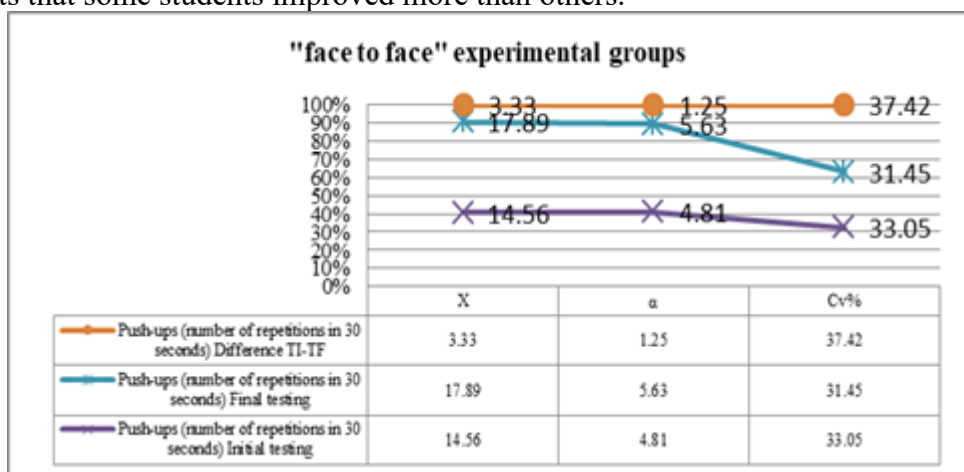


Fig.2 Push-ups

The average number of push-ups performed by the group in 30 seconds increased by 3.33 repetitions, from 14.56 to 17.89. A significant progress in muscle strength was observed, and the moderate coefficient of variability (33.05% for TI and 31.45% for TF) confirms a uniform distribution of results at the group level.

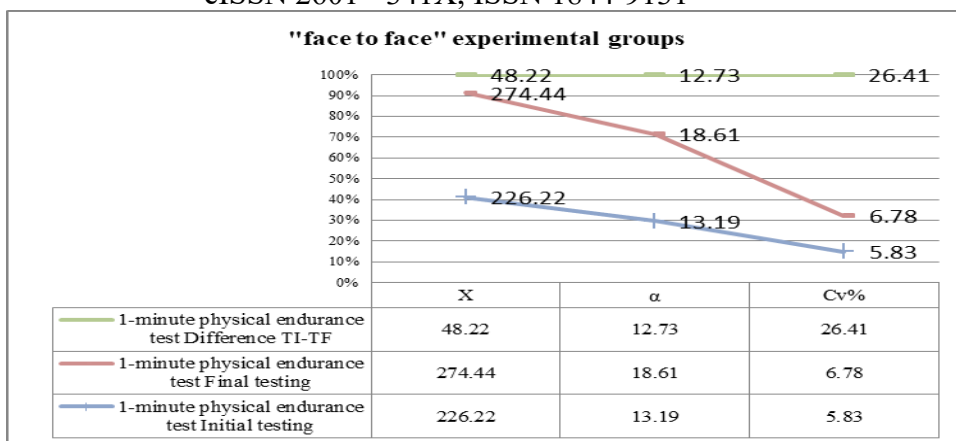


Fig.3 Physical endurance test (1 minute)

Students achieved an average increase of 48.22 in their endurance test performance, from 226.22 to 274.44. The low coefficient of variability below 7% in both the TI and TF suggests that the group presented a high level of homogeneity in terms of developing physical endurance.

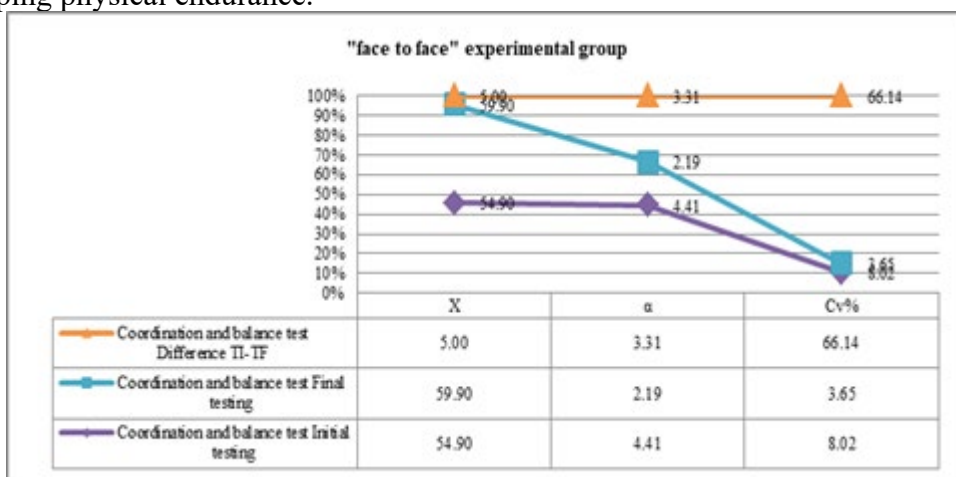


Fig.4 Coordination and balance test

The group achieved an average increase of 5, from 54.90 to 59.90, indicating a considerable improvement in coordination and balance. The reduction of the standard deviation from 4.41 to 2.19 and the coefficient of variability from 8.02% to 3.65% demonstrates a uniformity of the final results, reflecting the fact that the method used had a positive impact on the entire group.

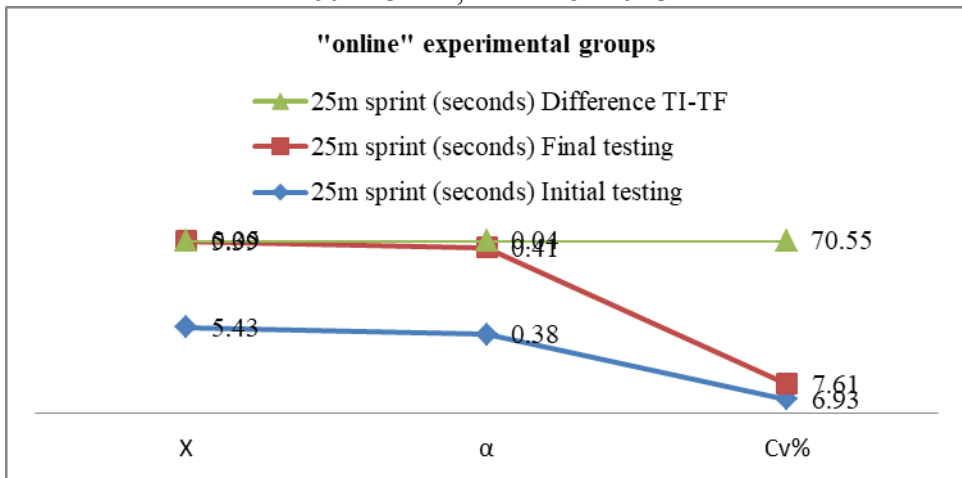


Fig. 5 25m sprint (seconds)

The group mean scores decreased slightly, from 5.43 seconds at baseline to 5.39 seconds at posttest, representing a mean difference of only 0.05 seconds. This modest improvement indicates limited progress in speed development. The standard deviation increased slightly, from 0.38 at baseline to 0.41 at posttest, reflecting greater variation between students at posttest. The coefficient of variation for the TI-TF difference is very high at 70.55%, suggesting that improvements were highly variable between students.

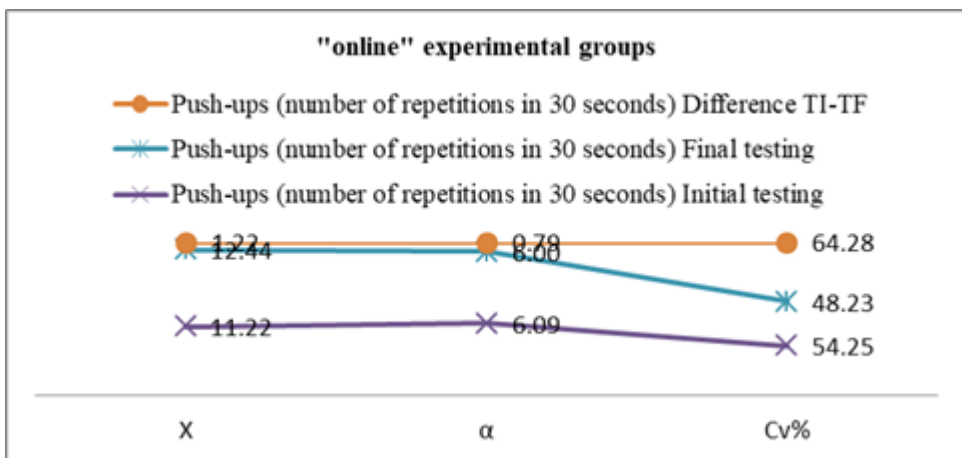


Fig.6 Push-ups

The average number of push-ups performed by the group increased from 11.22 to 12.44, with a mean difference of 1.22 repetitions. This modest improvement shows a limited increase in muscle strength. The standard deviation decreased slightly at the final test, from 6.09 at the initial test to 6.00 at the final test, suggesting a stabilization of the results within the group. The coefficient of variability remained

high, but decreased from 54.25% to 48.23%, indicating a significant dispersion of the results, which reflects an uneven adaptation to the lessons.

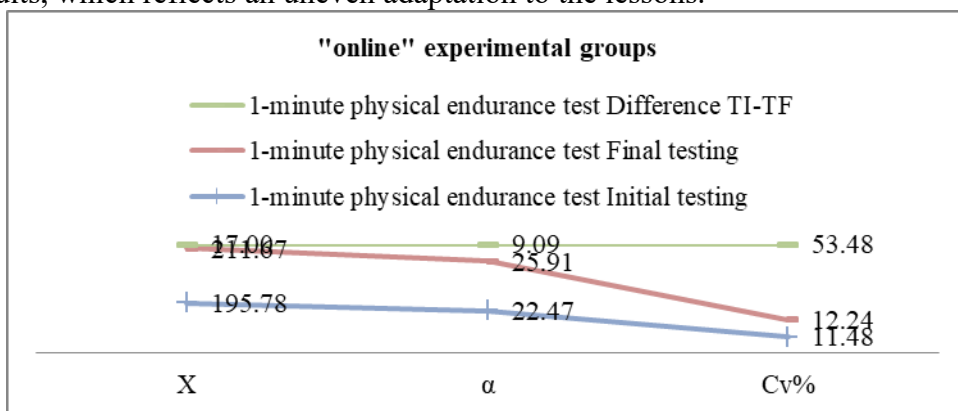


Fig.7 Physical endurance test (1 minute)

The group experienced a mean increase in performance of 17, from 195.78 to 211.67. This increase reflects a modest improvement in physical endurance compared to the face-to-face group. The standard deviation increased from 22.47 to 25.91, indicating greater within-student variability at the final test. The coefficient of variation of the TI-TF difference (53.48%) suggests that improvements were uneven within the group.

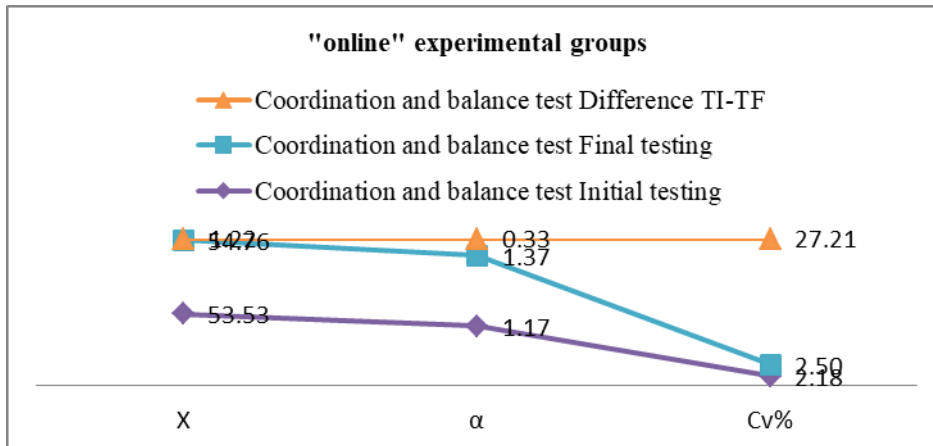


Fig. 8 Coordination and balance test

It is observed that the mean score increased from 53.53 to 54.76, with a mean difference of 1.22. This minimal progress shows that improvements in coordination and balance were reduced. The standard deviation increased slightly, from 1.17 at baseline to 1.37 at final testing, reflecting slightly higher variability within the group at final testing. The coefficient of variability remained low at 2.18% for TI and 2.50% for TF, indicating good homogeneity of the results, but the coefficient of variability of the TI-TF difference (27.21%) suggests that progress was more variable.

Comparative analysis between the "face-to-face" and "online" experimental groups.

The differences between the two groups are significant in several aspects, reflecting the different impact of the lessons on physical performance.

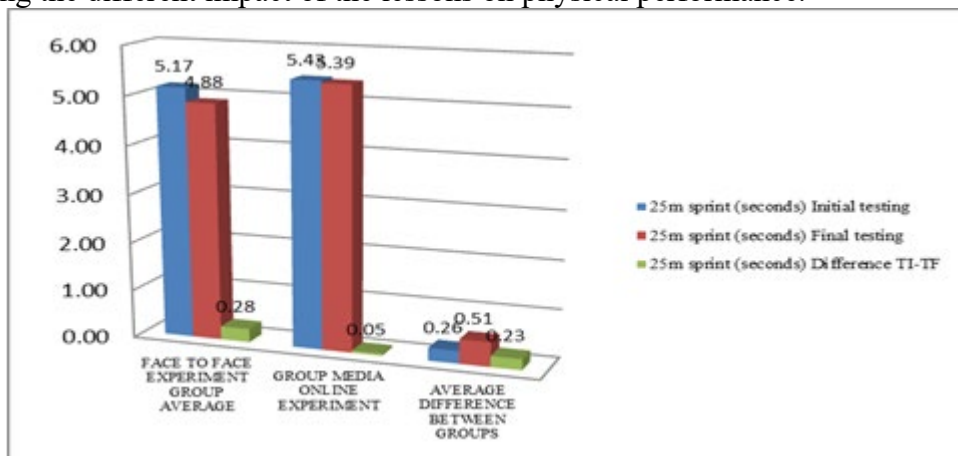


Fig.9 25m sprint (seconds)

The face-to-face group showed a greater improvement in average time of 0.28 seconds compared to the online group of 0.05 seconds, with a difference in average progress of 0.23 seconds. This result indicates that face-to-face interaction may have a stronger impact on speed development, likely due to more rigorous monitoring and increased motivation.

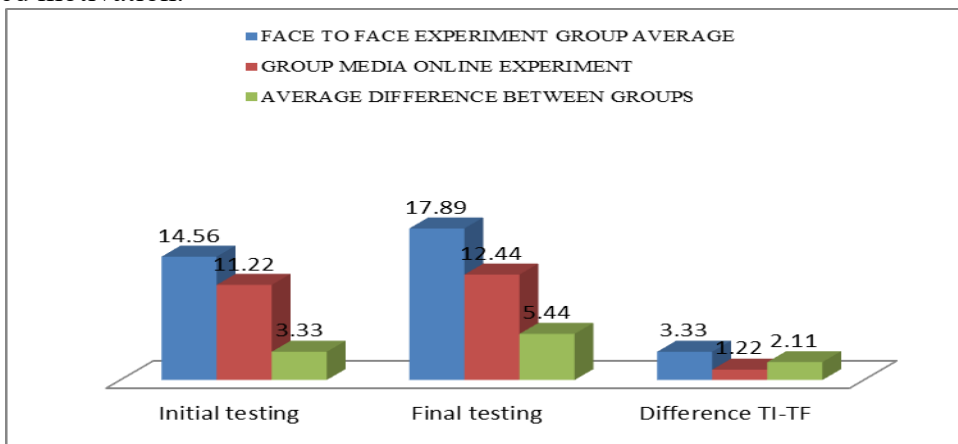


Fig.10 Push-ups (number of repetitions in 30 seconds)

The "face-to-face" group made an average progress of 3.33 push-ups, while the "online" group only recorded 1.22 push-ups, a difference of 2.11 repetitions. This result shows a significantly greater development of muscle strength in the face-to-face method, highlighting the limitations of distance lessons in promoting muscle strength and endurance.

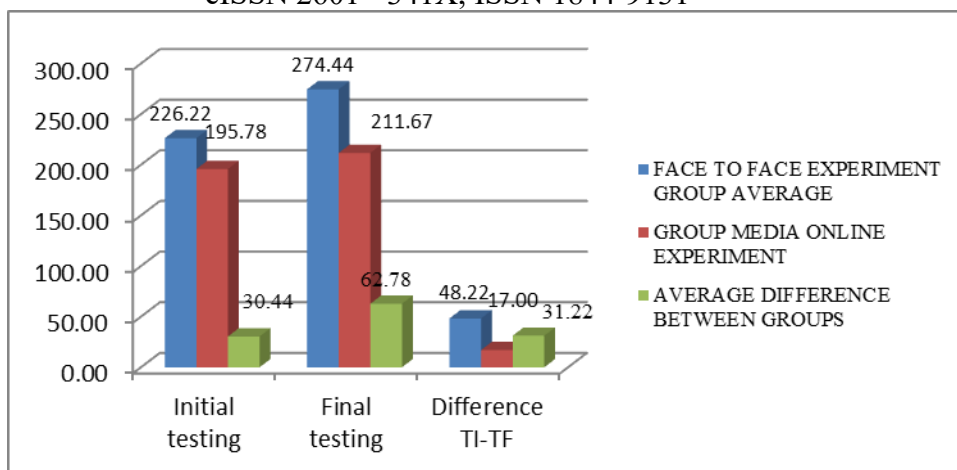


Fig.11 Physical endurance test (1 minute)

The average progress of the "face-to-face" group of 48.22 is much higher than that of the "online" group of 17.00, with a difference of 31.22. This indicates that the direct interaction has a significant effect on increasing physical effort capacity, probably due to the personalized feedback and motivation provided during the lessons.

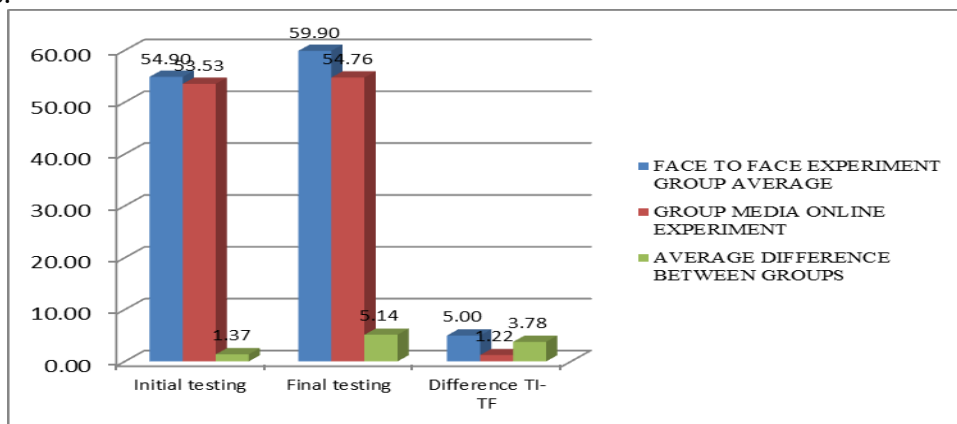


Fig.12 Coordination and balance test

The face-to-face group achieved an average improvement of 5.00, compared to only 1.22 for the online group, a difference of 3.78. This result highlights that lessons conducted under direct supervision are more effective in developing coordination and balance, where immediate correction of execution can play an essential role.

Discussions: The findings of a study highlighted that educators recognize the importance of teaching physical education in a face-to-face format to ensure a meaningful experience, as the online method has multiple limitations. Teaching in an online environment can amplify professional pressure and dissatisfaction with the teaching career. The results of this study can serve as a starting point for a critical

discussion on the challenges that physical education teachers face in the process of online teaching [2]. When teaching physical education online, another study highlighted similar challenges, highlighting that the lack of direct interaction and real-time feedback affects the effectiveness of activities. It was also observed that the level of student engagement was negatively influenced by technological constraints, such as poor internet connection or insufficient devices. At the same time, the study showed that teachers encountered difficulties in adapting physical exercises for confined spaces and in maintaining student motivation over the long term. These findings highlight the need for integrated solutions to improve online physical education teaching [1].

Conclusions: The “face-to-face” experimental group demonstrated clear progress in all the tests assessed, which confirms the effectiveness of the direct approach, probably characterized by personalized feedback and structured instruction. The variable progress observed in some tests (e.g., speed running) may indicate individual differences in adaptation to physical education lessons. The “online” group recorded small improvements in all tests, which suggests that the remote physical education and sports lesson may have limitations in effectiveness compared to other methods.

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