PODIUM
Journal of Science and Technology in Physical Culture

Volume 19
Issue 3
2024

University of Pinar del Río "Hermanos Saíz Montes de Oca"

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, September-December 2024; 19(3): e1730

Original article

Physical activities to develop digital and socio-emotional competencies in high school

Actividades físicas para desarrollar competencias digitales y socioemocionales en estudiantes de bachillerato

Atividades físicas para desenvolver competências digitais e socioemocionais em estudantes do ensino médio

Ronald Gabriel Garcés Quilambaqui[1*], *Roberto Carlos Solis Castro*[2*], *Sandra Elizabeth Loján Loján*[3*], *Jorge Luis Serrano Aguilar*[1*], *José David Zapata Escobar*[4*]

[1*]Universidad Técnica de Machala

[2*]Escuela de Educación Básica Eloy Alfaro

[3*]Escuela de Fútbol Formativo "Independiente del Valle" sede Puembo.

[4*]Investigador Independiente

Corresponding author: rgarces@utmachala.edu.ec

Received: 28/09/2024

Approved: 11/10/2024

ABSTRACT

Physical education promotes the comprehensive development of students, including digital, socio-emotional and cognitive competencies, essential to face the challenges of the contemporary world in their academic and professional life. The objective of this article is to let know the results of a research related to the application a set of physical activities from Physical Education that contribute to the development of transversal competencies such as digital and socio-emotional ones in high school students. The research used a pre-experimental design with a quantitative and qualitative approach, applied to 105 high school students in Quito, Ecuador. For this, a physical activity program was designed which was applied for two months, validated by experts, with pretest and posttest to measure the skills. The results showed improvements in digital and socio-emotional competencies after the intervention. 63% of the students reported greater technological capacity, while 60% expressed satisfaction with their socio-emotional development, highlighting progress in leadership, teamwork and emotional management. Physical activities, integrated with digital technologies, improved performance and developed essential competencies for students' emotional well-being and academic success.

Keywords: Digital socio-emotional and skills, Physical Education, high school, intervention

RESUMEN

La educación física promueve el desarrollo integral de los estudiantes, incluye competencias digitales, socioemocionales y cognitivas, esenciales para enfrentar los desafíos del mundo contemporáneo en su vida académica y profesional. El objetivo de este artículo es dar a conocer los resultados de una investigación relacionada con la aplicación de un conjunto de actividades físicas desde la Educación Física que contribuya al desarrollo de competencias transversales como las digitales y socioemocionales en estudiantes de bachillerato. La investigación utilizó un diseño preexperimental con un enfoque cuantitativo y cualitativo, aplicado a 105 estudiantes de bachillerato en Quito, Ecuador. Para ello se diseñó un programa de actividades físicas aplicado durante dos meses, validado por expertos, con

pretest y postest para medir las competencias. Los resultados mostraron mejoras en las competencias digitales y socioemocionales tras la intervención. El 63% de los estudiantes reportó una mayor capacidad tecnológica, mientras que un 60% expresó satisfacción con su desarrollo socioemocional, se destacó avances en liderazgo, trabajo en equipo y gestión emocional. Las actividades físicas, integradas con tecnologías digitales, mejoraron el rendimiento, desarrollaron competencias esenciales para el bienestar emocional y el éxito académico de los estudiantes.

Palabras clave: Competencias digitales y socioemocionales, Educación Física, bachillerato, intervención.

RESUMO

A Educação Física promove o desenvolvimento integral dos estudantes, incluindo competências digitais, socioemocionais e cognitivas, essenciais para enfrentar os desafios do mundo contemporâneo na sua vida académica e profissional. O objetivo deste artigo foi aplicar um conjunto de atividades físicas no âmbito da Educação Física que contribuíssem para o desenvolvimento de competências transversais, como as digitais e socioemocionais, em estudantes do ensino secundário. A investigação utilizou um desenho pré-experimental com uma abordagem quantitativa e qualitativa, aplicada a 105 estudantes do ensino secundário em Quito, Equador. Foi desenhado e implementado um programa de atividades físicas ao longo de dois meses, validado por especialistas, com avaliações de pré-teste e pós-teste para medir estas competências. Os resultados mostraram melhorias nas competências digitais e socioemocionais após a intervenção. 63% dos estudantes relataram uma maior capacidade tecnológica, enquanto 60% expressaram satisfação com o seu desenvolvimento socioemocional, destacando progressos na liderança, trabalho em equipa e gestão emocional. As atividades físicas, integradas com tecnologias digitais, melhoraram o desempenho e promoveram competências essenciais para o bem-estar emocional e o sucesso académico dos estudantes.

Palavras-chave: Competências digitais, socioemocionais, Educação Física, ensino médio, intervenção.

INTRODUCTION

Physical Education (PE) contributes to the physical development of students, as well as their mental, emotional and social processes. As a discipline, PE is an inexhaustible source of skills and abilities that can be transferred to other areas of knowledge, making it an essential and comprehensive subject. In today's educational field, the importance of including competencies in curricula that prepare students to face the challenges of the contemporary world is increasingly recognized. These competencies are not limited to the physical, but also cover socio-emotional, cognitive and digital aspects, all essential for their future academic and professional performance.

Competencies do not reside solely in the technical skills that a person possesses, but in their ability to mobilize and apply them in problem solving. As Triviño et al. (2019) mention, true competence manifests itself in action and in the ability to link different actions that allow achieving an objective in diverse situations. In this sense, Physical Education offers an ideal environment to foster these competencies, since it promotes a comprehensive approach that includes knowing how to act, teamwork, self-management and decision-making.

Physical Education, Recreation and Sport training within the educational context not only develops physical competencies, but also transversal competencies such as socio-emotional and digital, which are crucial for the academic and professional life of students. In this sense, "corporeality", understood as the fundamental role of the body in the process of self-knowledge and in understanding the environment, plays a central role in the integral formation of the individual. This corporeality facilitates not only interaction with others, but also with the natural world, promoting a deep connection between the body, mind and environment (Soto and Vargas, 2019).

In the case of PE, as Macheno (2022) suggests, the development of competencies requires the integration of attitudes, values, knowledge and skills that allow students to face challenges in a creative and flexible way. A clear example of this is observed in teamwork

during Physical Education classes, where students not only learn to collaborate, but also develop autonomy in decision-making and the ability to adapt.

Through interdisciplinary projects, such as choreographic shows, school olympiads or nature excursions. In addition, previous studies, such as that of Campos et al. (2011), have shown that competencies such as the use of games, teaching resources, body expression and the promotion of healthy habits are especially valued in the comprehensive training of students.

Likewise, Baena and Granero (2012) highlight the importance of promoting physical activity habits and healthy lifestyles among schoolchildren. These authors underline the relationship between physical activity, hygiene and health habits, as well as the promotion of competencies such as initiative, leadership and management of work groups, which are essential in the educational and professional environment. Haro and Mora (2012) point out that both students and teachers develop competencies such as collaboration, ethical behavior and social responsibility. These are essential to promote lifelong participation in physical activities and in the school and professional environment (Álvarez-Flores, 2024).

In this way, Physical Education also contributes to the development of mathematical and linguistic competencies, as observed in the calculation skills applied in measuring distances or analyzing sports results, as well as in verbal and non-verbal communication practiced during physical activities (Figueras et al., 2016). These competencies are aligned with the objectives of the current educational system, which seeks to train students capable of facing the challenges of an increasingly interconnected and technologically advanced world.

In this context, there is a need to research how Physical Education can be a tool for the development of competencies beyond the physical, affecting socio-emotional and digital aspects that are increasingly relevant in the contemporary educational field (Brito Mancheno, 2022). In addition, it is necessary to explore how these competencies can be effectively integrated into the high school curriculum to prepare students for the challenges of the modern world. The objective of the research was to apply a set of physical activities

from Physical Education that contribute to the development of transversal competencies such as digital and socio-emotional ones in high school students.

MATERIAL AND METHODS

This research was carried out in a private educational institution located in the city of Quito, Ecuador. The sample consisted of 105 third-year high school students, distributed in three parallel groups of 35 students each, out of a total of 800 students enrolled in the institution. The research was framed in a pre-experimental design, with a quantitative and qualitative approach, focused on the evaluation of the impact of a physical activity program on the development of transversal, digital and socio-emotional competencies of students.

It was begun with the design of an exercise program by an interdisciplinary team of Physical Education teachers, experts in educational technologies and psychopedagogues, to implement a set of physical activities that promoted the development of digital and socio-emotional competencies in students, such as collaboration, leadership and decision-making and the use of technology. These activities were designed to integrate seamlessly with the Physical Education curricular objectives and were based on principles of active pedagogy and collaborative learning.

This program was implemented over two months, with 45-minute pedagogical sessions, twice a week. Each session included physical activities that involved the use of mobile applications for monitoring physical performance, such as time and distance records, analysis of results, as well as group exercises that promoted teamwork and problem solving in simulated situations. The design of these activities was aimed at improving motor skills and socio-emotional competencies in students.

The program was validated by a committee of experts in Physical Education and pedagogy, who reviewed the relevance of the proposed activities and their alignment with the research objectives. In addition, a pilot test was carried out with a group of 10 students to assess the feasibility of the activities and adjust the design according to the needs observed in the educational context. This validation was important to ensure that the activities were

appropriate in physical terms and to guarantee the development of transversal and digital competencies.

The study followed a pre-experimental scheme with the application of a pretest before the intervention and a posttest at the end of the program. The pretest assessed the initial level of the students' digital and socio-emotional competencies. The surveys used in the pretest measured digital competencies in terms of technological skills and socio-emotional skills in terms of teamwork, decision-making, empathy and leadership. After the application of the physical activity program for two months, a posttest was administered to assess changes in the developed competencies.

The construction of the data collection instrument was based on an analysis of the digital and socio-emotional competencies that were sought to be measured in students. To ensure the relevance and clarity of the items, a bibliographic review of previous studies addressing skills in the field of Physical Education and the use of technological tools applied in educational environments was carried out.

The questions were designed taking into account three key dimensions: cognitive, procedural and evaluative-affective, covering aspects such as knowledge of digital technologies, the ability to work in a team, and emotional self-management. The items were formulated on a five-point Likert scale, in order to gradually capture the perceptions of students and teachers about the impact of physical activities on the development of these competencies.

To ensure the validity of the designed instruments, a validation process was carried out by expert judgement. Five specialists in Physical Education, educational technologies and psychometrics were selected, who reviewed the items in terms of their coherence, relevance and clarity. This process allowed the questions to be adjusted and refined to ensure that they adequately reflected the competencies that were sought to be measured. Subsequently, a pilot test was carried out with a group of 10 students with characteristics similar to those participating in the main study, to detect possible difficulties in understanding the questions and to ensure that the items were appropriate for the target population.

Once the pilot test was applied, a reliability analysis of the instruments was carried out using Cronbach's Alpha coefficient, in order to measure the internal consistency of the items in each of the dimensions evaluated. The results of the analysis yielded a coefficient of 0.85, which indicates a high level of reliability of the instrument. This index supports the robustness of the surveys applied, ensuring that the measurements carried out are reliable and reproducible in similar contexts.

Surveys were designed and applied to both students and teachers, evaluating:

- Digital competencies as skills to use technological tools in educational and personal contexts.
- Socio-emotional competencies such as aspects of teamwork, empathy, decision-making, and the ability to lead and collaborate in group activities. The surveys used a five-point Likert-type scale to measure the level of agreement or disagreement with statements related to these competencies.

RESULTS

The results of the pre- and post-diagnosis, after the application of physical activities aimed at developing digital and socio-emotional competencies in third-year high school students. In addition, the impact of these activities on the perceptions of students and teachers is shown, as well as the analysis of the weaknesses and strengths identified.

A structured survey was administered to students to address the three main dimensions (cognitive, procedural and evaluative-affective). The results are presented below:

Table 1. *Results of the survey applied to students (pre)*

Dimensions/Questions	Always	Almost always	Sometimes	Rarely	Never
Cognitive Dimension					
1. Do you think that physical activities have helped you improve your ability to use technological tools?	7 (20%)	10 (29%)	12 (34%)	4 (11%)	2 (6%)

Dimensions/Questions	Always	Almost always	Sometimes	Rarely	Never
2. Do you think that the competencies learned in Physical Education benefit you in other subjects, such as Mathematics and Computer Science?	6 (17%)	8 (23%)	14 (40%)	5 (14%)	2 (6%)
Procedural Dimension					
1. Do you actively participate in the use of technological tools to record and analyze your physical performance?	5 (14%)	9 (26%)	13 (37%)	6 (17%)	2 (6%)
2. Do you think that physical activities have taught you to work better in a team or to lead groups?	6 (17%)	9 (26%)	13 (37%)	5 (14%)	2 (6%)
Evaluative-Affective Dimension					
1. Are you satisfied with how Physical Education contributes to your personal and academic development?	9 (26%)	11 (31%)	10 (29%)	4 (11%)	1 (3%)
2. Do you think that physical activities have helped you better manage your emotions and face new challenges?	8 (23%)	9 (29%)	11 (31%)	5 (14%)	2 (6%)

Interpretation of initial results:

1. Cognitive Dimension: 49% of students reported that physical activities have helped them improve their ability to use technological tools, although 34% indicated that they perceived this only "sometimes." In addition, 40% of students considered that the competencies acquired in Physical Education influenced their performance in other subjects, such as Mathematics and Computer Science.
2. Procedural Dimension: 63% of students indicated that they actively participate in the use of technological tools to record and analyze their physical performance, and 54% perceived that physical activities improved their teamwork and leadership abilities. However, a significant percentage stated that this relationship is sporadic.
3. Value-Affective Dimension: 57% of students expressed satisfaction with the impact of Physical Education on their personal and academic development, while 54% indicated that these activities helped them better manage their emotions and face new challenges. Although there is a positive impact, there is room for improvement in terms of emotional and academic self-management.

After the implementation of physical activities designed to develop digital and socio-emotional competencies, data was collected through a second survey.

Table 2. *Post-intervention results (post)*

Dimensions/Questions	Always	Almost always	Sometimes	Rarely	Never
Cognitive Dimension					
1. Do you think that physical activities have helped you improve your ability to use technological tools?	12 (34%)	10 (29%)	7 (20%)	2 (6%)	4 (11%)
2. Do you think that the competencies learned in Physical Education benefit you in other subjects, such as Mathematics and Computer Science?	14 (40%)	8 (23%)	6 (17%)	3 (9%)	6 (17%)
Procedural Dimension					
1. Do you actively participate in the use of technological tools to record and analyze your physical performance?	13 (37%)	9 (26%)	5 (14%)	6 (17%)	2 (6%)
2. Do you think that physical activities have taught you to work better in a team or to lead groups?	13 (37%)	9 (26%)	6 (17%)	5 (14%)	2 (6%)
Evaluative-Affective Dimension					
1. Are you satisfied with how Physical Education contributes to your personal and academic development?	11 (31%)	9 (26%)	10 (29%)	4 (11%)	1 (3%)
2. Do you think that physical activities have helped you better manage your emotions and face new challenges?	19 (29%)	8 (23%)	11 (31%)	5 (14%)	2 (6%)

Analysis of the subsequent results:

1. Improvements in the Cognitive Dimension: 63% of students reported a significant improvement in their ability to use technological tools as a result of physical activities, which represents an increase of 14% compared to the initial results. Similarly, 40% of students considered that these competencies benefit their performance in other subjects, although 23% still perceive that the impact is sporadic.
2. Procedural Dimension: There was a 17% increase in active participation in the use of technological tools to record physical performance, indicating a stronger integration of technology into Physical Education classes. In addition, 63% of students perceived improvements in their leadership and teamwork skills, exceeding the initial results.

3. Value-Affective Dimension: 60% of students indicated being satisfied with the contribution of Physical Education to their personal and academic development, an increase in relation to the initial results. However, there is still room for improvement in the emotional impact, as 37% of students still perceive occasional difficulties in managing their emotions.

DISCUSSION

When comparing the results obtained in this research with similar studies, important coincidences and divergences are evident that contribute to understanding the role of Physical Education in the development of competencies beyond the physical field, focusing on the digital and socio-emotional fields.

In line with what Opstoel et al. (2020) pointed out, the interdisciplinary nature of PE is confirmed as a key tool for promoting transversal values and competencies such as ethics, decision-making, responsibility, leadership, and cooperation. The results of this study reflect that students, through physical activities designed with an interdisciplinary approach, developed motor skills, as well as essential capacities for social and academic life, such as teamwork and emotional management (Posso and Barba, 2023, 2024).

However, it is important to highlight that, as Zayas et al. (2020) indicate, these achievements are only consistently achieved in educational environments where the conditions are adequate. Zayas argues that the values and attitudes promoted in PE often remain hypothetical if certain pedagogical and social conditions are not met (Posso et al., 2024a). This study supports this position by observing that, although students showed improvements in their digital and socio-emotional competencies, the benefits were more significant in those contexts where teachers adopted an active pedagogical approach and technologies were effectively integrated into physical activities (Posso et al., 2024a).

This finding suggests that for digital and socio-emotional competencies to be fully developed, it is necessary to implement physical activities designed for these purposes, as well as an educational context that supports interdisciplinarity and collaboration between

subjects, as noted by Posso et al. (2024b). The link between scientific content, pedagogical methods, and the social objectives of education is key to ensuring that students internalize the competencies developed in PE and apply them in other academic and personal contexts.

On the other hand, Posso et al. (2024c) analyse how physical activity contributes to the development of professional competencies in university students, highlighting the importance of integrating physical activities into the development of skills useful for future employment. Although this study focuses on the university context, the conclusions are applicable to this work at the high school level, given that students also develop competencies necessary for their future academic life and to adapt to a digital and collaborative environment.

An important difference with other studies is that, although they recognize the role of PE in the comprehensive development of the student, their focus is more oriented towards physical development and they do not deeply explore the impact on digital competencies (De Diego et al. 2024; Almonacid and Herrera, 2024). In contrast, the present research not only shows the potential of PE for physical and motor development, but also emphasizes its ability to promote digital competencies through the use of technological tools such as mobile applications and digital platforms to monitor and analyze physical performance.

CONCLUSIONS

This study has shown that, by using mobile applications and other technological tools in the context of Physical Education, students improve their motor skills, and also develop technological competencies applicable to other areas of knowledge, such as Mathematics and Computer Science. This finding establishes a new relationship between Physical Education and digital learning, which until now has been little explored at the high school level.

Through collaborative physical activities, students developed essential skills for their academic and personal lives, such as the ability to work in a team, lead groups, and manage stress. This provides a solid basis to justify the inclusion of social-emotional competencies

within the Physical Education curriculum, showing that this approach directly contributes to the emotional well-being and academic success of students.

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Conflict of interest statement:

The author declares that there are no conflicts of interest.

Author's contribution:

The author is responsible for writing the work and analyzing the documents.