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ŢURCANU Alina-Petruța

MONITORING THE INSTRUCTIONAL-EDUCATIONAL PROCESS IN PHYSICAL EDUCATION LESSONS THROUGH THE APPLICATION OF INFOEMATION TECHNOLOGIES

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Composition of the Public Defense Committee for the Doctoral Thesis:

1. Dorgan Viorel, Doctor of Pedagogical Sciences, university professor, Institute of Physical Education and Sport of the USM – chair of the committee

2. Vizitiu Lakhdari Elena, Doctor of Pedagogical Sciences, Associate Professor, "Stefan cel Mare" University of Suceava, Romania – scientific supervisor

3. Volcu Gheorghe, Doctor of Pedagogical Sciences, Associate Professor, Institute of Physical Education and Sport, USM - official rapporteur

4. Ciorbă Constantin, Doctor of Pedagogical Sciences, university professor, Ion Creangă State Pedagogical University of Chisinau – official reviewer

5. Moisescu Petronel Cristian, Doctor of Human Motor Sciences, Professor, Dunarea de Jos University of Galati, Romania, - official reviewer

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The doctoral thesis and abstract can be consulted at the Library of the Institute of Physical Education and Sport of the USM and on the ANACEC website.

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Chair of the Public Defense Committee
Dorgan Viorel,
Doctor of Pedagogical Sciences, University Professor

Scientific Advisor
Vizitiu Lakhdari Elena,
Doctor of Pedagogical Sciences, Associate Professor

Author
Ţurcanu Alina-Petruţa

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CONCEPTUAL HIGHLIGHTS OF THE RESEARCH

The relevance and importance of the topic addressed

The contemporary educational process takes place in a context marked by digitization and the continuous modernization of teaching methods, which requires the integration of information technologies in all school subjects, including physical education. The use of digital resources contributes to increasing the attractiveness of motor activities, stimulating student motivation, and developing the digital skills necessary for lifelong learning [22, p. 43; 24].

The relevance of this topic is determined by the need to adapt the teaching and learning process to current technological realities and the requirement to harness the potential of digital applications in monitoring and evaluating motor performance. In this context, the physical education teacher becomes a mediator of learning through technology, capable of using interactive platforms and IT tools to individualize student activities [2, p.144; 23, p. 504].

The proposed research responds to these demands by developing and applying an innovative digital model designed to optimize the educational process and increase the efficiency of instruction in primary education.

Description of the situation in the field of research and identification of problems

The integration of information technologies into physical education is one of the current directions of modernization of the teaching-learning process, in line with the transformations of the contemporary educational system and the requirements of the digital society [12]. Studies conducted by Gherghel C. L. [10], Mihălcescu C. [13], Tudor V. and Gherghel C. L. [18] highlight multiple possibilities for applying information technology in physical education lessons, especially in the teaching, learning, and assessment process.

The results of this research confirm that the use of information technologies contributes to increasing the efficiency of motor activities, stimulating student motivation, and improving teaching communication [14, 20].

However, the literature reveals that the systematic application of these tools in primary education is still limited due to insufficient resources, partial training of teachers, and the lack of digital models adapted to the specificities of this age group [19].

In this context, this research proposes to capitalize on the potential of information technologies by developing a digital educational platform, sport-edu.digital, intended for both teachers and students. The platform offers features such as uploading video support materials, integrating QR codes for quick access to correctly performed exercises and assessment, as well as completing individual feedback forms online. The options regarding video materials, QR codes, and online feedback are supported in the literature [2; 20, p.138; 25, p.504].

This approach responds to the need to modernize physical education lessons, providing an interactive and effective framework for the development of motor, cognitive, and digital skills of primary school students, in line with the strategic directions of modern education.

The aim of the research is to determine the effectiveness of the teaching-learning process in physical education lessons through the application of information technologies.

To achieve this goal, the following research objectives were formulated:

1. Analyzing the specialized literature on the integration of information technologies in the educational process, with an emphasis on their applicability in the field of physical education in primary education;

2. Identifying current needs and challenges in organizing physical education lessons in the context of the digitization of education;

3. Developing and implementing a digital platform for monitoring student performance and integrating digital educational resources into physical education lessons in primary education;

4. Demonstrating the effectiveness of applying information technologies in physical education lessons in primary education, based on data obtained during the experimental program.

Research hypothesis. It was assumed that the application of information technologies in physical education lessons, through a digital platform designed to monitor student progress, increases the efficiency of the teaching-learning process, improves test results, and increases student motivation to participate in physical and sports activities.

The scientific approach of the research was based on a set of complementary, traditional, and modern methods. Classic methods of pedagogical research were used, such as specialized bibliographic study, observation, pedagogical experimentation, questionnaire surveys, tests, and statistical-mathematical methods, alongside modern methods of teaching and assessment assisted by information technology. These included the application of blended learning strategies in physical education lessons, such as video observation and posture analysis, digital self-assessment through online forms, digitally assisted motor skills assessment with performance rubrics, and the integration of asynchronous feedback through the *sport-edu.digital* platform. The use of QR codes to access files and demonstration videos, as well as the implementation of automatic comparative assessments of motor progress, contributed to increasing the objectivity and efficiency of the teaching and learning process. The application of these methods aimed to outline a modern perspective on how the integration of information technology contributes to increasing the efficiency of physical education lessons and stimulating the motor and cognitive progress of primary school students.

The experimental basis of the research consists of the sports fields and gyms of pre-university schools in Suceava and Neamt counties, as well as the digital resources used in physical education lessons, namely the *sport-edu.digital* platform, video support materials, and applications for monitoring motor skills. This base provided the necessary conditions for implementing the experimental program and integrating information technology into the teaching and learning process.

The scientific novelty and originality of the paper lies in the design and validation of a digital platform for monitoring the motor performance of primary school students in physical education classes. The research contributes to the modernization of the teaching and learning process by integrating interactive information technologies, which increases the objectivity of assessment and improves the effectiveness of teaching in primary education.

The results obtained, **which contribute to solving an important scientific problem**, address the need to optimize the teaching and learning process in physical education lessons in primary education by integrating information technologies as a modern means of supporting teaching

activities. The research proposes the development and application of a digital platform designed to monitor students' progress and motor performance.

The theoretical significance lies in strengthening the conceptual framework for integrating information technologies into physical education through the use of a digital platform and interactive multimedia resources. The research offers an innovative perspective on the role of technology in supporting the teaching and learning process and in monitoring the performance of primary school students.

The practical value of the paper lies in the fact that the results obtained can be used as a methodological guide by physical education teachers in primary education, in the context of increasing the effectiveness of physical education lessons conducted with primary school students.

The scientific results were implemented in physical education classes in primary schools in several schools in Suceava County, through the application of an experimental program focused on the use of the *sport-edu.digital digital* platform, video support materials, and digital tools for monitoring students' motor performance.

The proposed experimental methodology was approved and applied in the training process of students at the "Iorgu Vârnav Liteanu" Technological High School in Lietni, the "Aurelian Stanciu" Secondary School in Salcea, Suceava County, and the "Ieremia Irimescu" Secondary School in Brusturi, Neamț County. The activities were carried out in accordance with the experimental program developed, by integrating information technology into physical education lessons, using the *sport-edu.digital* platform, video support materials, and digital tools for monitoring motor performance. The research results were capitalised on through articles and scientific papers presented at national and international conferences, as well as through participation in symposiums and specialist scientific sessions. The materials developed were published in specialist journals between 2020 and 2025.

The volume and structure of the thesis includes the annotation, introduction, three chapters, conclusions and recommendations, bibliography with 269 sources, and 13 appendices. The paper totals 214 pages, of which 131 constitute the main text, including 24 tables and 61 figures. The research results were capitalized on through the publication of 11 scientific articles.

THESIS CONTENT

THEORETICAL AND METHODOLOGICAL ARGUMENTATION REGARDING THE APPLICATION OF INFORMATION TECHNOLOGY IN THE INSTRUCTIONAL AND EDUCATIONAL PROCESS IN PRIMARY EDUCATION

(basic content of Chapter 1)

The process of modernizing education necessitates the use of information technologies in educational activities, including in physical education, where they contribute to optimizing the teaching and learning process, increasing student motivation, and individualizing the learning process [7; 11, p.198].

Information technology provides valuable support for teaching activities, facilitating teaching, learning, and assessment through interactive tools, multimedia resources, and educational applications adapted to the age characteristics of students [26, p.144].

Physical education, due to its specific nature, plays an essential role in the harmonious development of students, in the formation of motor, cognitive, and socio-affective skills, contributing to maintaining health and cultivating an active lifestyle [6; 8; 17; 27].

The integration of technological means into physical education lessons contributes to improving the training process by correctly visualizing exercises, analyzing execution techniques, and providing immediate and objective feedback [2, p.144].

The analysis of the specialized literature outlined the main theoretical concepts that underpin the research: teaching technology, digital educational resources, digital competence, computer-assisted instruction, and blended learning [24, p.96].

Modern, student-centered pedagogical models promote active and constructive learning, using technology as a tool to stimulate motivation and increase learning efficiency [11, p. 198; 13].

The rational application of digital tools in physical education activities aims to combine traditional and modern elements to support the development of motor and digital skills [12; 19].

The model presented in Figure 1 summarizes the organization of the instructional-educational process in physical education lessons through the application of information technology, highlighting the correlations between curricular content, modern teaching methods, digital resources, and technology-assisted assessment.

This conceptual model forms the theoretical and methodological basis of the experimental research.

The chapter also includes an analysis of the biopsychomotor characteristics of primary school children, emphasizing the importance of adapting the teaching process to age-specific rates of physical, mental, and motor development.

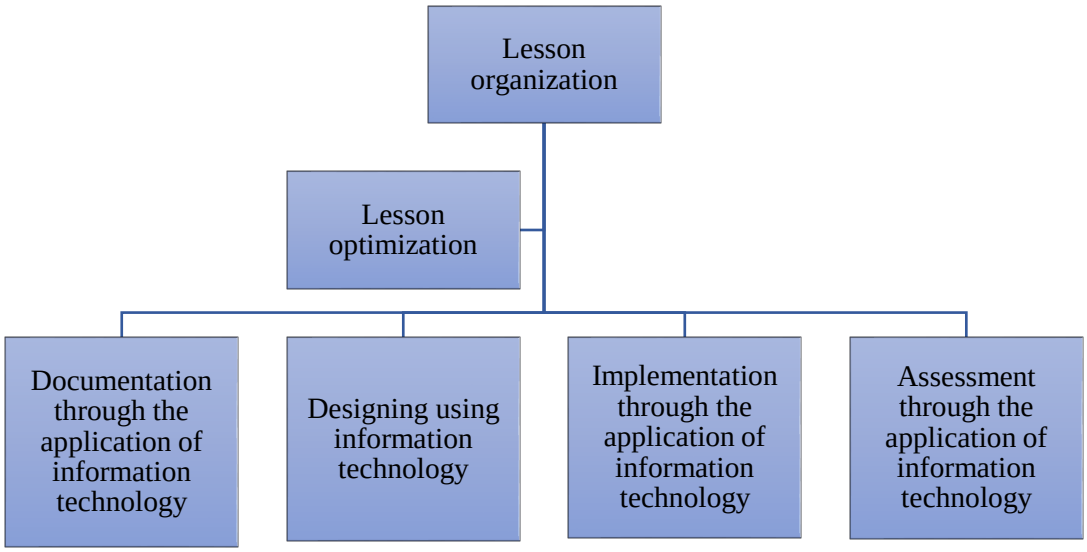

Fig. 1. Organization of the instructional-educational process in physical education lessons through the application of information technology (developed by the author, 2025)

The uneven pace of growth, developing coordination, and increased mobility require careful planning of exercises and appropriate selection of means of action [1, 3; 5 p.274].

The use of digital resources allows for the monitoring and analysis of progress, facilitating personalized pedagogical interventions [23, p. 504].

The paper highlights the main forms of organization of physical education activities, along with concrete ways of integrating information technology into each stage of the lesson. Digital tools can be used at all stages: for presenting content, demonstrating motor techniques, monitoring performance, and final assessment [25, p. 207].

The summary of the chapter highlights that the integration of information technology into the teaching and learning process in primary education is a current and necessary direction for the modernization of physical education activities, contributing to improving the quality of education, stimulating motivation for physical activity, and developing students' motor and digital skills [4, p.119; 13].

The theoretical and methodological argument presented constitutes the scientific basis for the pedagogical experiment and for the analysis of the impact of the use of information technology on student training.

METHODOLOGICAL FOUNDATIONS FOR IMPLEMENTING INFORMATION TECHNOLOGIES IN PHYSICAL EDUCATION LESSONS IN PRIMARY SCHOOLS (basic content of Chapter 2)

Research methodology

The research presented in this chapter aimed to organize and provide a methodological basis for the study on the integration of information technologies in physical education lessons in primary education, seeking to identify their impact on the teaching-learning process and on the level of physical and psychomotor training of students.

To this end, a series of scientific methods were applied, such as specialized bibliographic research, observation, pedagogical experimentation, questionnaire surveys, testing, and statistical and mathematical analysis, each contributing to ensuring a rigorous and valid framework for the investigation.

The research methodology was designed in accordance with the established goals and objectives, aiming to identify the initial level of physical and psychomotor training of students, as well as to analyze teachers' perceptions regarding the use of information technologies in the teaching-learning process.

Research organization

The research was conducted between 2018 and 2024 and was structured in three stages: theoretical foundation (2018–2020), observational experiment (2020–2022), and the actual pedagogical experiment (2022–2024), a period that was partially extended due to restrictions imposed by the COVID-19 pandemic.

The experimental activity was organized at the "Iorgu Varnav Liteanu" Technological High School in Liteni, Suceava County, and involved primary school students aged 10 to 11, selected according to specific inclusion criteria: no medical contraindications, non-membership in competitive sports clubs, and availability for regular participation. The sample consisted of 100 students, evenly divided between genders and distributed into two groups: experimental and control. The application stage took place over a period of ten months and aimed to assess the motor and psychomotor skills of the students in order to determine the effectiveness of applying information technologies in the teaching and learning process in physical education lessons.

Before implementing the experimental program itself, a diagnostic experiment was conducted to assess the initial situation. The diagnostic experiment was carried out in several schools in Suceava County and aimed to determine the actual level of physical fitness of the students and the degree of use of digital tools in the teaching process. The research included 152 students (76 boys and 76 girls) from grades III and IV, grouped by age and gender. The assessment was carried out by applying standardized tests of speed, endurance, strength, dexterity, and coordination. The results revealed significant differences between the optimal level predicted by the literature [9; 16, p. 79] and the actual performance of the students, forming the basis for the subsequent development and implementation of the experimental program.

Somatic indicators were measured-height, body weight, arm span, and body mass index (BMI)-and standardized motor tests were administered to assess speed, endurance, strength, dexterity, and coordination.

Analysis of the results showed that height and arm span values were generally within the normal range for the students' age, but a significant increase in body weight and body mass index (BMI) was observed in both boys (22.11 kg/m² compared to the standard of 20) and girls (22.90 kg/m² compared to 20). These differences indicate a tendency towards overweight, which can negatively influence motor performance.

In all motor tests, the values obtained were below the reference level, especially in endurance and coordination tests. For example, in endurance running, the averages of the students in the sample

were 0.3-0.5 minutes lower than the standard values, and in vertical target throwing, differences of over 50% from the optimal level were recorded.

These results were also influenced by the post-pandemic context, as the period of online learning contributed to a reduction in motor activity and a decrease in overall physical tone.

Therefore, the need to integrate information technologies into the teaching and learning process as a means of motivating, monitoring, and optimizing physical training at the primary level was confirmed.

An important aspect of the research was the analysis of physical education teachers' perceptions regarding the use of information technology in teaching. Based on a questionnaire administered to 204 teachers from 14 counties in Romania, it was found that the majority of respondents consider it necessary to integrate technology into physical education lessons and support the reorganisation of the educational system in this regard.

The results, summarized in Table 1 and Table 2, confirmed the existence of significant correlations between the use of information technologies and student attendance, as well as between the assessment of psychomotor performance and the perception of the effectiveness of these tools. The analysis of the responses obtained provides a relevant picture of how teachers perceive the role of technology in optimizing motor activities and the assessment process.

Table 1. Relationship between student frequency and technology use

Student attendance at physical education classes	Pearson Coefficient (r)	0,516
The use of technology in physical education classes	Significance level (P)	< 0,001
	N	204

Note: P<0,05, P<0,01, P<0,001

The results showed a significant correlation between the use of information technologies and student attendance in physical education classes r=0.516, P<0.001, as illustrated in Table 1. This confirms that the integration of digital tools into the teaching and learning process stimulates student participation and engagement, contributing to the increased effectiveness of physical education lessons.

Table 2. Relationship between the variable of psychomotor performance assessment and the need to use technologies

The need to use technology in physical education classes	Pearson Coefficient (r)	0,307
Assessment of students' psychomotor performance	Significance level (P)	< 0,001
	N	204

Note: P<0,05, P<0,01, P<0,001

The Pearson correlation coefficient r=0.307, P<0.001, presented in Table 2, highlights a significant positive link between the assessment of students' psychomotor performance and the perception of the need to use information technologies. The result confirms that the application of digital tools supports a more objective and accurate assessment of students' motor progress.

Based on the results obtained from the analysis of teachers' perceptions and the data from the observational experiment, methodological benchmarks were defined for the development of an experimental program for the implementation of information technology in the teaching and learning

process. It was designed to integrate modern digital tools in order to increase the efficiency of teaching activities and student motivation [11, p. 198].

The experimental model was organized into five modules, corresponding to the planned thematic units. The proposed content and activities aimed at the balanced development of motor skills, the formation and consolidation of fundamental and specific motor skills, the cultivation of attitudes of cooperation, responsibility, and fair play, as well as the formation of hygienic and sanitary behaviors and personality components in students.

Its structure, based on interdisciplinary connections and supported by the integration of information technology, is presented in Table 3, which includes the thematic units, the proposed activities, and the digital media used during the program.

Table 3. Structure of the experimental program for fourth-grade students

Thematic unit		Proposed activities	Digital media used
Elements of motor activity organization		Assembly formations; lining up in rows and columns, at different intervals and distances; standing at attention and at ease; turning left and right, about-face; starting and stopping while marching, in two steps; forming and closing the gymnastics column	Demonstrative videos, interactive exercises with QR codes, interactive Wordwall application
Elements of harmonious physical development		Correct posture in basic positions and various motor actions; basic and derived positions; free exercises, with objects and with a partner for selective influence on the locomotor system; complexes for harmonious physical development (free, with portable objects, with/without background music, with a partner); exercises for teaching breathing and regulating breathing during exercise	The *sport-edu.digital* platform, music apps, effort sensors, the interactive Wordwall app, digital flashcards with QR codes
Motor skills	Speed	Speed of reaction to stimuli (visual, auditory, tactile); speed of execution (in complex motor actions); speed of movement (over varying distances and in different directions, depending on landmarks and competitors)	Demonstration videos, timing applications (Pacer), exercises via QR codes
	Coordination skills / Dexterity	Coordination of body segments in actions of increasing complexity; coordination of motor actions in relation to partner/opponent; coordination in handling objects specific to sports disciplines; eye-hand coordination in complex motor tasks	The *sport-edu.digital* platform, interactive applications for skill development
	Strength	Segmental and general dynamic (isometric) strength; explosive strength; segmental dynamic strength, in resistance mode	Video resources, digital assessment tools, *sport-edu.digital* platform
	Resistance	General resistance to aerobic exercise; local muscle endurance	Digital stopwatch, progress charts, effort monitoring apps, *sport-edu.digital* platform
Joint mobility and stability		Mobility of the spine and hip joints; stability of the shoulder, elbow, knee, and ankle joints	Demonstrative videos, interactive Wordwall application, *sport-edu.digital* platform

Basic motor skills and practical applications	Walking, running, jumping, throwing, climbing, scrambling, crawling, balancing	Demonstrative videos, interactive worksheets on *sport-edu.digital*
Manipulation skills	Throwing, catching, hitting, receiving	Digital exercises, interactive Wordwall application, video resources integrated into the *sport-edu.digital* platform
Stability skills	a) Axial type: bending, stretching, twisting, turning, balancing (with objects, partner) b) Static or dynamic positions: orthostatic positions, rolls, starts (performed through specific sports disciplines); application courses and relays	Digitally assisted driving routes, interactive application games, *sport-edu.digital* platform
Motor skills specific to athletics	Running school -endurance running (middle-distance running stride; standing start -sprinting with a standing start (acceleration running stride, speed running stride, standing start) Jumping school -long jump with run-up, crouching technique (jumping phases) -high jump with stride Throwing school -throwing the oina ball from a standing position, at a distance (throwing phases)	Technical filming, QR codes for exercises, resources on the *sport-edu.digital* platform
Motor skills specific to acrobatic gymnastics	Static and dynamic elements (rolls, rolls, bridge, half-moon, balance beam, standing on shoulders, acrobatic connections)	Demonstration videos, QR codes for exercises, digital assessment tools on the *sport-edu.digital* platform
Motor skills specific to dynamic games and mini-football/mini-handball	Mini handball, mini soccer – dynamic games, rules, tactics	The interactive Wordwall application, digital game timer, video resources on *sport-edu.digital*
Hygiene and personal protection	Exercises and rules for preparing the body for exercise; exercises and rules for recovering the body after exercise; rules of collective hygiene; signs of deterioration in personal and collective hygiene; measures to maintain personal and collective hygiene; measures to sanitize the spaces, facilities, and equipment used; techniques for mutual assistance/support in performing motor acts with a high degree of difficulty	Educational applications about hygiene, digital files on the *sport-edu.digital* platform
Components of personality	Responsibility for one's own health; the roles performed by students in practicing sports; rules and communication skills between students, partners, opponents, referees, spectators; emotional states and reactions that arise in sports competitions; accepted attitudes and behaviors in competitive sports activities; interpersonal and teamwork skills among team members in physical education classes.	Digital reflection and feedback sections on the *sport-edu.digital* platform

To highlight the applicability of the experimental program and the integration of digital technologies, we present below some representative examples of activities carried out in physical education lessons, selected from different thematic units.

Examples of digital activities applied in physical education lessons:

Example 1 - Module I: Endurance running - self-assessment and progress with digital support

Thematic unit: Motor skills specific to athletics

The activity followed a methodical sequence, starting with an initial timed running test, performed using the Pacer app, followed by filming the execution for postural analysis. Students completed a digital self-assessment form accessed via a QR code, and their progress was tracked on the *sport-edu.digital* platform. Feedback was provided asynchronously in a personalized format.

Example 2 - Module II: Acrobatic gymnastics - learning static elements, one-leg balance and low bridge

Thematic unit: Acrobatic gymnastics

Students watched demonstration videos for the "one-leg balance" and "low bridge," then practiced in pairs, recording their own performances. Self-assessment was carried out using the sport-edu.digital platform, accessed via QR code, and the teacher's feedback was sent asynchronously, accompanied by digital assessment rubrics.

Example 3 - Module III: Motor complex for posture, breathing, and mobility development

Thematic unit: Elements of harmonious physical development

The lesson included posture and mobility exercises, supported by videos accessed via QR codes. Students filmed themselves, completed digital self-assessment forms, and received differentiated feedback.

Example 4 - Module IV: Sprinting from a standing start

Thematic unit: Motor skills specific to athletics

The students watched video demonstrations of the phases of sprinting, accessed via QR code. They then practiced the technique during the lesson, with the activity being filmed for later analysis. The teacher provided asynchronous, individualized feedback based on each student's performance. The lesson ended with a distance learning task: watching a new video and completing a digital reflection sheet in preparation for the next lesson's assessment.

Example 5 - Module V: Specific dynamic and preparatory games - mini handball

Thematic unit: Motor skills specific to dynamic and preparatory games

The students participated in a short warm-up game, organized in small teams, to familiarize themselves with the game structure. The activity was filmed, and the recordings were used for further analysis of cooperation and positioning. Subsequently, the students completed a digital self-assessment form via QR code. The actual assessment of performance was carried out by the teacher using a digital rubric integrated into the *sport-edu.digital* platform, focusing on initiative, positioning, and team play. The Pacer app was used to time each sequence, ensuring objectivity in performance assessment.

Through this integrated approach, physical education activities have become a dynamic, motivating process tailored to the individual needs of students. The integration of technology has

enabled personalized learning, in which each student has been able to discover their own pace of work, receive differentiated feedback, and have permanent access to interactive resources. The collaborative dimension of the lessons was emphasized through the use of the *sport-edu.digital* platform, and student autonomy was encouraged through methods based on gamification, digital reflection, and asynchronous assessment. Thus, the experimental program not only succeeded in improving the teaching-learning process, but also in proposing a flexible and transferable educational model in similar contexts.

An essential component of the research was the *sport-edu.digital* educational platform, designed as the main tool to support the training and assessment process. The platform was developed using the Next.js framework and the React library, ensuring a user-friendly and responsive interface, adapted to any type of device (desktop, tablet, mobile). A relational MySQL database was used for data management, allowing for the efficient storage of information on students, classes, and motor performance [21].

From a pedagogical point of view, the platform was designed in accordance with the principles of student-centered education, ensuring transparency of results, progress monitoring, and personalized feedback. Thus, the use of technology supported a modern, adaptable instructional-educational process based on reflection and autonomy in learning [15; 22, p. 43].

The integration of the *sport-edu.digital* platform into the experimental program represented an innovative step, aimed at providing an interactive educational framework with asynchronous assessment, self-analysis, and automatic reporting of results. The application was tested in real conditions, demonstrating stability, high data security, and compatibility with the existing IT infrastructure in educational institutions.

In addition to its technological component, the sport-edu.digital platform stood out for its educational value, providing an integrated environment for planning, teaching, assessment, and self-assessment. It was observed that it facilitates real-time tracking of student progress through automatically generated graphs and reports, while also providing continuous, personalized, and visual feedback. Through gamification elements and an intuitive interface, the platform has contributed to increased motivation and active involvement in the motor learning process. Furthermore, the centralization of data and the possibility of comparative analysis of results have enabled objective performance evaluation and adaptation of content to the real needs of students. At the same time, through its classification and automatic reporting functionalities, the platform allows the identification of students with high performance potential, thus providing useful support for the selection and orientation processes towards specific sports activities.

This preparatory stage established the technical and pedagogical foundations of the experimental research, detailed in Chapter 3, which analyses the impact of the application of information technologies on the motor and psychomotor development of primary school students.

ARGUMENTATION AND EXPERIMENTAL JUSTIFICATION OF THE USE OF INFORMATION TECHNOLOGIES IN PHYSICAL EDUCATION LESSONS WITH PRIMARY SCHOOL STUDENTS

(basic content of Chapter 3)

The influence of the experimental program on the dynamics of anthropometric indices of primary school students

The analysis of anthropometric indices showed a favorable evolution of morphological parameters in students from the experimental groups compared to those from the control groups, confirming the effectiveness of the teaching program based on the use of information technologies.

For a complete picture of the results, the initial and final average values of the analyzed anthropometric indices are presented in Tables 4 and 5, which compare the data obtained for boys and girls in the experimental and control groups.

The results show that both boys and girls made significant progress in terms of height and arm span, while maintaining a stable body weight. This led to a decrease in body mass index (BMI) values, indicating a harmonious evolution of the weight-to-height ratio and balanced body development.

Table 4. Comparative analysis of anthropometric and physical development indices in boys from the experimental and control groups (n=25)

No.	Anthropometric indices	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Height (cm)	EG	144,08±0,94	147,00±0,96	25,54	<0,001
		MG	144,84±1,12	146,04±1,13	12,00	<0,001
		t	0,52	0,64	-	-
		P	>0,05	>0,05	-	-
2.	Weight (kg)	EG	45,44±1,07	45,76±1,01	1,32	>0,05
		MG	44,68±1,31	45,2±1,29	2,83	<0,01
		t	0,45	0,34	-	-
		P	>0,05	>0,05	-	-
3.	Arm span (cm)	EG	144,28±0,98	147,08±0,97	18,33	<0,001
		MG	145,4±1,06	146,36±1,08	4,37	<0,001
		t	0,77	0,49	-	-
		P	>0,05	>0,05	-	-
4.	BMI (kg/m²)	EG	21,85±0,38	21,13±0,32	6,00	<0,001
		MG	21,21±0,46	21,24±0,42	0,28	>0,05
		t	1,05	0,20	-	-
		P	>0,05	>0,05	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Table 5. Comparative analysis of anthropometric and physical development indices in girls from the experimental and control groups (n=25)

No.	Anthropometric indices	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Height (cm)	EG	143,32±0,90	146,00±0,92	24,07	<0,001
		MG	142,96±1,13	144,24±1,10	13,97	<0,001
		t	0,25	1,22	-	-
		P	>0,05	>0,05	-	-
2.	Weight (kg)	EG	44,92±0,96	44,28±0,89	3,72	<0,001
		MG	44,56±1,28	45,36±1,32	6,20	<0,001
		t	0,22	0,68	-	-
		P	>0,05	>0,05	-	-
3.	Arm span (cm)	EG	143,44±0,93	146,08±0,97	20,70	<0,001
		MG	143,00±1,05	144,32±1,09	5,15	<0,001
		t	0,31	1,20	-	-
		P	>0,05	>0,05	-	-
4.	BMI (kg/m²)	EG	21,85±0,32	20,75±0,27	12,40	<0,001
		MG	21,72±0,41	21,64±0,40	1,35	>0,05
		t	0,25	1,81	-	-
		P	>0,05	>0,05	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

In particular, girls in the experimental group showed superior adaptation to the program requirements, reflected in a more pronounced reduction in BMI and better maintenance of weight parameters compared to the control group.

These results suggest active and constant involvement in digitally assisted motor activities, confirming the positive impact of technological means on the harmonious and balanced development of students.

Although the differences between the experimental and control groups were not statistically significant in all cases, the magnitude of the progress observed confirms the positive influence of the experimental program on the somatic development of students. The developments recorded reflect not only the direct effects of motor exercises, but also the motivational and self-regulatory impact induced by the use of information technologies in the instructional-educational process.

Height increased significantly in both experimental groups: in boys from 144.08±0.94 cm to 147.00±0.96 cm, t=25.54; P<0.001, and in girls from 143.32±0.90 cm to 146.00±0.92 cm, t=24.07; P<0.001. In the control groups, the increase was lower, with t=12.00; P<0.001 in boys and t=13.97; P<0.001 in girls, indicating a natural age-related development.

Body weight remained relatively constant in the experimental groups, boys: t=1.32; P>0.05 and girls: t=3.72; P<0.001, while in the control groups there were significant increases, boys: t=2.83; P<0.01 and girls: t=6.20; P<0.001. These differences suggest a weight regulation and body mass control effect among students who participated in the experimental program.

Arm span showed a significant increase in all groups, but more pronounced in the experimental groups, boys: t=18.33; P<0.001 and girls: t=20.70; P<0.001, compared to the control groups, boys: t=4.37; P<0.001 and girls: t=5.15; P<0.001, confirming the positive effect of varied motor activities on postural and muscular development.

Body mass index (BMI) decreased significantly only in the experimental groups, both in boys, t=6.00; P<0.001, and girls, t=12.40; P<0.001, while in the control groups the values remained stable P>0.05. This evolution indicates an optimal adaptation of the body to effort and a favorable adjustment of body composition.

These findings confirm that the application of information technologies in the teaching and learning process contributes not only to the optimization of teaching content and methods, but also to the development of healthy movement and self-control skills. Continuous progress monitoring, digital feedback, and the possibility of self-assessment have led to more active student involvement, strengthening their motivation for regular participation in physical activities. The experimental program has proven highly effective in stimulating harmonious physical development and forming a positive attitude towards physical exercise and the use of technology for educational purposes.

Analysis of motor tests of primary school students participating in pedagogical experiments

General physical training is a systematic process aimed at developing and educating motor skills, as well as improving the functional capacity of the body, objectives that can be achieved by using both selective and global means of influencing body segments [99, p. 15].

Seven tests were used to assess motor skills: 25 m sprint, endurance run, long jump, trunk lifts and extensions, ball throw, and mobility test. The analysis of the data obtained focused on both the evolution of performance within each group and the statistical differences between the experimental and control groups, in order to highlight the real effect of the program applied.

The results and statistical indicators t and P are summarized in Tables 6 and 7.

The analysis of the motor tests applied to the students in the experimental and control groups showed clear differences in the evolution of motor performance, confirmed by relevant statistical values of the *t* and *P* tests.

In boys, clear improvements were observed in all tests, with the most significant changes recorded in:

- ✓ 25 m sprint, with a reduction in average time from 5.85±0.09 s to 5.27±0.09 s, t=30.95; P<0.001;
- ✓ endurance running, where the distance covered increased significantly t=9.98; P<0.001, with the final difference between groups also being relevant t=5.13; P<0.001;
- ✓ trunk extensions t=15.34; P<0.001 and throwing the oina ball t=20.94; P<0.001, tests that reflected improved segmental control and arm strength;
- ✓ in the trunk lifts, long jump, and mobility tests, the differences between the groups were not statistically significant, but the average values indicated a consistently positive evolution. In girls, a similar dynamic was observed, with significant progress in the speed tests t=32.04; P<0.001, endurance running t=9.31; P<0.001, trunk extensions t=18.75; P<0.001, and ball throwing t=24.71; P<0.001.

Table 6. Comparative analysis of motor tests in boys in the experimental and control groups (n=25)

No.	Motor tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	25 m sprint (sec.)	EG	5,85±0,09	5,27±0,09	30,95	<0,001
		MG	5,75±0,07	5,67±0,07	2,88	<0,05
		t	0,85	3,36	-	-
		P	>0,05	<0,01	-	-
2.	Long-distance running (3.00 min.)	EG	2,48±0,04	2,76±0,03	9,98	<0,001
		MG	2,45±0,04	2,47±0,04	9,60	<0,001
		t	0,32	5,13	-	-
		P	>0,05	<0,001	-	-
3.	Trunk lifts from supine position (number of repetitions)	EG	16,72±0,79	19,04±0,81	24,36	<0,001
		MG	16,80±0,72	17,88±0,65	6,64	<0,001
		t	0,07	1,11	-	-
		P	>0,05	>0,05	-	-
4.	Trunk extensions from prone position (number of repetitions)	EG	18,76±0,58	21,40±0,58	15,34	<0,001
		MG	18,84±0,66	19,56±0,68	6,64	<0,001
		t	0,09	2,04	-	-
		P	>0,05	<0,05	-	-
5.	Standing long jump (cm)	EG	133,16±2,04	137,80±2,02	36,38	<0,001
		MG	133,28±2,69	135,04±2,60	14,73	<0,001
		t	0,03	0,81	-	-
		P	>0,05	>0,05	-	-
6.	Throwing the oina ball (m)	EG	12,72±0,76	15,92±0,73	20,94	<0,001
		MG	12,24±0,75	12,72±0,73	3,11	<0,01
		t	0,44	3,08	-	-
		P	>0,05	<0,01	-	-
7.	Mobility in the hip joint (cm)	EG	-0,96±1,27	+1,52±1,24	11,04	<0,001
		MG	-0,92±1,22	-0,24±1,19	3,44	<0,01
		t	0,02	1,01	-	-
		P	>0,05	>0,05	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Moderate progress in trunk lifts, long jump, and joint mobility suggests balanced development of overall motor skills.

A comparison between the sexes revealed similar trends in progress, with boys recording higher values in running tests, both over short distances and in endurance, as a result of the physiological characteristics of their age.

Table 7. Comparative analysis of motor tests in girls in the experimental and control groups (n=25)

No.	Motor tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	25 m sprint (sec.)	EG	5,96±0,09	5,33±0,09	32,04	<0,001
		MG	5,91±0,10	5,81±0,10	14,80	<0,001
		t	0,34	3,42	-	-
		P	>0,05	<0,01	-	-
2.	Long-distance running (3.00 min.)	EG	2,28±0,02	2,41±0,01	9,31	<0,001
		MG	2,29±0,02	2,31±0,02	8,31	<0,001
		t	0,50	4,36	-	-
		P	>0,05	<0,001	-	-
3.	Trunk lifts from supine position (number of repetitions)	EG	15,76±0,77	18,36±0,76	15,92	<0,001
		MG	16,04±0,73	17,08±0,69	7,69	<0,001
		t	0,26	1,22	-	-
		P	>0,05	>0,05	-	-
4.	Trunk extensions from prone position (number of repetitions)	EG	18,68±0,49	21,12±0,44	18,75	<0,001
		MG	18,28±0,54	19,20±0,50	11,50	<0,001
		t	0,54	2,85	-	-
		P	<0,05	<0,01	-	-
5.	Standing long jump (cm)	EG	120,28±2,39	123,96±2,43	29,33	<0,001
		MG	120,64±1,71	121,72±1,67	10,94	<0,001
		t	0,12	0,75	-	-
		P	>0,05	>0,05	-	-
6.	Throwing the oina ball (m)	EG	11,88±0,69	14,40±0,69	24,71	<0,001
		MG	11,84±0,47	12,72±0,44	8,36	<0,001
		t	0,04	2,04	-	-
		P	>0,05	<0,05	-	-
7.	Mobility in the hip joint (cm)	EG	+1,08±1,14	+3,52±1,08	20,92	<0,001
		MG	+1,00±0,94	+1,60±0,93	4,64	<0,001
		t	0,05	1,33	-	-
		P	>0,05	>0,05	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Overall, the analysis of *t* and *P* values demonstrates a significant positive evolution of motor parameters in the experimental groups, indicating objective progress in fundamental physical abilities.

This evolution correlates with the consistent application of modern methods and digital tools, which have enabled the individualization of exercises, immediate feedback, and accurate monitoring of motor performance.

The influence of the experimental program on the evolution of psychomotor tests in primary school students

Psychomotor assessment is a complex and multidimensional process aimed at providing an integrated analysis of a child's motor and cognitive skills. This process involves examining motor

coordination, balance, dexterity, and associated cognitive functions such as attention, perception, and memory. This assessment aims to provide a holistic perspective on how psychomotor skills interact with and influence both the child's behavior and learning ability, thus contributing to the development of appropriate strategies for intervention and optimization of their development [16, p. 282; 49, p. 10].

The psychomotor test, which included mini handball-a simple game structure, balance, and touching the plates-aimed to assess essential components of the individual's motor and cognitive development.

The overall level of psychomotor skills was assessed through a simple mini-handball game structure. The balance test assessed static balance and postural control, essential components of motor skills and body stability. The plate touching test assessed reaction speed, eye-hand coordination, and manual dexterity.

The results obtained from the psychomotor tests were recorded, analyzed, and compared, and are summarized in Table 8 for boys and Table 9 for girls.

Table 8. Comparative analysis of psychomotor tests in boys from the experimental and control groups (n=25)

No.	Psychomotor tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Mini handball - simple game structure (sec.)	EG	12,03±0,85	9,79±0,68	9,68	<0,001
		MG	12,16±0,73	11,72±0,68	3,48	<0,01
		t	0,10	2,02	-	-
		P	>0,05	<0,05	-	-
2.	Balance (sec.)	EG	22,53±1,32	25,42±1,11	8,97	<0,001
		MG	22,63±1,12	23,26±1,09	3,78	<0,001
		t	0,05	1,37	-	-
		P	>0,05	>0,05	-	-
3.	Touching the plates (sec.)	EG	15,74±0,55	12,94±0,43	15,36	<0,001
		MG	15,71±0,53	14,94±0,53	7,15	<0,001
		t	0,04	2,92	-	-
		P	>0,05	<0,01	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Mini handball - simple game structure

For boys, the average time decreased from 12.03±0.85 s to 9.79±0.68 s, a statistically significant improvement t=9.68; P<0.001, while in the control group the reduction was more modest t=3.48; P<0.01. The final difference between the groups was significant t=2.02; P<0.05.

In girls, the values decreased from 12.96±1.00 s to 10.76±0.86 s, an extremely significant improvement t=10.93; P<0.001, compared to a smaller reduction in the control group t=6.49; P<0.001.

These results confirm the effectiveness of cooperative exercises and digital play tasks in developing coordination, reaction speed, and spatial orientation.

Table 9. Comparative analysis of psychomotor tests in girls from the experimental and control groups (n=25)

Nr. crt.	Psychomotor tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Mini handball - simple game structure (sec.)	EG	12,96±1,00	10,76±0,86	10,93	<0,001
		MG	13,10±0,74	12,85±0,73	6,49	<0,001
		t	0,10	1,84	-	-
		P	>0,05	>0,05	-	-
2.	Balance (sec.)	EG	20,87±1,31	23,49±1,15	10,03	<0,001
		MG	20,91±1,31	21,46±1,25	5,55	<0,001
		t	0,02	1,19	-	-
		P	>0,05	>0,05	-	-
3.	Touching the plates (sec.)	EG	15,95±0,56	13,19±0,50	14,84	<0,001
		MG	15,97±0,59	15,35±0,56	6,42	<0,001
		t	0,02	2,84	-	-
		P	>0,05	<0,01	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Balance

In the experimental group, the boys recorded an increase in the average from 22.53±1.32 s to 25.42±1.11 s, a significant improvement t=8.97; P<0.001, and the girls from 20.87±1.31 s to 23.49±1.15 s, also with an extremely significant difference t=10.03; P<0.001. In both cases, the control group had lower progress, boys t=3.78; P<0.001, girls t=5.55; P<0.001. Although the comparative differences between groups were not statistically significant, the greater amplitude of progress in the experimental groups highlights the favorable effects of digitally assisted stability and postural control exercises.

Reaching for plates

This test showed consistent progress in both sexes. Boys in the experimental group improved their time from 15.74±0.55 s to 12.94±0.43 s, an extremely significant difference t=15.36; P<0.001, compared to the control group t=7.15; P<0.001. For girls, the average decreased from 15.95±0.56 s to 13.19±0.50 s, an extremely significant improvement t=14.84; P<0.001, while in the control group the improvement was smaller t=6.42; P<0.001. The final differences between the groups were significant P<0.01, confirming the positive effect of digital exercises on eye-hand coordination and manual dexterity.

For both boys and girls, the experimental program generated greater improvements than traditional instruction, as evidenced by significant progress in speed, coordination, and dexterity tests. Although in some tests the final differences between groups were not significant, the greater amplitude of progress in the experimental groups demonstrates the effectiveness of modern methods integrated into the teaching process.

Therefore, the use of innovative technologies and interactive materials proved to be a decisive factor in stimulating the psychomotor development of primary school students.

Assessment of agility and attention in primary school students participating in the pedagogical experiment

The integration of information technologies into physical education has opened up new perspectives on the process of assessing the motor and psychocognitive abilities of primary school students. In this context, digitally assisted tests can become effective tools for the objective, rapid, and reproducible measurement of fundamental indicators such as agility, attention, and reaction speed. These components not only reflect the level of physical fitness, but also the ability of students to respond to complex tasks in diverse motor and cognitive contexts.

The present study aimed to apply a set of digital tests adapted to the age of 10–11 years, in order to assess, in an integrated manner, the response of students to stimuli specific to physical activities. The tests were selected based on criteria of validity, methodological relevance, and technological accessibility, taking into account the availability of interactive whiteboards in classrooms and the possibility of using personal mobile devices.

The agility test (4×10 m shuttle run) assessed the students' ability to quickly change direction under controlled movement conditions, using digitally assisted measurement with precise timing. *The visual attention test*, conducted through an interactive Wordwall game of the "match the object with the sport" type, allowed for the assessment of selective attention and rapid recognition of visual stimuli with motor relevance. In addition, *the attention and patience test*, based on the lexical identification of sports terms in a digital selection game, provided an insight into the students' ability to maintain concentration and operate effectively with fundamental concepts in the field of physical education.

The collected data were statistically processed, and the results showed significant differences between the experimental and control groups, supporting the hypothesis of the effectiveness of technology-assisted educational intervention.

The results obtained were centralized and statistically processed, being summarized in Table 10 for boys and Table 11 for girls, where the means, standard errors, t-test values, and statistical significance levels for the three tests applied are presented.

In the agility test - 4×10 m shuttle run, the boys in the experimental group reduced the average execution time from 12.05±0.25 s to 10.27±0.25 s, an extremely statistically significant difference $t=22.06$; $P<0.001$, while the control group had a smaller improvement $t=5.68$; $P<0.001$. The final difference between the groups was significant $t=3.44$; $P<0.01$, in favor of the experimental group. Similar results were observed in girls, where the time decreased from 12.10±0.30 s to 10.24±0.24 s, $t=10.94$; $P<0.001$, with a significant final difference compared to the control group $t=3.42$; $P<0.01$.

These data confirm that digitally assisted intervention contributed to the development of agility, an essential component for movement control and rapid response to stimuli.

Table 10. Comparative analysis of technology-assisted tests in boys from the experimental and control groups (n=25)

No.	Technology-assisted tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Agility – 4×10 m shuttle run test (sec.)	EG	12,05±0,25	10,27±0,25	22,06	<0,001
		MG	12,10±0,24	11,52±0,25	5,68	<0,001
		t	0,13	3,44	-	-
		P	>0,05	<0,01	-	-
2.	Visual attention – object–sport association (sec.)	EG	37,37±1,15	33,82±1,09	18,26	<0,001
		MG	37,28±0,89	37,05±0,90	3,15	<0,01
		t	0,05	2,25	-	-
		P	>0,05	<0,05	-	-
3.	Attention and patience – sports lexical identification game (min.)	EG	3,24±0,28	1,66±0,16	9,65	<0,001
		MG	3,25±0,23	3,15±0,23	1,97	>0,05
		t	0,03	5,12	-	-
		P	>0,05	<0,001	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

Table 11. Comparative analysis of technology-assisted tests in girls from the experimental and control groups (n=25)

No.	Technology-assisted tests	Groups and statistical indicators	Statistical indicators			
			I.t. X±m	F.t. X±m	t	P
1.	Agility – 4×10 m shuttle run test (sec.)	EG	12,10±0,30	10,24±0,24	10,94	<0,001
		MG	12,02±0,30	11,55±0,29	5,09	<0,001
		t	0,19	3,42	-	-
		P	>0,05	<0,01	-	-
2.	Visual attention – object–sport association (sec.)	EG	36,36±1,03	32,90±1,00	14,42	<0,001
		MG	36,02±1,07	35,84±1,06	2,15	<0,05
		t	0,23	2,01	-	-
		P	>0,05	<0,05	-	-
3.	Attention and patience – sports lexical identification game (min.)	EG	3,10±0,22	1,61±0,16	11,98	<0,001
		MG	3,08±0,17	2,95±0,18	1,85	>0,05
		t	0,06	5,45	-	-
		P	>0,05	<0,001	-	-

Note: EG-experimental group, n=25; MG-control group, n=25;

	P<0,05	0,01	0,001
df=48;	t=2,009	2,678	3,505
df=24;	t=2,060	2,787	3,725
Probability:	95%,	99%,	99,9%

In the visual attention test-object-sport association, which measures rapid recognition of motor-relevant visual stimuli-the boys in the experimental group improved their solution time from 37.37±1.15 s to 33.82±1.09 s, t=18.26; P<0.001, and the final difference from the control group was significant t=2.25; P<0.05. The girls showed a similar evolution, with the time decreasing from 36.36±1.03 s to 32.90±1.00 s, t=14.42; P<0.001, with a significant final difference in favor of the experimental group t=2.01; P<0.05. This test highlighted the role of interactive digital resources (Wordwall exercises, rapid visual association) in training selective attention and visual processing speed.

The greatest differences between groups were recorded in the *attention and patience test*-sports lexical identification, which assessed sustained concentration and working capacity. In boys, the time was reduced in the experimental group from 3.24±0.28 min to 1.66±0.16 min. t=9.65; P<0.001, while in the control group the change was not statistically significant t=1.97; P>0.05. The final difference between the groups was very significant t=5.12; P<0.001, in favor of the experimental group. In girls, the situation was similar: the time was reduced from 3.10±0.22 min to 1.61±0.16 min. t=11.98; P<0.001, compared to the control group where no significant changes were recorded t=1.85; P>0.05; the final difference between the groups was very significant t=5.45; P<0.001. This result shows that the use of structured digital tasks, with immediate feedback and visual clarity, supported the development of concentration and attentional stability in 10–11-year-old children.

A comparison of the results for boys and girls shows superior progress in the experimental groups, especially in agility and attention–patience. The developments confirm the effectiveness of digitally assisted methods in stimulating coordination, reaction speed, and concentration in primary school students.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

The analysis of data obtained from theoretical and experimental research conducted within the study led to the formulation of general conclusions that reflect the essential results of the scientific approach undertaken. These conclusions highlight the impact of applying information technologies in physical education lessons at primary level and the effectiveness of the pedagogical intervention carried out in the experimental context.

1. Integrating information technologies into physical education lessons at the primary level is a key factor in modernizing the teaching and learning process. The use of digital tools—such as educational apps, online platforms, and interactive devices—significantly contributes to the individualization of instruction, increasing student motivation, and optimizing assessment by adapting activities to their needs and developmental characteristics.

2. The effective implementation of modern technologies in physical education requires an integrative pedagogical approach that takes into account the biopsychomotor characteristics of young schoolchildren. This involves not only adapting teaching strategies, but also the continuous training of teachers and ensuring equitable access to digital resources, which are essential conditions for consolidating student-centered physical education anchored in the contemporary realities of the educational process.

3. The results obtained from the questionnaire administered to a sample of 204 teachers from 14 counties confirm, through a significant correlation coefficient, r=0.516, P<0.001, the positive

influence of the use of information technology on student attendance in physical education classes. In addition, 89.7% of respondents say they are ready to integrate digital resources, and 80.1% consider it necessary to reorganize the educational system towards digitization.

4. The results obtained in the observational experiment reflect the overall level of physical fitness of primary school students as insufficient. The deficiencies identified confirm the need for modern interventions to stimulate motor development and reduce the negative effects of the COVID-19 pandemic on physical activity. The analysis of somatic and motor samples revealed a lower than expected level of physical fitness, with poor performance in most of the tests applied.

5. Following the implementation of the experimental program, the experimental groups showed superior progress compared to the control groups in terms of anthropometric indicators: height increased by an average of 2.92 cm in boys and 2.68 cm in girls, with similar values for arm span; body mass index decreased by 0.72 kg/m² in boys and 1.10 kg/m² in girls. These results confirm the beneficial effect of the program in supporting harmonious physical development.

6. The experimental program had a significant impact on the motor and psychomotor development of students, contributing to improved coordination, balance, and reaction speed. The integration of technology-assisted tests and the use of the *sport-edu.digital* platform allowed for objective and interactive assessment, providing students with immediate feedback on their performance. This way of working stimulated attention, motivation, and active involvement, promoting constant progress in motor activities.

The results obtained from our research, focused on *monitoring the teaching-learning process using information technologies in physical education* classes in primary education, led to the resolution of a significant scientific problem, which allowed for greater efficiency in the educational process. In particular, we succeeded in integrating innovative teaching-learning-assessment methods and personalising learning, which resulted in a significant improvement in students' physical performance and their motivation to actively participate in physical education classes.

Based on the conclusions and results obtained from applying the methodology for implementing information technology in physical education lessons for primary school students, we have formulated the following recommendations:

1. Promoting the continuous training of teachers in the use of information technologies by organizing dedicated courses and workshops to ensure their correct and effective integration into physical education lessons.

2. Teachers must be supported in the use of digital tools to create personalized lessons adapted to each student's learning pace, thus maximizing the impact of technologies on their development.

3. The creation and implementation of integrated educational platforms at the level of the Ministry of Education, which allow for the continuous monitoring and evaluation of students' progress, providing real-time feedback and adapting to their individual needs. These platforms could include self-assessment tools and interactive tests that support motor and psychomotor progress, contributing to active and continuous learning for students.

4. Considering the positive impact observed on student motivation and engagement, it is recommended that the use of digital technologies be a central element of physical education lessons.

5. We recommend that information technologies be formally integrated into the physical education curriculum to support both physical development and student motivation. This would help increase the relevance of physical education lessons, engaging students and encouraging them to actively participate in physical activities.

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2. ȚURCANU, Alina-Petruța. *Utilizarea tehnologiei informaționale în lecțiile de educație fizică la elevii din ciclul primar.* În: Știința Culturii Fizice, nr. 40/2, 2022, pp. 181-185. https://doi.org/10.52449/1857-4114.2022.40-2.13

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1. ȚURCANU, Alina-Petruța, JURAT, Valeriu. Modul de predare online a disciplinei educaţie fizică şi sport la elevii din ciclul primar. In: *Formarea continuă a specialistului de cultură fizică în conceptul acmeologic modern*: Conferința științifică internațională Chișinău, Republica Moldova: Catedra de Gimnastică a USEFS, 2021, Ediția 2, pp. 117-123. ISBN 978-9975-68-440-8. https://ibn.idsi.md/ro/vizualizare_articol/171200

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3. ȚURCANU, Alina-Petruța, JURAT, Valeriu. Optimizarea procesului instructiv-educativ în lecțiile de educație fizică și sport prin utilizarea eficientă a tehnologiilor informaționale, sub perspectiva principiilor acmeologice. In: *Formarea continuă a specialistului de cultură fizică în conceptul acmeologic modern*: Conferință științifică cu participare internațională. Chișinău, Republica Moldova: Dapartamentul Sporturi de Lupte și Gimnastică al USEFS, 2024, Ediția 4, pp. 149-154. ISBN 978-9975-68-504-7. https://ibn.idsi.md/ro/vizualizare_articol/206950

4. ȚURCANU, Alina-Petruța. Integration of a digital educational platform for optimizing the teaching process in physical education and sport lessons in primary school. In: *International Scientific Conference „Actualities and Perspectives of Physical Education and Sport Sciences"*, 2025. București.

ANNOTATION

Ţurcanu Alina-Petruţa: Monitoring the teaching and learning process in physical education lessons through the application of information technologies, *PhD thesis in education sciences*, Chisinau, 2025.

The structure of the thesis includes an annotation, an introduction, three chapters, conclusions and recommendations, a bibliography with 269 sources, and 13 appendices. The paper has a total of 214 pages, of which 131 constitute the main text, including 24 tables and 61 figures. The research results were capitalized on through the publication of 11 scientific articles.

Keywords: instructional-educational process, lesson, physical education, application, information technologies.

The aim of the research is to determine the effectiveness of the teaching and learning process in physical education lessons through the application of information technologies.

Research objectives: 1. Analyzing the specialized literature on the integration of information technologies in the educational process, with a focus on their applicability in the field of physical education in primary education; 2. Identifying current needs and challenges in organizing physical education lessons in the context of the digitization of education; 3. To develop and implement a digital platform for monitoring student performance and integrating digital educational resources into physical education lessons in primary education; 4. To argue for the effectiveness of applying information technologies in physical education lessons in primary education, based on data obtained from the experimental program.

The novelty and scientific originality of the paper lies in the design and validation of a digital platform for monitoring the motor performance of primary school students during physical education lessons. The research contributes to the modernization of the teaching and learning process by integrating interactive information technologies, which increases the objectivity of assessment and improves the effectiveness of teaching in primary education.

The results obtained, which contribute to solving an important scientific problem, address the need to optimize the teaching and learning process in physical education lessons in primary education by integrating information technologies as a modern means of supporting teaching activities. The research proposes the development and application of a digital platform designed to monitor students' progress and motor performance.

The theoretical significance lies in strengthening the conceptual framework for integrating information technologies into physical education through the use of a digital platform and interactive multimedia resources. The research offers an innovative perspective on the role of technology in supporting the teaching and learning process and in monitoring the performance of primary school students.

The practical value of the research lies in the fact that the results obtained can be used as a methodological guide by physical education teachers in primary education, in the context of increasing the effectiveness of physical education lessons conducted with primary school students.

The scientific results were implemented by applying the experimental program that integrated the *sport-edu.digital* digital platform into physical education lessons in primary education. The activities took place at the "Iorgu Vârnav Liteanu" Technological High School in Liteni, Suceava County, and in other schools. The practical application was confirmed by implementation certificates, and the effectiveness of the method was demonstrated by the pedagogical experiment.

ADNOTARE

Ţurcanu Alina-Petruţa: Monitorizarea procesului instructiv-educativ în lecţiile de educaţie fizică prin aplicarea tehnologiilor informaţionale, *teză de doctor în ştiinţe ale educației*, Chișinău, 2025.

Structura tezei cuprinde adnotarea, introducerea, trei capitole, concluziile și recomandările, bibliografia cu 269 de surse și 13 anexe. Lucrarea totalizează 214 pagini, dintre care 131 constituie textul de bază, incluzând 24 de tabele și 61 de figuri. Rezultatele cercetării au fost valorificate prin publicarea a 11 articole științifice.

Cuvinte-cheie: proces instructiv-educativ, lecţie, educaţie fizică, aplicare, tehnologii informaţionale.

Scopul cercetării constă în determinarea eficienței procesului instructiv-educativ în cadrul lecțiilor de educație fizică prin aplicarea tehnologiilor informaționale.

Obiectivele cercetării: 1. Analizarea literaturii de specialitate privind integrarea tehnologiilor informaționale în procesul educațional, cu accent pe aplicabilitatea acestora în domeniul educației fizice din învățământul primar; 2. Identificarea nevoilor și provocărilor actuale în organizarea lecțiilor de educație fizică în contextul digitalizării învățământului; 3. Dezvoltarea și implementarea unei platforme digitale destinate monitorizării performanțelor elevilor și integrării resurselor educaționale digitale în lecțiile de educație fizică din învățământul primar; 4. Argumentarea eficienței aplicării tehnologiilor informaționale în cadrul lecțiilor de educație fizică din învățământul primar, pe baza datelor obținute în cadrul programului experimental.

Noutatea și originalitatea științifică a lucrării constă în proiectarea și validarea unei platforme digitale, destinată monitorizării performanțelor motrice ale elevilor din ciclul primar, în cadrul lecțiilor de educație fizică. Cercetarea contribuie la modernizarea procesului instructiv-educativ prin integrarea tehnologiilor informaționale interactive, ceea ce permite creșterea obiectivității evaluării și îmbunătățirea eficienței actului didactic în învățământul primar.

Rezultatele obținute, care contribuie la soluționarea unei probleme științifice importante, vizează necesitatea optimizării procesului instructiv-educativ în lecțiile de educație fizică din învățământul primar, prin integrarea tehnologiilor informaționale ca mijloc modern de sprijin al activităților didactice. Cercetarea propune elaborarea și aplicarea unei platforme digitale destinate monitorizării progresului și performanțelor motrice ale elevilor.

Semnificația teoretică constă în consolidarea cadrului conceptual privind integrarea tehnologiilor informaționale în educația fizică, prin utilizarea unei platforme digitale și a resurselor multimedia interactive. Cercetarea oferă o perspectivă inovatoare asupra rolului tehnologiei în sprijinirea procesului instructiv-educativ și în monitorizarea performanțelor elevilor din învățământul primar.

Valoarea aplicativă a lucrării constă în faptul că rezultatele obținute pot fi utilizate ca ghid metodologic de către profesorii de educație fizică din învățământul primar, în contextul creșterii eficienței lecțiilor de educație fizică desfășurate cu elevii din clasele primare.

Implementarea rezultatelor științifice s-a realizat prin aplicarea programului experimental care a integrat platforma digitală *sport-edu.digital* în lecțiile de educație fizică din învățământul primar. Activitățile s-au desfășurat la Liceul Tehnologic „Iorgu Vârnav Liteanu” din Liteni, județul Suceava, și în alte unități școlare. Aplicarea practică a fost confirmată prin adeverințe de implementare, iar eficiența metodei a fost demonstrată prin experimentul pedagogic.

ŢURCANU ALINA-PETRUȚA

MONITORING THE INSTRUCTIONAL-EDUCATIONAL PROCESS IN PHYSICAL EDUCATION LESSONS THROUGH THE APPLICATION OF INFOEMATION TECHNOLOGIES

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