Global trends of gamification in enhancing students' social skills in physical education (2015–2025)

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ABSTRACT

Background: The development of digital technology has triggered a more interactive learning transformation through gamification, namely using game elements to increase students' motivation, engagement, and social skills, such as cooperation, communication, empathy, and problem solving.

Objectives: This study aims to analyze global research trends on gamification in enhancing students' social skills, particularly in physical education, through a bibliometric analysis from 2015 to 2025.

Methods: This study employed a bibliometric design. Data were retrived from the Scopus database on April 22, 2025, using specific keywords: (gamification OR gamified learning OR game-base-based learning) AND ("physical education" OR "PE class" OR "sport education") AND (social skills" OR "social competence" OR "social interaction") AND (elementary school" OR "primary school" OR "midle school" OR "junior high school" OR "high school" OR "secondary school" From an initial 120 documents, 47 met the inclusion criteria. VOSViewer was used to analyze keyword co-occurrence, visualize trends, and identify thematic clusters by completely counting on all keywords with at least two documents per author.

Results: 47 relevant articles were identified, with publication peaking in 2020. Keyword analysis revealed five main thematic clusters: gamification in education, digital game-based learning, collaborative learning, emerging technologies, and motivation. The most frequent keywords were game-based learning (n=12), gamification (n=9), and students (n=8). The University of Patras emerged as the most productive institution, while the leading journal was the International Journal of Learning, Teaching and Educational Research.

Conclusions: Although research on gamification has grown significantly, its application in physical education remains underexplored. This study reveals a gap in leveraging gamification to develop students' social skills in physical education. Future research should focus on integrating gamification in this context while considering sociocultural and technological factors to ensure inclusive and effective implementation.

Keywords: bibliometric analysis, gamification, physical education, social skills.

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INTRODUCTION

The development of digital technology has driven significant transformation in the world of education, especially in more interactive and participatory learning approaches. One innovative approach now widely applied is gamification, using game elements in non-game contexts, including in the learning process. Gamification has been proven to increase motivation, engagement, and learning experiences for students in a more enjoyable and meaningful way (Figueiredo & Garcia-Penalvo, 2020; Othman et al., 2024; Smirani & Yamani, 2024). More than just improving cognitive aspects, gamification also has a positive impact on the formation of students' social skills, such as cooperation, communication, empathy, and the ability to resolve conflicts (Pysmennyi, 2024; Fonseca et al., 2023; Bracho Mosquera et al., 2024).

Social skills are an important aspect in developing 21st-century competencies that students must have in order to be able to adapt and contribute to dynamic social life (Oluwagbohunmi & Alonge, 2023; Ramamonjisoa, 2024). Previous research shows that a game-based learning approach can create a learning environment that supports social interaction, fosters collaboration, and develops students' interpersonal competencies (Zheng et al., 2021). However, most of these studies are still scattered and descriptive and have not shown a systematic, in-depth relationship between the application of gamification and the development of students' social skills (Liu et al., 2020). This condition shows the need to summarize and analyze existing findings comprehensively to map the direction of scientific development in gamification-based learning and social skills (Hashim et al., 2024).

In recent years, the number of publications discussing the link between gamification and social skills has increased. However, studies that specifically map the relationship between gamification and social skills through bibliometric analysis are still minimal. Bibliometric analysis is needed to identify research trends, dominant keywords, scientific collaboration networks, and developing thematic clusters. With this approach, researchers can find out to what extent the topic of gamification and social skills has received academic attention, as well as identify areas that are still not worth exploring as future research gaps.

This study makes a unique contribution to the international literature by presenting the first comprehensive bibliometric analysis that maps explicitly the relationship between gamification and students' social skills in the context of physical education. While most previous studies have focused more on the impact of gamification on cognitive or motivational aspects in general learning environments, this study fills an important gap by covering the global research landscape, identifying emerging thematic clusters, and highlighting under-explored areas such as the application of game-based learning strategies in the domain of physical education and health. By integrating data visualization techniques through VOSViewer software and analyzing publication trends over the past decade from the Scopus database, this study offers strategic insights for researchers, educators, and policymakers who wish to leverage gamification more holistically to support students' interpersonal skills development through physical activity-based learning.

METHODS

Study Design

This type of research is a quantitative bibliometric study that aims to map scientific publication trends and intellectual structures related to gamification and students' social skills in physical education. The bibliometric approach is used to identify patterns, main themes, and scientific collaborations that have developed over a specific period.

Search Strategy and Selection Process

The sampling technique used the Scopus database as the primary data source. Data collection was conducted on April 22, 2025 using word (gamification OR gamified learning OR game-based learning) AND (physical education" OR "PE class" OR "sport education") AND ("social skills" OR "social competence" OR "social interaction") AND ("elementary school" OR "primary school" OR "middle school" OR "junior high school" OR "high school" OR "secondary school"). In addition, the publication year filter was limited to the range of 2015 to 2025. From the initial search results, 120 articles were obtained. After filtering based on inclusion criteria and removing duplications, 47 articles met further requirements. The search procedure can be shown in Figure 1.

The main instrument used in this analysis is VOSViewer software, which is used to visualize and map the relationships between elements in scientific publications. The parameters used in VOSViewer include:

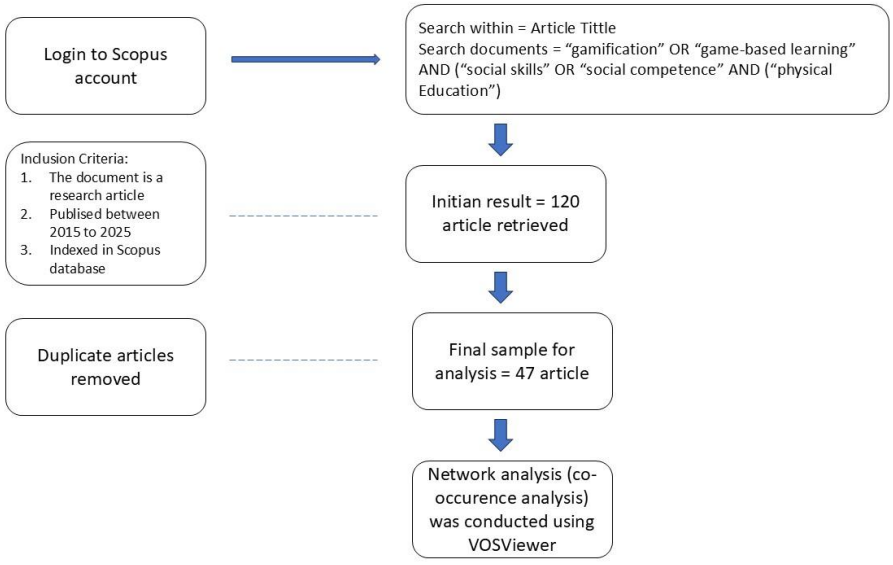

Figure 1. Article Metadata Search Design from Scopus

The analysis in this study uses co-occurrence analysis as the primary type of analysis, with the unit of analysis being all keywords. The calculation method used is complete counting, namely, each occurrence of a keyword is entirely counted without considering the relative weight. For contributor mapping, the minimum number of documents per author included in the analysis is set at two documents to ensure each author's relevance and significant contribution in publications related to gamification and social skills.

Data Analysis

Data analysis techniques are carried out through two main approaches, publication map and keyword co-occurrence analysis, which are part of the co-word analysis technique. This analysis includes mapping the main contributors to the publication (authors, university affiliations, and journal sources), identifying publication trends based on frequently appearing keywords, and tracking the main thematic clusters that develop in gamification research.

In addition, the analysis results are presented in the form of data visualization, which illustrates the relationship between keywords, frequency of occurrence, and thematic developments based on the year of publication. This visualization aims to display the knowledge structure and direction of topic development comprehensively. Researchers mapped the main contributors (authors, universities, and source names) and applied keyword co-occurrence analysis to determine publication trends. They traced the main themes or topics in the publications (McAllister et al., 2022).

RESULTS

Productivity of publication and mapping of publications in the field of gamification

Based on gamification publication productivity data, 47 article publications were recorded and distributed from 2015 to 2025 (Figure 2). In the publication productivity table, the frequency of publication per year shows quite significant fluctuation. In early 2015-2017, publications were relatively stable, with the number of publications ranging from 2 to 3 per year. However, there was a decline in productivity in 2018, which only produced one publication.

A Significant increase occurred in 2020, with a peak of 14 publications. This spike can be caused by the increasing attention to applying gamification in various fields, especially in education, and the encouragement of technology use during the pandemic. After 2020, publication productivity fluctuated again. In 2021, only one publication was recorded, then it increased to 6 publications in 2022. In 2023 and 2024, publications were relatively stable, with a frequency of 3 and 10 publications, respectively.

Meanwhile, in 2025, there will be only one publication. From the results of the publication mapping, it can be seen that there is a fluctuating trend, with a decreasing-peak-decreasing pattern, which describes the dynamics of research in gamification. The peak of productivity occurred in 2020, then declined drastically the following year.

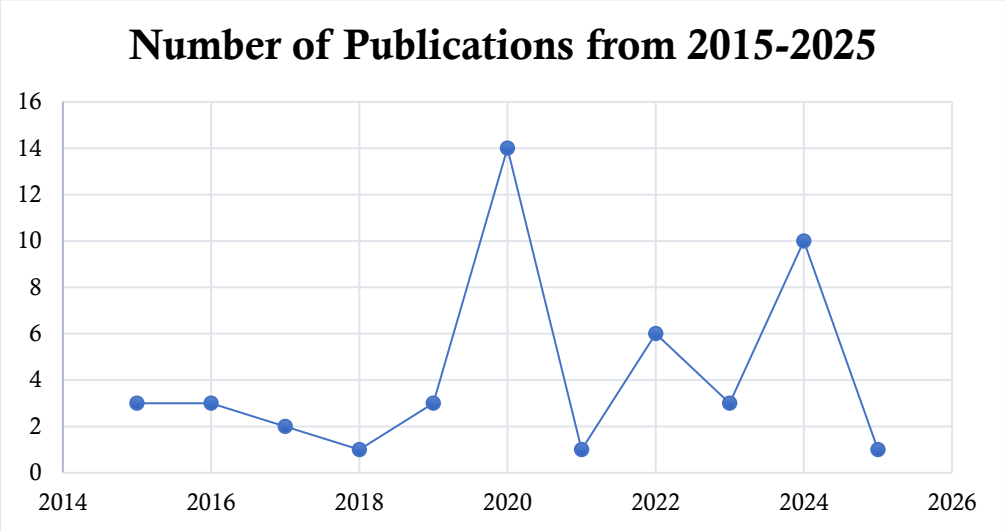

Figure 2. Number of Publications from 2015-2025, with "gamification" in their title show consistent annual growth (Source: Scopus)

A bibliometric analysis of gamification research was conducted based on data from the Scopus database, which lists the five main topics of gamification publications. With 12 publications, "gamification in education" is the most popular topic. "Digital game-based learning (8 publications) and "collaborative learning" (7 publications) are other widely discussed topics. All of this shows researchers' interest in utilizing gamification as a "collaborative learning" strategy. Furthermore, six publications note "emerging technology trends in education", and four publications discuss "motivation in game-based learning".

The institution contributing most significantly to gamification research is the University of Patras, which has four publications, followed by Wenzhou University (two). Other contributing institutions include Liuzhou Railway Vocational Technical College, Çankırı Karatekin University, and various national educational institutions, each with one publication. This distribution demonstrates international collaboration in gamification studies across different educational levels, from university to primary education institutions.

The journal that published the most articles on gamification was the International Journal of Learning, Teaching and Educational Research (3 publications). In addition, the International Journal of Game-Based Learning also has two publications, which emphasize the research focus on using gamification in education. There are also publications from other multidisciplinary journals such as Sustainability Switzerland, Information Switzerland, Smart Learning Environments, and several other journals that show the relationship between gamification and the themes of sustainability, information technology, and innovative learning environments.

The most productive authors in gamification-related publications are Rigou (3 publications), followed by Leonardou (3 publications), Garafalakis (3 publications), and several other authors who each have one publication. The diversity of authors' names indicates the existence of international collaboration in gamification research, with researchers from various countries actively contributing to this field.

The keyword map visualization based on co-occurrence analysis using VOSViewer shows that "game-based learning", "students", and "gamification" are the most dominant and frequently appearing keywords in publications related to

gamification and social skills. The highest density centers are seen in areas that group terms such as collaborative learning, motivation, and learning systems, reflecting a strong focus on game-based collaborative learning strategies. Meanwhile, the emergence of keywords such as augmented reality, psychology, and computer-aided instruction indicates that the gamification approach has evolved towards using advanced technology and psychological approaches. On the other hand, keyword groups such as elementary school, male, female, and intellectual intelligence indicate research attention to learner characteristics based on age, gender, and cognitive abilities. Overall, this visualization displays a broad thematic structure, reflecting the complexity and multidimensionality of gamification in the context of social education. The visualization of item density from high-frequency keywords is presented in Figure 3.

Table 1. Gamification Field Publication Profile

Category	Top 10 Levels
Subject Area	*Gamification in Education* (12), *Digital game-based learning* (8), *Collaborative learning* (7), *Emerging technology in education* (6), *Motivation in game-based learning* (4)
Afiliation	University of Patras (4); Wenzhou University (2); Luizhou Railway Vocational Technical College (1); Karatekin University (1); Ministry of National Education (1); Consejeria de Education de la Generalitat (1); Atayurt School Primary School Teacher (1); Recovery Plus Clinic (1); Benazir Bhutto Shaheed University Lyari (1); Lusofana University (1)
Source Title	International Journal of Learning Teaching and Educational Research (3); Computers and Education (3); International Journal of Game Based Learning (2); Information Switzerland (2); Sustainability Switzerland (1); Space and Culture India (1); Smart Learning Environments (1); Revista Lusofona De Educacao (1); Revista Interuniversitaria De Formacion Del Profesorado (1); Revista Eureka (1)
Author	Rigou, M (3); Leonardou, A (3); Garofalakis, J (3); Panogiotrou, A (1); Cilek, A (1); de las Heras, E (1); Zhao, L (1); Yusoff, H.N (1); Yunus, M.M (1); Yilmaz, F.G (1)

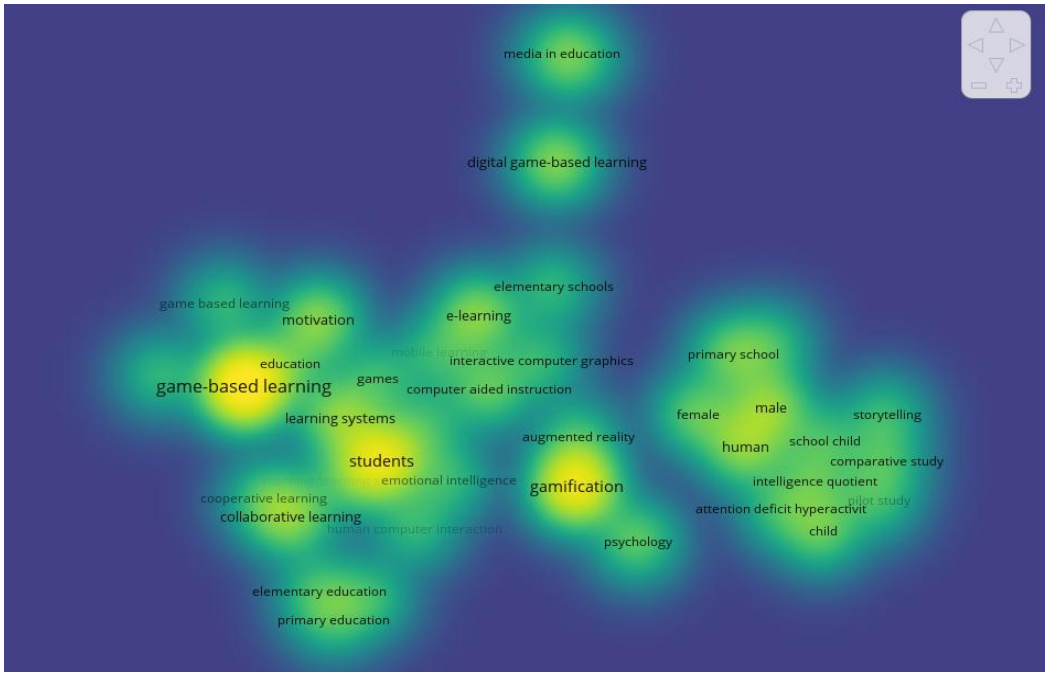

Figure 3. The item density visualization presents the concentration and relationships among high-frequency keywords within the gamification research field. Source: Research data on the database obtained from Scopus (April 22, 2025), which has been analyzed using the VOSViewer application.

Table 2. Top 10 High-frequency Keywords in the Gamification Research Field

No.	Keywords	Occurernce	Link	Total Links Strength	Average publication year
1.	Game-based learning	12	13	21	2020.42
2.	Gamification	9	18	27	2021.22
3.	Students	8	16	29	2021.00
4.	Learning system	4	11	17	2021.50
5.	E-learning	4	14	22	2021.50
6.	Male	4	16	27	2021.25
7.	Digital game-based learning	4	12	15	2021.25
8.	Collaborative learning	4	6	6	2020.75
9.	Motivation	4	10	17	2020.50
10.	Child	3	11	20	2021.67

Source: Research data on the database obtained from Scopus (April 22, 2025), which has been analyzed using the VOSViewer application

Meanwhile, analyzing the co-occurrence of the highest keyword frequency brings up thematic groups/clusters in game-based learning. These groups are shown in Figure 4.

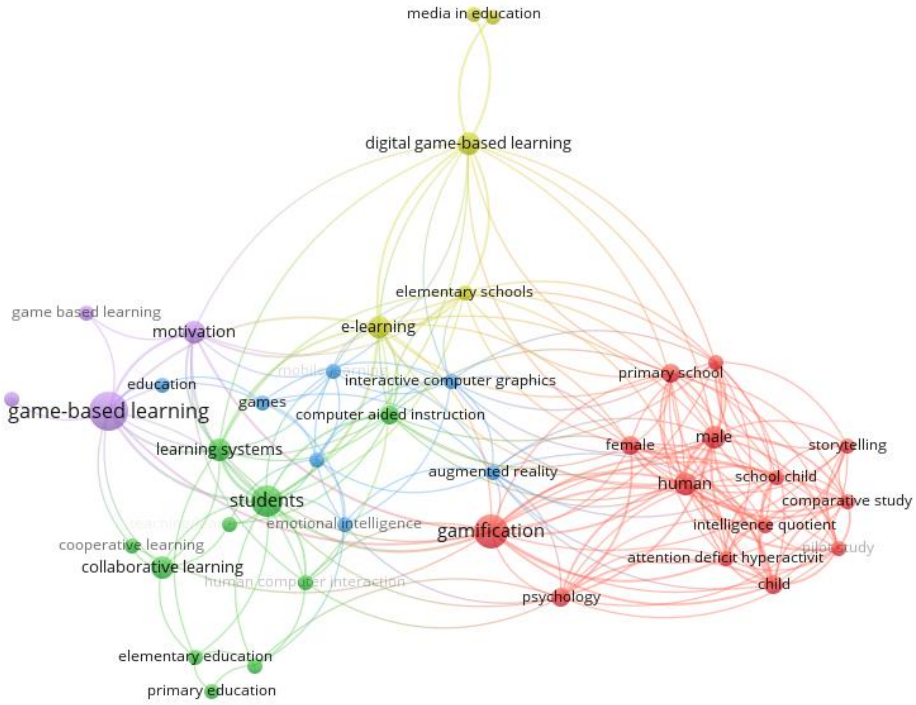

Figure 4. Visualization of keyword co-occurrence network in the field of gamification and social skills based on Scopus data from 2015–2025: Research data on databased obtained from Scopus (April 22, 2025) which has been analyzed using VOSViewer application

In Figure 4, the keyword network visualization above shows the thematic structure in the gamification and social skills literature analyzed using VOSViewer. Each color represents a related thematic cluster, while the connecting lines indicate the strength of the relationship between keywords based on their frequency of occurrence in the publications. The central cluster is indicated by game-based learning, students, collaborative learning, digital game-based learning, and gamification. The keyword "game-based learning" is closely connected to terms such as motivation and education, reflecting the focus on pedagogical aspects. On the other hand, the word "gamification" forms a dense cluster related to psychology,

augmented reality, and demographic variables such as male, female, and child. Meanwhile, other clusters show the relationship between digital technology and learning, such as e-learning and interactive computer graphics. This connection pattern illustrates that research on gamification not only discusses learning techniques but also integrates psychological approaches, educational technology, and learner characteristics as part of a holistic learning strategy.

Based on the visualization in Figure 4, 5 thematic clusters can be identified, namely: (1) Gamification in education; (2) Digital game-based learning; (3) Collaborative learning; (4) Emerging technology in education; and (5) Motivation and game-based learning. Items categorized into the identified thematic clusters are listed in Table 3. Keywords in bold are keywords with the highest number of occurrences.

Table 3. High-frequency Keyword Groups Related to Publications about Gamification

Cluster number/label/color	Number of keywords	Keywords (occurrence)
Cluster 1/*Gamification in eductaion*/Red	12	*attention deficit hyperactivity disorder* (2); *child* (3); *comparative study* (2); *female* (3); ***gamification*** (9); *intelligence quotient* (2); *male* (4); *primary school* (3); *psychology* (3); *school child* (2); *storytelling* (2)
Cluster 2/*Digital game-based learning*/*green*	8	*collaborative learning* (4); *computer-aided instruction* (3); *cooperative learning* (2); *elementary education* (2); *learning systems* (4); *primary education* (2); ***students*** (8); *teaching/learning strategy* (2)
Cluster 3/*Collaborative learning*/*blue*	7	*augmented reality* (2); ***cooperative/collaborative*** (2); *education* (2); *emotional intelligence* (2); *games* (2); *interactive computer graphics* (2); *mobile learning* (2)
Cluster 4/Emerging technology in education/yellow	6	*game based learning* (2); ***game-based learning*** (12); *human computer interaction* (2); *motivation* (4); *traditional games* (2)
Cluster 5/Motivation and game-based learning/violet	4	*digital game-based learning* (4); *e-learning* (4); *elementary schools* (2); *media in education* (2)

Source: Research data based on data obtained from Scopus (April 22, 2025), which has been analyzed using the VOSViewer application.

Based on Figure 5, the visualization shows the keyword co-occurrence network based on the average year of publication in gamification and social skills studies, analyzed using VOSViewer software. The colors in the network represent the average year of occurrence of each keyword, with a gradient from purple (earlier years, around 2020) to bright yellow (more recent years, around 2022).

Keywords such as "game-based learning", "education", and "collaborative learning" are dominated by purple, indicating that these topics were discussed more in the early period of the analysis (2020–2021). Meanwhile, keywords such as "primary school", "male", "female", and "school child" appear more yellow, indicating that the research focus on student demographics and the application of gamification at the primary education level has become a growing theme in recent years (2021–2022).

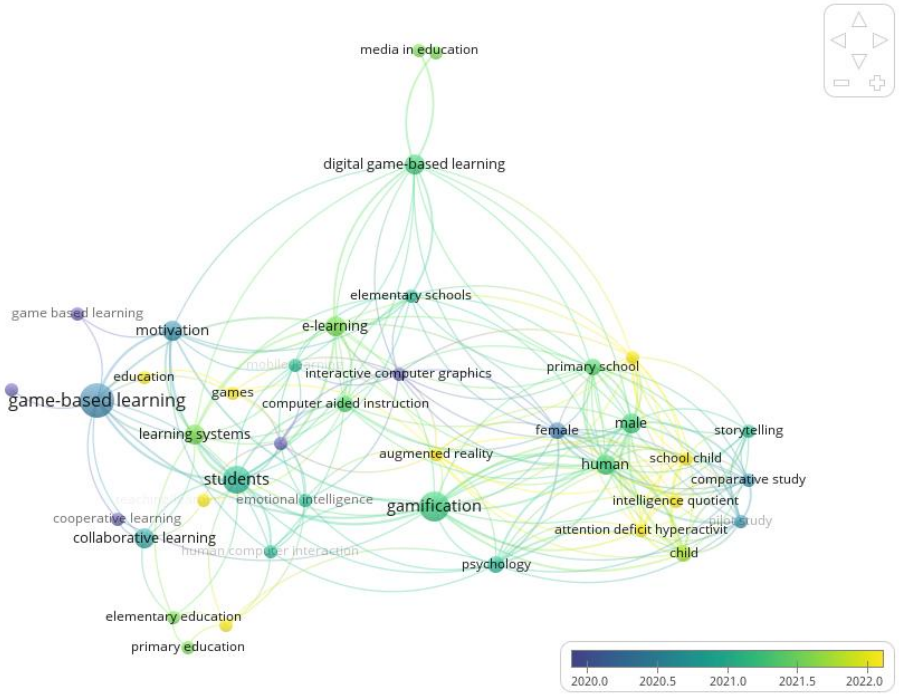

Figure 5. Visualization of keyword networks based on average year of publication in gamification and social skills research. Source: Researcher data based on data obtained from Scopus (April 22, 2025), which has been analyzed using the VOSViewer application.

In the center of the map, the keywords "gamification", "students", "psychology", and "augmented reality" are colored yellowish green, indicating that these topics are connecting clusters and are constantly evolving in recent publications. The close connection between digital game-based learning, media in education, and interactive computer graphics reinforces the integration trend between digital technologies and game-based learning strategies in modern education.

Overall, this visualization provides a temporal overview of how the focus of research in gamification has shifted and evolved, and identifies topics at the center of academic attention in recent years.

Table 4. Bibliometric Features of Recent Keywords from Publications in the Field of Gamification (Ordered by Publication Date)

Keyword	Average publication year	Occurrances	Links	Total Link Strength	Cluster
Cooperative learning	2018.50	2	3	3	2
game-based learning	2019.50	2	2	2	4
cooperative/collaborative	2020.00	2	8	8	3
interactive computer graphics	2020.00	2	12	12	3
traditional games	2020.00	2	1	1	4
Female	2020.33	3	15	19	1
game-based learning	2020.42	12	13	21	4
comparative study	2020.50	2	10	12	1
Motivation	2020.50	4	10	17	4
collaborative learning	2020.75	4	6	6	2
Psychology	2021.00	3	12	15	1
Storytelling	2021.00	2	8	8	1
Students	2021.00	8	16	29	2
emotional intelligence	2021.00	2	8	8	3
mobile learning	2021.00	2	11	11	3
human computer interaction	2021.00	2	7	8	4

Continued Table 4. Bibliometric Features of Recent Keywords from…

elementary schools	2021.00	2	11	13	5
Gamification	2021.22	9	18	27	1
Male	2021.25	4	16	27	1
digital game-based learning	2021.25	4	12	15	5
primary school	2021.33	3	14	15	1
Computer-aided instruction	2021.33	3	12	14	2
elementary education	2021.50	2	4	4	2
learning systems	2021.50	4	11	17	2
primary education	2021.50	2	1	1	2
e-learning	2021.50	4	14	22	5
media in education	2021.50	2	1	2	5
Child	2021.67	3	11	20	1
teaching/learning strategy	2022.00	2	4	4	2
augmented reality	2022.00	2	13	13	3
Education	2022.00	2	2	3	3
Games	2022.00	2	7	7	3
attention deficit hyperactivit disorder	2024.00	2	11	16	1
intelligence quotient	2024.00	2	11	16	1
school child	2024.00	2	11	16	1

Source: Research data based on data obtained from Scopus (April 22, 2025) which has been analyzed using the VOSViewer application.

DISCUSSION

Based on bibliometric analysis using VOSViewer on Scopus publications, gamification research in education over the last decade is divided into five main clusters. The largest cluster indicates the dominance of the theme "gamification in education" with a research focus on the application of gamification at the elementary school level, psychological approaches, and issues related to gender differences (Bulic & Blazevic, 2020; Glazunova, 2024; Gomes & Tedesco, 2017). These findings indicate a strong trend towards utilizing gamification as a pedagogical strategy to increase student engagement, particularly through approaches that consider psychosocial aspects (García-Peña & Rodriguez-Ayala, 2023; Ruiz et al., 2024). However, its effectiveness depends on careful implementation tailored to students' needs and addresses challenges such as inequities in access to technology (Tenor, 2021). Effective gamification requires careful design to align with educational goals and address potential issues such as unfair competition (Ramos et al., 2024). Gamification offers many benefits, but it is important to realize that its effectiveness can vary based on the quality and context of implementation (Riquelme Benítez, 2023; Sigala, 2015).

The second cluster, "digital game-based learning", highlights the importance of digital learning systems and collaborative strategies, reflecting a paradigm shift towards more interactive and participatory technology-based learning. Integrating digital learning systems and collaborative strategies signifies a paradigm shift towards technology-based and participatory learning. This approach enhances student engagement by promoting active participation, collaboration, and collective knowledge construction. Digital technologies facilitate a variety of communication platforms, enabling students to collaborate effectively and access various educational resources (Souza et al., 2024; Damasceno et al., 2024).

The third to fifth clusters show trends in new technologies such as augmented reality and mobile learning, with motivation as the primary variable often discussed.

This is in line with previous literature that emphasizes the importance of intrinsic motivation in the effectiveness of gamification (Ebina Justin & Joy, 2023; Chan et al., 2018). Despite the increasing adoption of digital technologies, variations in methodological focus and application contexts explain the differences in results between studies. In addition, studies are still dominated by the context of primary education, while the field of physical education and the diverse contexts of learners are still under-explored.

These results illustrate that gamification can fundamentally contribute to developing students' social skills, such as cooperation, communication, and empathy. In the context of physical education, teachers can integrate game elements such as points, challenges, and teamwork into learning activities to increase student engagement and social interaction. For curriculum developers and policy makers, these findings can be the basis for designing game-based learning models oriented towards cognition, character formation, and 21st-century social skills.

As a study based on secondary data from Scopus, this analysis is at risk of database bias, such as language bias (predominantly English-language articles), institutional bias (tends to be prominent and highly indexed journals), and time bias (delay in indexing of recent articles). Therefore, interpretation of the results in a global context needs to be done carefully and will be stronger if supported by triangulation of data from primary sources and other databases.

Limitations of the study

This study has several limitations. First, the exclusive use of the Scopus database may introduce selection bias, as articles from other databases such as Web of Science, ERIC, or non-Scopus-indexed regional publications may be missed. Second, this bibliometric approach is quantitative and only assesses the frequency and relevance of keywords, without assessing the methodological quality of the studies analyzed. In addition, the findings show that most studies are still focused on primary education, while other levels of education and physical learning contexts have not been widely explored.

Based on the above results and limitations, here are some recommendations for future research. Conduct experimental or quasi-experimental research in the context of physical education learning to directly assess the effects of gamification on students' social skills. Examine the application of gamification to minority groups or underrepresented populations, such as students in disadvantaged areas, people with disabilities, or those from low-income backgrounds. Incorporate a mixed methods approach to capture both quantitative results and qualitative student learning experiences. Integrate data from multiple databases in a bibliometric study or systematic review to generate more representative coverage and minimize bias.

CONCLUSIONS

Based on the results of a bibliometric analysis of publications indexed by Scopus in the last decade, it can be concluded that research on gamification in education shows an increasing and diverse trend. The five identified thematic clusters reflect a broad scope of studies, ranging from the application of gamification at the elementary education level, psychological approaches, gender issues, to the integration of digital technologies such as augmented reality and mobile-based learning. Among these

studies, student motivation emerged as a central theme that drives engagement in game-based learning.

However, the dominance of research in the context of general education, especially at the elementary school level, reveals a research gap in the field of physical education and health. This field is still relatively rarely explored in applications with gamification. Therefore, future research should explore gamification in physical education through empirical methodologies, such as experimental and quasi-experimental research designs, to spread its impact on students' social skills and physical participation. In addition, researchers need to consider contextual factors such as student diversity, local culture, and access to technology, so that the development of gamification models becomes more effective, inclusive, and adaptive in various educational domains.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request. All data were collected and analyzed by ethical standards and are stored securely by the research team.

FUNDING

This research does not receive external funding.

CONFLICT OF INTEREST

The author hereby declares that this research is free from conflicts of interest with any party.

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