The Annals of the "Ştefan cel Mare" University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131

GAMIFICATION IN PHYSICAL EDUCATION INSIGHTS FROM BIBLIOMETRIC ANALYSES AND CONCEPTUAL MAPPING

Stoica Leonard [1*]
Scheuleac Adelina [2]
[1] "Dunarea de Jos" University of Galati, Faculty of Physical Education and Sports, Department of Individual Sports and Kinetotherapy, 800008 Galati, Romania
[2] "Institute of Physical Education and Sport of USM, 22 Andrei Doga Street, University of Physical Education and Sports, Chișinău, Republic of Moldova"
* Corresponding author: leonard.stoica@ugal.ro / +40722463151

Keywords: gamification, physical education, bibliometric analysis, conceptual mapping

Abstract

This study examines the application of gamification in Physical Education (PE) by analyzing scientific literature published between 2020 and 2025 in the Web of Science database. From the records identified, 76 articles met the inclusion criteria and were evaluated through bibliometric, conceptual, and thematic analyses. The findings indicate increased research interest in gamification and highlight two central nodes, *Gamification* and *Physical Education*, around which three major thematic clusters are organized. The affective-motivational cluster shows consistent associations with intrinsic motivation, satisfaction, and student engagement, suggesting that gamified strategies enhance the psychological climate of PE lessons. The performance-oriented cluster includes outcomes related to motor and cognitive progress, indicating the potential of gamified interventions to support learning outcomes. The theoretical-methodological cluster reveals frequent reliance on frameworks such as Self-Determination Theory and Game-Based Learning. Overall, the reviewed literature indicates positive effects on student motivation and participation, although evidence regarding performance outcomes remains inconsistent. These results suggest that gamification is a promising instructional approach in PE, with potential for broader practical implementation, but further rigorous experimental studies and standardised methodologies are needed to strengthen the evidence base.

Introduction

In the current context of physical education, gamification represents a modern pedagogical approach designed to stimulate students' motivation, engagement and performance. The integration of game elements into the instructional process contributes to the development of motor skills and to the creation of a dynamic and attractive learning experience, and studies from recent years confirm the effectiveness of this method in increasing active participation and adapting content to the needs of different school levels.

In the last decade, interest in applying gamification in physical education lessons has increased significantly. This trend is driven by the potential of gamification to increase intrinsic motivation, active participation and student engagement by satisfying basic psychological needs such as autonomy, competence and relatedness, as defined by Self-Determination Theory (SDT). Recent studies ground their interventions in this theoretical framework, aiming to create learning environments in which students feel more engaged and autonomous, and therefore more motivated to participate actively in physical education classes [1].

The integration of game elements into physical education lessons supports the development of motor skills and emotional intelligence among primary school students. In a study conducted in British schools, gamified interventions were shown to be not only feasible but also effective in improving motor competence and emotional regulation, being positively valued by teachers [2]. At the secondary education level, research highlights that the use of gamified intermittent programming in physical education lessons has a significant impact on the degree of pleasure experienced by students during physical activities, which may contribute to a more positive long-term attitude toward movement [3].

Similarly, in the Philippines, a study with eighth-grade students showed that gamified lessons were perceived as more enjoyable and less stressful than traditional ones [4].

In addition to emotional effects, gamification also appears to have a beneficial impact on knowledge retention. The combination of the Total Physical Response (TPR) method with gamified lessons led to significant improvements in academic performance and learning durability among students and young people [5, 6]. This effect is also supported by the integration of new technologies: tangible systems based on RFID and gamification, such as Game-Learning, and technology-assisted environments using edge computing, which have led to higher levels of participation and learning [7, 8]. From a theoretical perspective, a coherent framework for understanding the impact of gamification is offered by Achievement Goal.

Theory, which highlights the importance of a task-oriented climate that promotes inclusion and the desire to learn [9]. Reviews and meta-analyses published between 2020 and 2025 synthesize these directions as follows: in 2022, Arufe-Giraldez et al. analyzed 17 empirical studies and observed increases in motivation

and engagement in physical activity, with one study reporting improvements in academic performance [10, 11], while in 2023 Ferriz-Valero reviewed 22 studies across different education levels and found that most indicate an increase in intrinsic motivation with positive effects on participation and school outcomes [1].

Other syntheses confirm the positive trends, reporting beneficial effects on participation, motivation and students' physical abilities [12, 13]. Fernández-Río conducted a 15-week intervention with 290 Spanish students, using a superhero theme, and found a significant increase in intrinsic motivation [14]. Martín-Rodríguez and colleagues showed that, in secondary education, gamification contributes to improving classroom climate and student engagement, even if effects on outcomes or motor abilities remain limited [15]. Quintas et al. [2020] introduced an exergaming unit with dance games for primary school students and observed increases in psychological satisfaction and flow state in the gamified group [16].

In a 2025 study with 120 nine-year-old students, the authors concluded that gamification increased self-esteem and social skills compared to traditional lessons [17], and at the middle school level, the authors showed that an eight-week intervention based on short challenges and digital rewards led to a significant increase in the level of satisfaction experienced in physical education lessons [3]. Most of these studies are conducted in Europe, especially in Spain, which has emerged as a hub of innovation in gamification applied to physical education. However, interest is also expanding to other regions (the Middle East, Latin America), indicating global recognition of the educational value of this approach [18].

Research on gamification, serious games and game-based learning draws on a wide range of theoretical frameworks, with frequent use of motivational theories such as Self-Determination Theory and Flow Theory [19]. Research on applications of artificial intelligence in education is diverse, including multiple models, techniques and challenges related to integrating AI into learning and teaching processes [20]. Gamification in science education is systematically analyzed as a method for increasing engagement and learning efficiency, highlighting trends, gaps and future research directions [21, 22].

In Romania, the authors highlight the increasing interest in integrating gamification into physical education. The first study shows that the use of game elements supports learning and student engagement, and during the pandemic teachers used gamified digital resources to maintain lesson attractiveness [23]. The third study proposes a conceptual model and practical framework for integrating gamification, built on a literature analysis from 2019–2025, and recommends its empirical validation in various educational contexts [24].

Gamification supports student motivation when the structure of activities respects autonomy, competence and relatedness. The analyzed studies show that students participate more actively and perceive physical education lessons as more attractive. Gamified interventions improve students' functioning at motor, emotional

and social levels; research in primary, middle and high school reports increases in experienced pleasure, emotional self-regulation, self-esteem and engagement. Recent reviews indicate a stable trend, with most being published between 2020 and 2025 and reporting positive effects on motivation, active participation and, in some cases, academic performance. The purpose of this article is to synthesize recent trends in gamification in physical education publish in the last 5 years, to highlight the most relevant findings from scientific literature and to discuss pedagogical implications for teachers and curriculum developers.

Material-method

This research is based on a systematic review of the literature, with the main objective of exploring trends and thematic directions regarding gamification in physical education lessons. The sole documentation source was the Web of Science Core Collection (Clarivate Analytics), chosen due to the rigor of its indexing and the international visibility of the publications included. The search was conducted in November 2025 using the phrase "gamification AND 'physical education'" in the Topic (TS) field. Only publications appearing between 2020 and 2025, in English, and classified as peer-reviewed scientific articles were selected, while conference proceedings, editorial notes, and other types of non-indexed scientific communications were excluded.

After applying these criteria and removing irrelevant articles, the final dataset consisted of 76 works out of a total of 353 identified. The file exported from the WoS platform was processed using the Python programming language, employing the Pandas, Matplotlib and NetworkX libraries. The data were cleaned by removing redundant or generic terms (such as "education", "school" or "learning"), after which titles, keywords, authors, abstracts and publication years were extracted. Frequencies of the most commonly used terms were calculated and visualized graphically, with chronological trends in article appearance being identified and analyzed. In the final stage, frequent terms were automatically grouped into thematic clusters, and the resulting networks were visually represented as conceptual maps, highlighting the significant connections among recurrent concepts in the specialized literature. This stage enabled the outlining of the main emerging themes and the identification of relevant directions for further research and for applicability in the educational context.

Results

The temporal distribution of the analyzed articles presented in Figure 1 reveals a constant increase in scientific interest in the theme of gamification in physical education lessons during the period 2020–2023. The number of publications increased from 33 in 2020, to 66 in 2021, and 80 in 2022, reaching a significant peak in 2023 with 98 articles indexed in Web of Science. This upward trend suggests the consolidation of the topic within the educational research agenda, reflecting both the

diversification of methodologies and the expansion of interest in applying game mechanics in formal educational contexts.

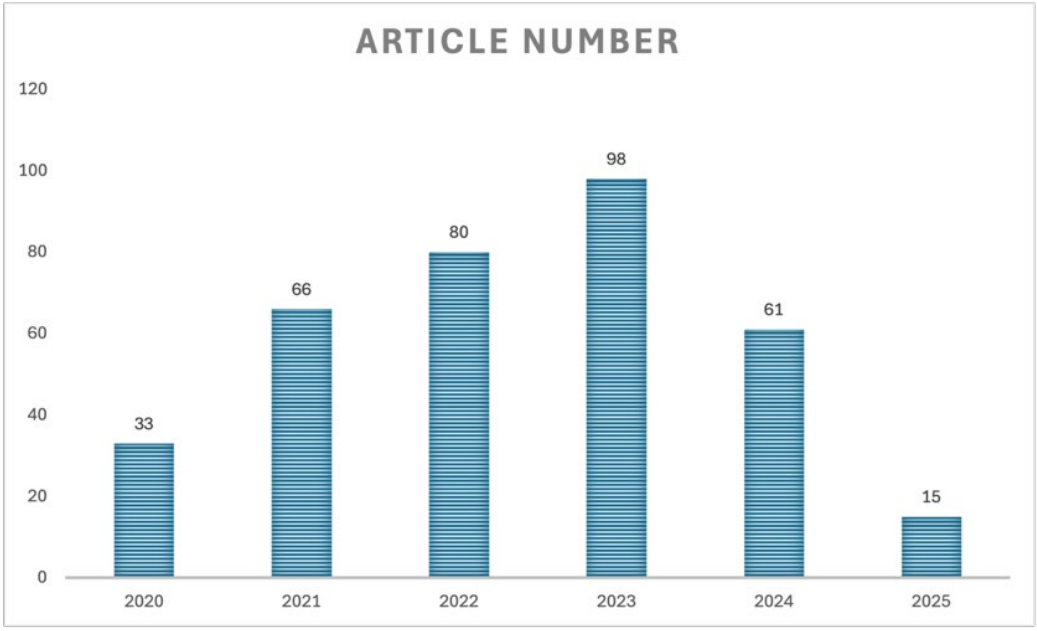

Figure 1. Article number/year

In contrast, the years 2024 and 2025 mark a decrease in the volume of publications, with 61 and 15 articles respectively. These fluctuations may be attributed to typical indexing delays, but also to a possible reorientation of scientific interest toward more specific or emerging subtopics, such as the integration of exergaming or differentiated analyses by age groups. This evolution indicates the need for in-depth analyses of the dynamics of dominant subjects in the specialized literature.

The diagram in Figure 2 logically structures the research field, facilitating the understanding of methodological priorities and the outcomes targeted in studies on Gamification in Physical Education.

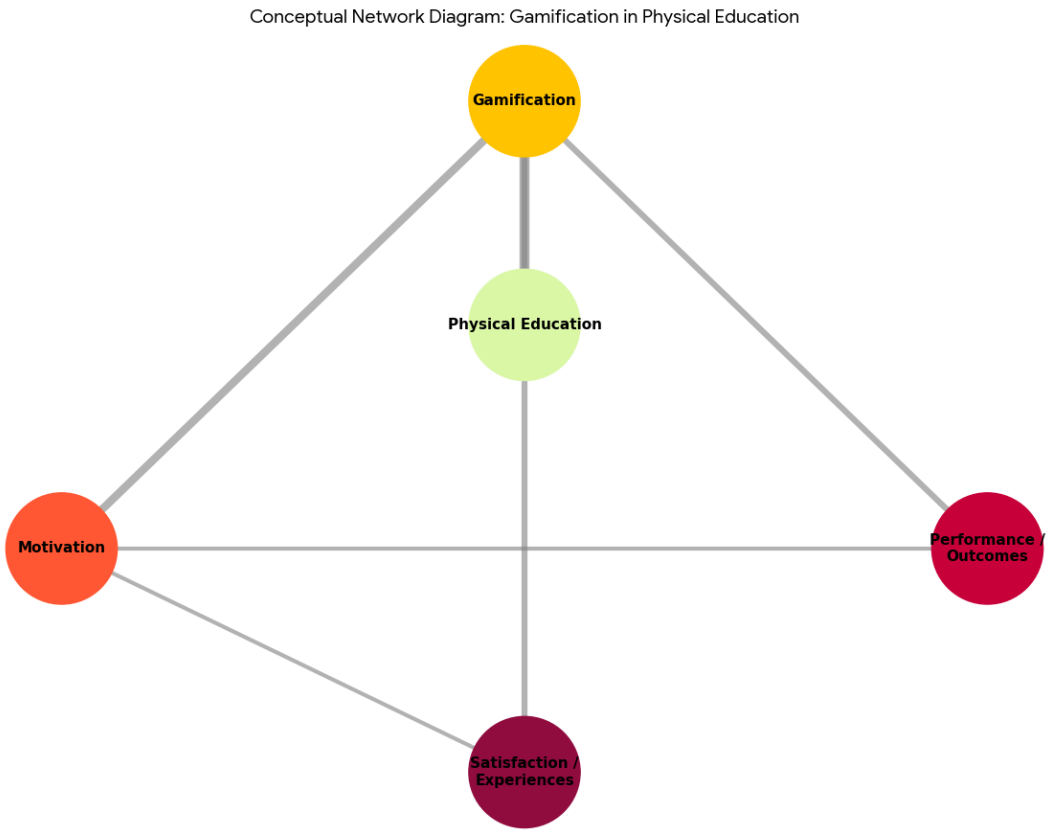

Figure 2. Conceptual Network Diagram

The conceptual network indicates the thematic structure of the literature on gamification in physical education and highlights five central nodes. The analysis of their positioning shows that Gamification and Physical Education form the main axis of the interventions. Gamification appears as a generator of direct influences on the other variables. Physical Education occupies the median position and functions as the space in which ludic mechanisms are applied and validated. The visible links in the diagram suggest high co-occurrence frequencies in the analyzed article sets, with stronger intensities on the Gamification–Motivation and Gamification–Performance relationships.

The motivational cluster includes terms such as Motivation and Satisfaction. The close connections between these nodes indicate that studies frequently report increases in intrinsic motivation and improvements in the learning experience. Their positioning at short distances from Gamification suggests a high degree of thematic association in bibliometric analyses. The literature reports consistent effects on students' perceptions, engagement and quality of affective experiences. These results

align with explanatory models based on the psychological needs of autonomy, competence and relatedness.

The performance-oriented cluster includes Performance and Outcomes. The direct link with Gamification indicates authors' interest in the impact on motor skill acquisition and cognitive progress. Studies frequently report quantitative measurements such as motor test scores, participation levels or progress indicators. The positioning of the five nodes reflects a coherent conceptual model. Gamification directly influences motivation, satisfaction and performance. Physical Education acts as the environment in which these effects are observed and measured. The network indicates an integrated model in which increased motivation correlates with more positive perceptions and, in certain contexts, with improved educational outcomes. This structure confirms the dominant directions in recent studies and provides a useful framework for interpreting relationships among the analyzed variables.

The conceptual network positions Gamification and Physical Education as the core of the analyzed interventions, while the nodes Motivation, Satisfaction and Performance form two major thematic groups. Research highlights the central role of affective-motivational mechanisms, as most interventions aim to increase students' motivation and engagement. Connections with performance variables show interest in the impact on motor and cognitive progress. Existing syntheses indicate the general effectiveness of gamified strategies, yet the moderate frequencies suggest an expanding field that requires additional experimental studies to strengthen theoretical foundations and validate the identified relationships.

Discussions

The analysis of the conceptual network built on the 353 articles highlights two central nodes, Gamification and Physical Education, which structure the entire thematic ecosystem of the literature. The high frequency of the term Gamification confirms its status as a dominant instructional method in recent studies. Physical Education appears as the main implementation space, reflecting the specific suitability of motor activities, immediate feedback and social interaction as support for ludic strategies integrated into the lesson.

The structure of the clusters indicates three major research directions. The first cluster is oriented toward performance and achievement, where terms such as Performance / Outcomes show the strongest links with Gamification. In this area, interventions are evaluated in relation to students' progress in cognitive, motor or measurable end-of-lesson performance. Studies aim to determine the extent to which the ludic climate supports the consolidation of competencies, demonstrating interest in an objective validation of the usefulness of gamified strategies in physical education.

The affective-motivational cluster shows that gamified interventions aim to increase intrinsic motivation and support active participation, while satisfaction and

positive perceptions are used as intermediate variables that influence lesson outcomes. The theoretical-methodological cluster indicates that studies rely on models such as Game-Based Learning and Self-Determination Theory, using concepts such as autonomy, competence and relatedness to substantiate activity design and maintain student interest.

The obtained data show that interventions are primarily oriented toward optimizing affective-behavioral variables, with secondary effects on performance and achievement. The moderate frequencies of the terms indicate an expanding research area in which additional investigations are needed, preferably experimental studies with rigorous design. The conceptual network suggests the existence of a clearly defined scientific direction but also highlights the heterogeneity of the methods used, which justifies the need for standardization and further development to strengthen causal relationships between gamification, motivation and performance in physical education lessons.

Future research may clarify the relationships between affective variables, motor progress and cognitive outcomes through experimental studies with larger samples and rigorous designs. The analysis of differences between primary and middle school may highlight how developmental stages influence students' responses to gamified activities. Longitudinal investigations may provide data on maintaining motivation and engagement over time. The integration of digital technologies into motor tasks opens perspectives for personalizing activities and for detailed monitoring of progress. Standardizing methodologies would improve the comparability of studies and strengthen the evidence base necessary for developing effective interventions in physical education.

Conclusions

The bibliometric analysis of Web of Science–indexed literature for the 2020–2025 period indicates a clear consolidation of research on gamification in physical education. The annual distribution highlights a steady increase in the number of publications up to 2023, followed by a decline that can be explained by indexing delays and a shift toward more specific subtopics. The temporal conceptual evolution confirms the maturation of the field and its integration into the international educational research agenda.

This conceptual profile indicates a dominant research orientation toward the analysis of motivational effects of gamification in physical education, while the assessment of its impact on motor and cognitive performance remains underdeveloped and requires further systematic investigation. The findings confirm that recent literature treats gamification as an integrated pedagogical tool within physical education rather than as an isolated intervention. Conceptual networks reveal recurrent use of motivational theoretical frameworks and learner-centered

approaches. This orientation reflects a sustained concern for the quality of participation and for the educational climate generated by physical education lessons.

Overall, the year-by-year analysis and the conceptual structure point to a field in a phase of theoretical stabilization and thematic diversification. The literature provides a solid framework for future investigations focused on causal relationships, age-related differentiation, and the standardization of methodologies used in studies on gamification in physical education.

References

[1]. Ferriz-Valero, A., Osterlie, O., García Martínez, S., & García-Jaén, M. (2020). Gamification in Physical Education: Evaluation of impact on motivation and academic performance within higher education. International Journal of Environmental Research and Public Health, 17(12), 4465 https://doi.org/10.3390/ijerph17124465

[2]. Rice, J., Foweather, L., Magill, C., Foulkes, J., De Meester, A., Lenoir, M., Stodden, D., & Fitton Davies, K. (2025). Feasibility, acceptability and preliminary effectiveness of a gamified physical education intervention on motor competence and emotional intelligence. *European Physical Education Review*, *0*(0). https://doi.org/10.1177/1356336X251388628

[3]. Becerra-Fernández, C. A., Mayorga-Vega, D., & Guijarro-Romero, S. (2025). Effect of a gamified intermittent programming unit on enjoyment in Secondary School pupils in the Physical Education context: Efecto de una unidad didáctica intermitente gamificada sobre el disfrute en estudiantes de Educación Secundaria en el contexto de la Educación Física. *ESPIRAL. CUADERNOS DEL PROFESORADO*, *18*(38), 80-94 https://doi.org/10.25115/ecp.v18i38.10475

[4]. Añasco, E. C., & Olimpo, H. V. (2025). Effects of gamification on the learning of physical education students. *Multidisciplinary Graduate Education Journal, 3*(1), 164–173. https://doi.org/10.54660/.IJMRGE.2025.6.3.799-808

[5]. Prasan, P., & Wongkamjan, J. (2025). TPR learning management integrated with gamification to enhance learning retention. *Journal of Education Rajabhat Maha Sarakham University, 19*(3), 23–35 https://so06.tci-thaijo.org/index.php/edu-rmu/article/view/283610

[6]. Mudayat, M., & Raharjo, S. (2025). Gamification in physical education learning: A strategy to increase student participation at Universitas Terbuka. *Jurnal Performa Olahraga, 7*(1), 88–99 https://performa.ppj.unp.ac.id/index.php/kepel/article/view/792

[7]. Guevara, C., & Bonilla-Jurado, D. (2025). Game-learning: A tangible RFID-based gamified system integrating pictophonics and reinforcement learning to accelerate

early grapheme-phoneme acquisition. *Frontiers in Education, 10*, Article 1623948. https://doi.org/10.3389/feduc.2025.1623948

[8]. Liu, Y., & Narmluk, M. (2025). Design and practice of gamified basketball teaching model based on edge computing: Exploration of improving middle school students' participation and learning outcomes. *Edelweiss Applied Science and Technology, 9*(7), 1972–1984 https://ideas.repec.org/a/ajp/edwast/v9y2025i7p1972-1984id9059.html

[9]. García-González, L., & García-Cazorla, J. (2025). Motivational climates from Achievement Goal Theory: Task-oriented climate as a motivational tool. In *Innovative Approaches in Physical Education* (pp. 245–260). Springer. https://doi.org/10.1007/978-3-031-86908-2_12

[10]. Arufe-Giráldez, V., Sanmiguel-Rodríguez, A., Ramos-Alvarez, O., & Navarro-Patón, R. (2022). Gamification in Physical Education: A systematic review. Education Sciences, 12, 540 https://doi.org/10.3390/educsci12080540

[11]. Sal-de-Rellán, A., Hernández-Suárez, Á., & Hernaiz-Sánchez, A. (2025). *Gamification and motivation in adolescents: A systematic review from Physical Education*. *Frontiers in Psychology, 16*, 1575104 https://doi.org/10.3389/fpsyg.2025.1575104

[12]. Ferriz-Valero, A., Agulló-Pomares, G., & Tortosa-Martínez, J. (2023). Benefits of gamified learning in physical education students: A systematic review. Apunts Educación Física y Deportes, 153, 39-51 https://doi.org/10.5672/apunts.2014-0983.es.(2023/3).153.04

[13]. El-Tanahi, N., Soliman, M., Hady, H. A., Alfrehat, R., Faid, R., Abdelmoneim, M., Torki, M., & Hamoudah, N. (2024). The effectiveness of gamification in physical education: A systematic review. *International Journal of Education in Mathematics, Science and Technology*, 12(2), 4005 https://doi.org/10.46328/ijemst.4005

[14]. Fernández-Río, J., Cecchini, J. A., Méndez-Giménez, A., & Méndez-Alonso, D. (2020). *Gamification and physical education. Impact on motivation and basic psychological needs*. Physical Education and Sport Pedagogy, 25(5), 509–522. https://doi.org/10.1080/17408989.2020.1743253

[15]. Martín-Rodríguez, A., & Madrigal-Cerezo, R. (2025). Technology-Enhanced Pedagogy in Physical Education: Bridging Engagement, Learning, and Lifelong Activity. *Education Sciences*, *15*(4), 409. https://doi.org/10.3390/educsci15040409

[16]. Quintas, A., Bustamante, J. C., Pradas, F., & Castellar, C. (2020). Psychological effects of gamified didactics with exergames in primary school physical education. Computers & Education, 152, 103874 https://doi.org/10.1016/j.compedu.2020.103874

[17]. Carcelén-Fraile, M. D., (2025). Active gamification in the emotional well-being and social skills of primary education students. *Education Sciences, 15(*2), 212
https://doi.org/10.3390/educsci15020212

[18]. El-Tanahi, N., Soliman, M., Hady, H. A., Alfrehat, R., Faid, R., Abdelmoneim, M., Torki, M., & Hamoudah, N. (2024). The effectiveness of gamification in physical education. *International Journal of Education in Mathematics, Science and Technology, 12*(2), 4005
https://doi.org/10.46328/ijemst.4005

[19]. Krath, J., Schürmann, L., & von Korflesch, H. F. O. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior, 125*, 106963
https://doi.org/10.1016/j.chb.2021.106963

[20]. Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J., Yuan, J., & Li, Y. (2021). *A review of artificial intelligence (AI) in education from 2010 to 2020*. Complexity, 2021, 8812542
https://doi.org/10.1155/2021/8812542

[21]. Kalogiannakis, M., Papadakis, S., & Zourmpakis, A.-I. (2021). *Gamification in science education. A systematic review of the literature*. Education Sciences, 11(1), 22
https://doi.org/10.3390/educsci11010022

[22]. Manzano-León, A., Camacho-Lazarraga, P., Guerrero, M. A., Guerrero-Puerta, L., Aguilar-Parra, J. M., Trigueros, R., & Alias, A. (2021). *Between level up and game over: A systematic literature review of gamification in education*. Sustainability, 13(4), 2247
https://doi.org/10.3390/su13042247

[23]. Gulap, M., & Stoica, A. (2022). From game to gaming and gamification in physical education. *eLearning & Software for Education*, 2, 87 https://openurl.ebsco.com/EPDB%3Agcd%3A9%3A1555209/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A182911465&crl=c&link_origin=scholar.google.com
https://doi.org/10.12753/2066-026X-22-087

[24]. Mănescu, D. C. (2025). A conceptual model and practical framework for integrating gamification strategies into Physical Education and Sports. *Preprints*. https://doi.org/10.20944/preprints202507.1114.v1