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Bibliometric Analysis of Gamification Research: Trends, Contributions, and Global Impact

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Abstract

This bibliometric analysis examines research trends in gamification across four key domains such as school level, college level, professional development, and professional education, using data retrieved from the Web of Science database for the period of 2020 to 2024. A total of 365 school level-related, 77 college level-related, 84 professional development, and 124 professional education-related publications were initially retrieved, with duplication removal yielding 210, 60, 44, and 79 records, respectively. The study analyses year-wise distribution, document types, language preferences, influential journals, top contributing institutions, and leading countries in gamification related research. The results indicate a steady increase in gamification-related publications, particularly at school level and professional education, with English being the dominant language. Education and Information Technologies and Sustainability emerge as the most influential journals. Spain, China, and the USA lead in research output, while institutions such as the University of Hong Kong, Universidad de Granada, and the University of Zaragoza make significant contributions. The visualization of keyword co-occurrence in gamification research reveals key themes and trends across school, college, professional development, and professional education contexts, highlighting the impact of gamification on motivation, engagement, and learning outcomes. The findings highlight gamification's growing impact on education and professional training, with potential for further expansion in diverse learning environments.

Keywords: Gamification, Bibliometrics, Web of Science, School Level, College Level, Professional Development, Professional Education.

Introduction

Gamification, the application of game design elements in non-game contexts, has gained significant attention in recent years as a tool for enhancing learning, engagement, and motivation across various fields (Deterding et al., 2011). Within education, gamification has been extensively explored as a means to improve student participation, learning outcomes, and knowledge retention in both formal and informal learning environments (Hamari et al., 2014). Similarly, in professional settings, gamification has been leveraged to enhance workforce training, skill development, and productivity (Seaborn & Fels, 2015). Given the rapid expansion of gamification research, a bibliometric analysis is essential to assess publication trends, key contributors, and the impact of research across different domains.

Bibliometric studies are a quantitative approach to analyzing academic literature, offering insights into research trends, publication patterns, and scholarly impact. By applying statistical and computational methods, bibliometric analysis helps identify key contributors, influential journals, emerging research topics, and global research collaboration networks (Donohue, 1972). It plays a crucial role in understanding the development of scientific knowledge, evaluating research productivity, and assessing the impact of specific fields or topics over time (Pritchard, 1969). Bibliometric techniques are widely applied in various disciplines, including education, healthcare, social sciences, and technology, to evaluate research dynamics and measure scientific progress (Moed, 2005).

By examining global research trends, this bibliometric study aims to provide valuable insights into the evolution of gamification research and its applications in educational and professional contexts. The results will help scholars, educators, and industry professionals better understand the research landscape, identify gaps, and explore future directions in gamification studies.

These studies are particularly valuable for emerging fields, such as gamification research, where understanding publication trends and identifying influential contributors can shape future research directions.

Review of Literature

Gamification-based learning has gained significant traction in educational research due to rapid digital advancements. Studies have increasingly focused on its integration into e-learning environments and its effects on motivation, engagement, and achievement. Fathian et al. (2021) addressed the gap in organizational gamification research by proposing a comprehensive methodology for designing and implementing enterprise gamification. Their study integrated organizational, human, and gamification aspects, resulting in customized solutions that enhance productivity and communication, with evaluations confirming its effectiveness.

Rapp et al. (2019) reviewed 14 articles, highlighting empirical and theoretical challenges in gamification research, such as the tendency to focus on short-term interactions and the slow advancement in design improvements. They identified three primary themes: enhancing theoretical quality, refining design practices, and adopting a critical perspective, advocating for broader theoretical frameworks and deeper ethical considerations in gamification applications.

Riar et al. (2022) explored how gamification can foster cooperation through a theoretical framework, systematically reviewing 51 studies. They proposed three motivational approaches-individualistic, cooperative, and hybrid outlined 11 future research directions, providing strategic insights for effectively designing gamification to support cooperative activities.

Several bibliometric analyses and systematic literature reviews have been conducted to identify key themes and emerging trends in this field. A study by Behl et al. (2022) examined 222 qualified articles published between 2015 and 2020, using VOS viewer software to identify prominent themes. Their findings highlighted four major research areas: personalization, game elements, learner styles, and learner engagement.

Swacha (2021) further contributed to the bibliometric analysis of gamification in education by conducting a study based on 2517 records retrieved from Scopus. His research explored various characteristics of gamification studies, including database coverage, geographic distribution, forms of publication, addressed research areas, and the most active researchers and institutions.

Trinidad et al. (2021) conducted a bibliometric study to analyze the structure and evolution of gamification as a scientific discipline. Their research employed bibliometric performance analysis and science mapping techniques to explore the intellectual, conceptual, and social networks within gamification research. Their findings provided a comprehensive overview of the discipline's development, revealing key research fronts, emerging trends, and collaboration networks among scholars.

Yazdi et al. (2024) conducted a comprehensive bibliometric and network analysis to map the scholarly landscape of gamification in online distance learning. By analyzing 2,419 publications from the Scopus database between 2000 and 2023, their study identified leading journals, influential articles, and critical research themes shaping the field. One of their key findings highlighted a growing international collaboration, with major contributions from the United States, the United Kingdom, China, Spain, and Canada, reflecting the global interest in gamified online education.

Yıldız et al. (2024) provide valuable insights into the evolution of gamification in health education, guiding future research in the field. Their study is expected to help scholars identify emerging trends, key contributors, and effective gamification strategies. As the field continues to expand, further research may focus on adaptive gamification, personalized learning experiences, and the long-term impact of gamified health education programs.

Guerrero-Alcedo's et al. (2022) study was the identification of a significant geographical gap in scientific production, particularly in Africa. This gap highlights the need for greater research contributions from underrepresented regions to ensure a more comprehensive understanding of gamification's impact on higher education worldwide. The study also revealed strong collaboration networks between leading research-producing countries, with high research output from regions such as North America and Europe.

Bassanelli et al. (2022) highlight the progression of gamification research from an early focus on motivational and persuasive techniques to more structured methodologies for designing and evaluating gamification strategies.

Dikmen and Bahadır's (2022) study revealed that terms such as gamification, motivation, game elements, and educational innovation were dominant in the literature. Their results emphasize the significance of gamification in fostering motivation, learning success, interaction, competition, and innovation in education.

Luo (2022) explored the effectiveness of educational gamification by analyzing 44 studies using HistCite and conducting a content analysis. The study examined effectiveness, measurement methods, and factors influencing varied results. A key contribution was redefining "game elements" as concrete features and "gamification mechanisms" as abstract principles tied to psychological needs. Additionally, Luo proposed a comprehensive framework for engagement, highlighting aspects such as goals, visualization, feedback, adaptation, challenge, competition, reward, and fun failure while discussing limitations and future research directions.

Mohanty & Christopher B (2023) conducted a bibliometric analysis and scientific mapping of research on the Gamification Octalysis Framework, highlighting its expanding role in training and behavior change. Their study examined research frontiers, collaboration networks, and the most cited works, revealing that 66.6% of cutting-edge studies are in the social sciences. They emphasized the framework's potential to enhance engagement beyond gaming contexts and recommended broader global adoption, particularly outside Europe, through research centers and academic initiatives.

In a more recent study, Mohanty & Christopher B (2023) conducted a bibliometric analysis and scientific mapping of research on the Gamification Octalysis Framework, uncovering its growing influence on training and behavior change. Their analysis indicated that 66.6% of cutting-edge research is situated within the social sciences. They emphasized the framework's potential to boost engagement beyond gaming contexts and recommended broader global adoption, particularly outside Europe, through research centers and academic initiatives.

González-Limón & Rodríguez-Ramos (2022) conducted a bibliometric analysis of cloud gamification research using Web of Science and VOSviewer, covering 108 publications from 2012 to mid-2022. Their study identified key authors, institutions, and countries contributing to the field, with Spain and Italy leading in scientific output. The most prolific author was Jakub Swacha, and Information was the most active journal. The research provided insights into the evolution of cloud gamification studies, highlighting collaborative networks and thematic developments over time.

Dinesh & Alur (2024) conducted a bibliometric analysis of gamification and app engagement research, examining 150 papers from Scopus. They identified key journals, authors, and research clusters, including gamified apps, cybersecurity, food consumption, and eHealth. Their insights are valuable for researchers and app designers seeking to enhance user engagement through gamification.

Gamification research has evolved from exploring basic motivational aspects to more structured methodologies across various domains, including education, enterprise, health, and online learning. Bibliometric analyses highlight its global expansion, growing collaboration, and the need for refined frameworks to enhance engagement and effectiveness. Future studies should focus on adaptive gamification, long-term impacts, and addressing geographical gaps to ensure a comprehensive understanding of gamification's role in diverse fields.

Methodology

The methodology for this bibliometric analysis on gamification research involved retrieving data from the Web of Science database for the period January 1, 2020, to December 31, 2024, with data extraction conducted on March 6, 2025. The Advanced Search feature was used with specific field tags to categorize research publications into four domains: school level, college level, professional development, and professional education, applying Boolean operators to refine the search.

The search queries ensured that school level-related publications excluded terms such as "college level," "higher education," and "university," while college-focused research excluded "school level." Similarly, professional development research included terms like "employees" while excluding "school level," "college level," "university," and "students," and professional education research excluded "employees."

The initial data retrieval resulted in 365 records at school level, 77 at college level, 84 in professional development, and 124 in professional education. After removing duplicates, the final dataset comprised 210 records for school level, 60 for college level, 44 for professional development, and 79 for professional education records. The data was exported as a plain text file, including full records and cited references. The analysis was conducted using Bibexcel, Excel, and Histcite, which facilitated data processing, document type, influential journals, and publication trends, institutional contributions, and key research patterns in gamification.

Objectives

The objectives of the study are as follows;

1. To analyze the year-wise distribution of research publications in gamification and identify trends in publication growth over time.
2. To examine the document type-wise distribution of research publications and determine the most common formats used for disseminating gamification research.
3. To figure-out the language-wise distribution of research publications and evaluate the dominance of specific languages in gamification literature.
4. To identify the most influential journals in gamification research and understand their contribution to the field.
5. To reveal the top five institutions contributing to gamification research and analyze their impact on academic advancements in this domain.
6. To find-out the top five countries leading gamification research and assess their regional contributions to the field.
7. To visualize and analyze the co-occurrence of keywords in gamification research across school, college, professional development, and professional education domains, highlighting key themes and research trends.

Analysis and results

Table 1: Year wise distribution of research publication in gamification

PY	School Level	College Level	Professional Development	Professional Education
2020	25	4	5	5
2021	38	11	8	13
2022	35	8	9	20
2023	45	17	5	10
2024	67	20	17	31
Total	**210**	**60**	**44**	**79**

The data in table 1 illustrates the year-wise distribution of research publications in gamification across four domains such as School level, College level, Professional Development, and Professional Education. A consistent growth is observed in the number of publications in each category, particularly at the School level and Professional Education domains. The number of school level-related publications steadily increased from 25 in 2020 to 67 in 2024, reflecting an increasing focus on gamification in educational settings. College level-related publications also show an upward trend, growing from 4 in 2020 to 20 in 2024. Professional Development publications, though slightly variable, peaked at 17 in 2024, indicating growing interest in gamification for workforce development. The largest growth occurred in the Professional Education category, which saw a significant rise from 5 publications in 2020 to 31 in 2024. This trend highlights the expanding use of gamification in professional training and skill enhancement. Overall, the total number of publications across all domains demonstrates a substantial increase, particularly in the years 2023 and 2024, indicating the growing adoption of gamification in both educational and professional contexts.

Table 2: Document type wise distribution of research publication in gamification

Document Type	School Level	College Level	Professional Development	Professional Education
Article	172	52	35	62
Article; Early Access	17	3	-	1
Review	14	5	7	14
Meeting Abstract	3	-	-	-
Article; Early Access; Retracted Publication	1	-	-	-
Article; Retracted Publication	1	-	-	-
Editorial Material	1	-	-	-
Review; Early Access	1	-	-	-
Article; Proceedings Paper	-	-	1	1
Letter	-	-	1	1
Total	**210**	**60**	**44**	**79**

Table 2 presents a detailed breakdown of research publication types in gamification across four domains. Articles are the predominant format, making up the majority of publications in each category as 172 articles in School level, 52 in College level, 35 in Professional Development, and 62 in Professional Education. This highlights the preference for comprehensive research reporting in gamification. Review articles, which synthesize existing literature and trends, are notably present across all categories, further underlining the importance of critical analysis in the field. Early access publications also appear, with the highest numbers in the School level category, indicating the increasing significance of rapid dissemination of emerging research. Lesser publication types such as meeting abstracts, editorial materials, retracted publications, proceedings papers and letters are minimal, showing that alternative formats are less commonly used. The data indicates a clear trust on traditional scholarly outputs, such as articles and reviews, while early access publications reflect the growing need to publish emerging findings promptly.

Table 3: Language wise distribution of research publication in gamification

Language	School Level	College Level	Professional Development	Professional Education
English	208	59	44	77
Italian	1	-	-	-
Spanish	1	1	-	-
Czech	-	-	-	1
German	-	-	-	1
Total	**210**	**60**	**44**	**79**

Table 3 highlights the language distribution of gamification research publications across the four domains. English dominates the academic landscape, with 208 publications in School level, 59 in College level, 44 in Professional Development, and 77 in Professional Education. This reinforces the

role of English as the primary language of scholarly communication in the field. While English is overwhelmingly preferred, a few publications are available in other languages. Italian and Spanish each account for one publication in the School level category, while Spanish also appears once in the College level category. A single publication in Czech and German can be found in the Professional Education category. These limited contributions from non-English languages suggest that research communities publishing in regional languages are underrepresented, and most research is targeted toward a global audience. The dominance of English, while facilitating wider dissemination, highlights the need for greater multilingual inclusivity to enrich the diversity of research perspectives in gamification.

Table 4: Most influential journals on gamification

Journal	School Level	College Level	Professional Development	Professional Education
Education and Information Technologies	**17**	**2**	-	**5**
Sustainability	**14**	**6**	**1**	**4**
Interactive Learning Environments	**9**	1	**2**	**2**
Heliyon	**6**	**3**	**1**	1
Computers & Education	**5**	-	**1**	2
Entertainment Computing	-	**3**	-	-
Games for Health Journal	-	**3**	-	-
Sensors	-	-	**2**	-
Business Strategy and the Environment	-	-	1	-
Computer Applications in Engineering Education	-	-	1	-
BMC Medical Education	-	-	-	**4**
Nurse Education Today	1	1	1	**4**

Table 4 presents the distribution of gamification research publications across four domains such as School level, College level, Professional Development, and Professional Education within the top five journals. The analysis reveals a significant variation in journal contributions across these categories.

In the **School level** domain, *Education and Information Technologies* (17 articles) and *Sustainability* (14 articles) lead the way, followed by *Interactive Learning Environments* (9), *Heliyon* (6), and *Computers & Education* (5). These journals reflect a strong emphasis on integrating gamification into educational practices and digital learning platforms.

For **College level**-related research, *Sustainability* dominates with 6 articles, with *Heliyon, Entertainment Computing*, and *Games for Health Journal* contributing 3 articles each. This distribution indicates the expanding role of gamification across various academic disciplines in college level education.

In the **Professional Development** domain, the research appears more limited, with *Interactive Learning Environments* and *Sensors* each contributing 2 articles. This suggests a relatively smaller body of work exploring gamification within professional development contexts.

Regarding **Professional Education**, *Education and Information Technologies* (5 articles) and *Sustainability* (4 articles) are notable contributors, while specialized journals like *BMC Medical Education* and *Nurse Education Today* report 4 articles each. This highlights a strong focus on gamification within healthcare education and its potential to enhance learning in professional settings.
Education and Information Technologies and *Sustainability* emerge as prominent journals in multiple categories, underscoring their influence in the field of gamification research. The presence of specialized journals like *Games for Health Journal*, *BMC Medical Education*, and *Nurse Education Today* emphasizes the growing application of gamification in healthcare and well-being education. This data reveals an expanding body of research in gamification across educational and professional domains, with certain journals serving as key platforms for dissemination.

Table 5: Top five Institution wise distribution of research publication in gamification

Institution	School level	College level	Professional Development	Professional Education
University of Hong Kong	**12**	1	-	-
National Taiwan University of Science and Technology	**8**	-	-	-
Universidad de Almeria	**6**	-	-	-
Universidad de Granada	**5**	**4**	1	**3**
Education University of Hong Kong	**4**	-	-	1
Indian Institutes of Technology	1	**2**	-	1
Macao Polytechnic University	-	**2**	-	-
Tamkang University	1	**2**	-	-
University of Michigan	-	**2**	-	-
Tampere University	1	-	**2**	-
Polytechnic University of Valencia	-	-	**2**	-
University of Zaragoza	3	1	**2**	**4**
Altran Portugal SA	-	-	**1**	-
Andalusian Health Service	-	-	**1**	1
Columbia University	1	-	-	**2**
Hacettepe University	-	-	-	**2**
Institute for Health Research Aragon	-	-	-	**2**

Table 5 outlines the institution-wise distribution of gamification research publications across four domains like School level, College level, Professional Development, and Professional Education based on the top contributing institutions. The total number of institutions publishing in each domain varies significantly, with 379 institutions in School level, 104 in College level, 95 in Professional Development, and 79 in Professional Education.
In the **School level** domain, the **University of Hong Kong** leads with 12 publications, underscoring its significant role in this area. **National Taiwan University of Science and Technology** follows with 8

publications, while **Universidad de Almeria** contributes 6. **Universidad de Granada** has notable contributions across domains, publishing 5 articles in School level, 4 in College level, and 3 in Professional Education.

In the **College level** category, institutions like the **Indian Institutes of Technology**, **Macao Polytechnic University**, **Tamkang University**, and the **University of Michigan** each contribute 2 publications, showing a balanced and global contribution to gamification research in higher education. For **Professional Development**, **Tampere University**, **Polytechnic University of Valencia**, and **University of Zaragoza** each publish 2 papers, while other institutions contribute more sparingly.

In **Professional Education**, **University of Zaragoza** leads with 4 publications, while **Columbia University**, **Hacettepe University**, and the **Institute for Health Research Aragon** each publish 2, highlighting a growing emphasis on gamification within healthcare and professional education.

The broader engagement of institutions in the **School level** domain suggests a greater focus on gamification in early education settings. While some institutions specialize in specific domains, others show a more diversified research approach, contributing across multiple categories. This distribution reflects the expanding global interest in gamification and its integration into various educational and professional contexts.

Table 6: Top 5 Country wise distribution of research publication in gamification

Country	School level	College level	Professional Development	Professional Education
Spain	**47**	**9**	**10**	**21**
Peoples R China	**33**	**13**	**3**	**6**
UK	**21**	3	**3**	**4**
Taiwan	**20**	**4**	0	2
USA	**18**	**15**	**7**	**14**
South Korea	5	**5**	0	2
Germany	4	1	**4**	2
France	3	0	0	**4**

A comprehensive study was conducted to analyse the distribution of research publications in gamification across countries in four key domains such as School level, College level, Professional Development, and Professional Education. The total number of countries published in each domain varied, with 53, 24, 28 and 37 countries in School level, College level, Professional Development, and Professional Education respectively. To ensure a focused analysis, the top five countries from each domain were selected for detailed examination. These findings are systematically presented in the table titled "Top 5 Country-Wise Distribution of Research Publications in Gamification." This study provides valuable insights into the leading contributors in the field, highlighting key trends and the impact of research in gamification across different educational and professional settings.

Spain leads the field with the highest number of publications in all categories, contributing 47 publications at School level, 9 at College level, 10 in Professional Development, and 21 in Professional Education. China follows closely, with 33 publications at School level, 13 in College level, 3 in Professional Development, and 6 in Professional Education. The USA ranks third, publishing 18 papers in School level, 15 in College level, 7 in Professional Development, and 14 in Professional Education.

The UK, with 21 publications at School level, 3 at College level, 3 in Professional Development, and 4 in Professional Education, holds a significant position as well. Taiwan contributes 20 publications at School level, 4 at College level, and 2 in Professional Education, though it has no publications in Professional Development. South Korea, Germany, and France involved with modest contributions. South Korea has 5 publications each at School and College levels, and 2 in Professional Education. Germany contributes 4 publications at School level, 1 at College level, 4 in Professional Development, and 2 in Professional Education. The output from France consists of 3 publications at School level and 4 in Professional Education, with no contributions at College level or Professional Development. The data of Spain underscores dominance in gamification research, with the USA and China also emerging as key contributors.

Co-occurrence of keywords Visualization

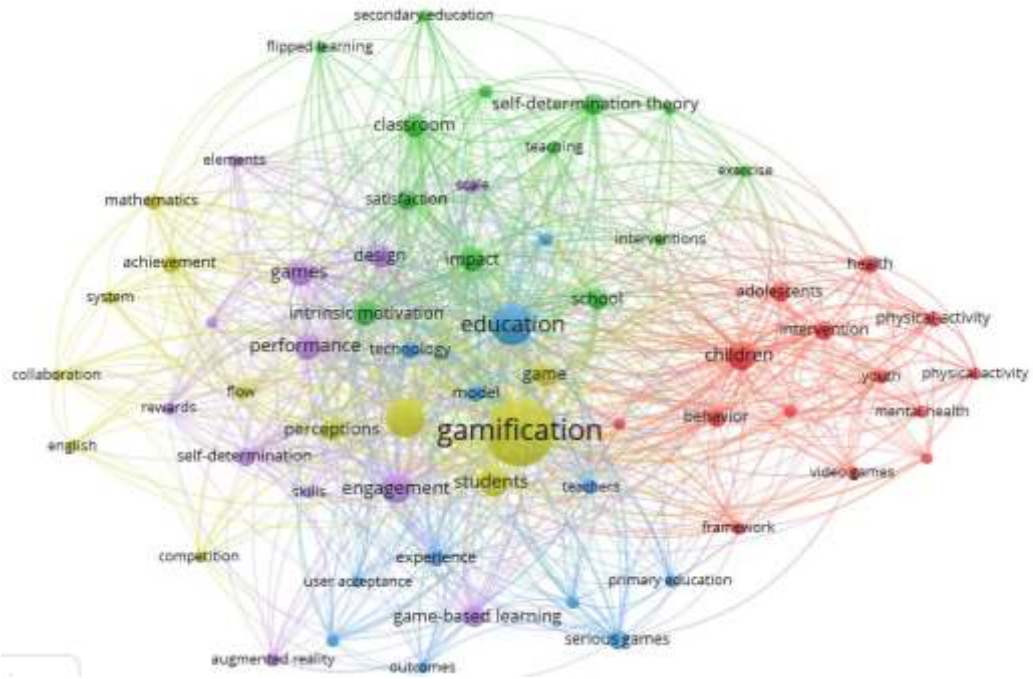

Figure 1: Co-Occurrence and Keywords Network Visualization of Gamification in School-Related Research

Figure 1 illustrates the the co-occurrence of keywords in research related to gamification in school settings, highlighting its main themes and research directions. The keyword "gamification" appears as the central node, closely associated with "education," "students," "engagement," "performance," and "game-based learning", emphasizing its role in enhancing learning experiences. Several key clusters emerge from the visualization. The green cluster, centered around self-determination theory, includes concepts like classroom, teaching, satisfaction, and secondary education, focusing on the psychological and pedagogical aspects of gamification, particularly its impact on student engagement and learning outcomes.

The red cluster, related to health and behavior, includes children, health, mental health, physical activity, adolescents, and behavior, highlighting research on gamification's role in physical activity, mental health interventions, and youth engagement through video games. The yellow cluster, focusing on

achievement, motivation, and competition, includes achievement, collaboration, self-determination, and rewards, exploring how game mechanics like competition and rewards influence student motivation and academic success.

The purple cluster, which revolves around game design and technology, includes games, intrinsic motivation, technology, performance, and flow, indicating an interest in the design of gamified learning systems and immersive experiences that promote engagement. Finally, the blue cluster, related to game-based learning and digital tools, includes game-based learning, serious games, augmented reality, primary education, and user acceptance, showing a strong connection between gamification and technology integration in early education.

Gamification research in schools primarily focuses on motivation, engagement, academic performance, and health-related interventions, with a significant influence from psychological theories like Self-Determination Theory. The visualization suggests that gamification is a multidimensional field, incorporating educational psychology, health sciences, digital technology, and pedagogy, with future research likely to explore its long-term impact on student learning, well-being, and motivation.

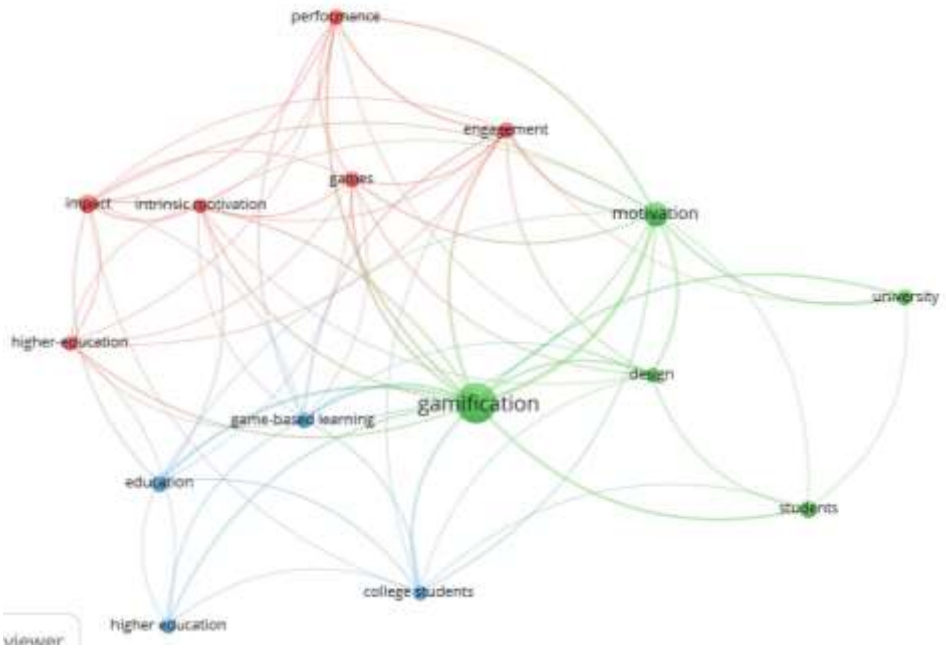

Figure 2: Co-Occurrence and Keywords Network Visualization of Gamification in College-Related Articles

Figure 2 represents the co-occurrence of keywords in gamification-related research in the college education domain. "Gamification" serves as the central keyword, closely linked to key concepts such as "motivation," "engagement," "performance," and "design," which suggests that gamification in college settings primarily aims to enhance student involvement and learning effectiveness.

The green cluster is centered around "motivation" and "students," indicating that gamification strategies are frequently associated with improving student engagement and learning motivation. The red cluster, which includes terms like "intrinsic motivation," "impact," "engagement," and "performance," highlights research focused on assessing the effectiveness of gamification. The blue cluster links "higher

education," "game-based learning," and "education," reflecting a broader academic discussion on gamification in tertiary education.

The strong interconnections between "gamification" and terms like "game-based learning" and "higher education" indicate ongoing debates about distinguishing gamification from other game-related learning methods. Furthermore, studies focus on evaluating its impact on students' academic performance and long-term engagement. These findings emphasize the importance of gamification in higher education and suggest the need for further research into its effectiveness and implementation in diverse college learning environments.

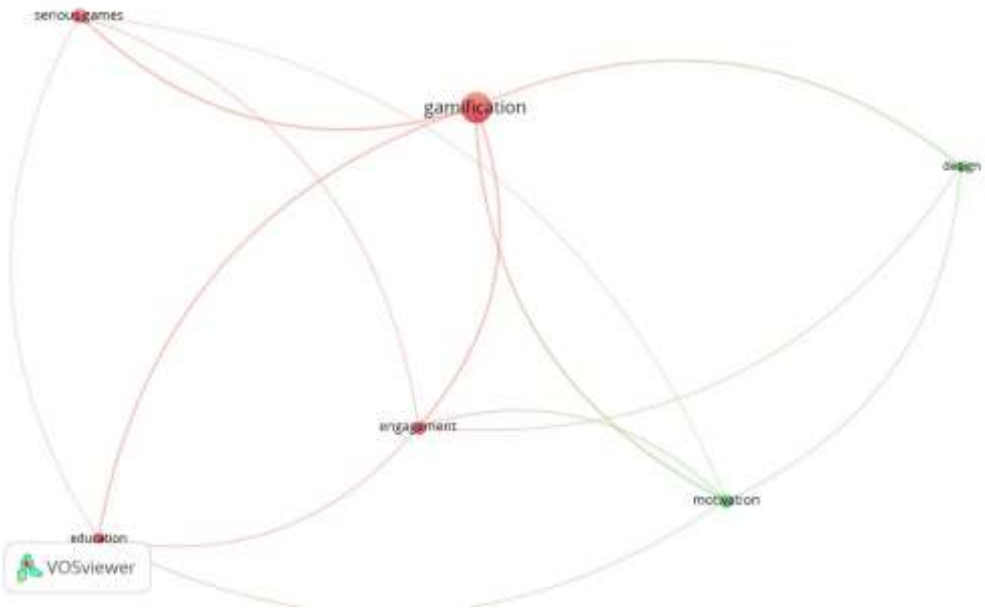

Figure 3: Co-Occurrence and keywords network visualization of gamification in professional development-related articles

Figure 3 showcases the "Co-Occurrence and Keywords Network Visualization of Gamification in Professional Development-Related Articles" illustrates the interconnected themes within research on gamification in professional development. The central node, "gamification," is strongly connected to key concepts such as "motivation," "engagement," "education," "design," and "serious games." These relationships suggest that gamification is widely studied in professional development settings to enhance motivation and engagement.

The presence of "serious games" indicates that game-based learning approaches are being integrated into professional training and skill development. Additionally, the linkage between "design" and gamification highlights the importance of instructional design strategies in implementing gamified learning experiences. The visualization provides insights into the academic discourse surrounding gamification in professional development, emphasizing its role in improving learning outcomes and engagement.

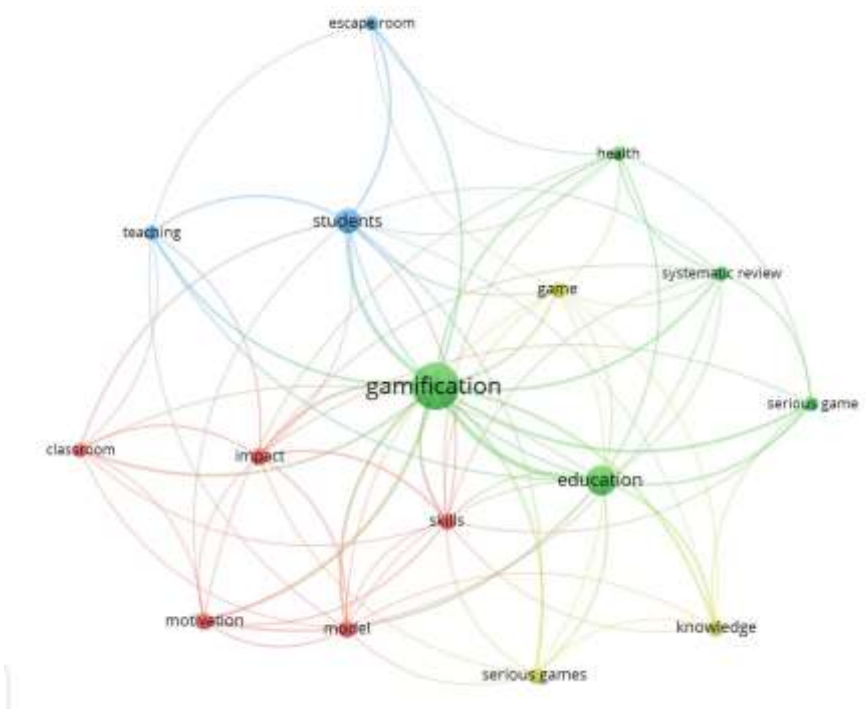

Figure 4: Co-Occurrence and keywords network visualization of gamification in professional education related articles

Figure 4 presents a co-occurrence analysis of keywords related to gamification in professional education articles. The central theme of gamification is strongly connected to various related concepts, emphasizing its relevance in education, students, skills, and motivation models. Key terms such as serious games, game-based learning, escape room, and knowledge acquisition suggest that gamification is widely used as an engaging and interactive learning tool in professional education. Additionally, teaching methodologies and systematic reviews indicate a research-driven approach to understanding gamification's impact.

The presence of health-related keywords suggests that gamification might also be applied in medical or health education settings. Overall, this visualization highlights the growing integration of gamification strategies in professional education to enhance learning outcomes, engagement, and skill development.

Discussion

The findings of this bibliometric analysis reveal a steady growth in gamification research across various domains, particularly at school level and professional education. The increasing number of publications over the years reflects a rising interest in gamification as an effective tool for enhancing engagement, motivation, and learning outcomes. The analysis highlights that school-based gamification research has gained significant traction, with 210 publications, demonstrating the widespread adoption of game-based learning strategies in primary and secondary education. Similarly, professional education has seen a notable increase in gamification research, with 79 publications, indicating its growing role in workforce training and skill development.

The language-wise analysis confirms that English is the dominant language of publication, accounting for the vast majority of research outputs. This suggests that gamification research is being disseminated

to a global audience, making it accessible to a wide range of researchers and practitioners. However, the minimal presence of non-English publications highlights the need for more multilingual contributions to capture diverse cultural and regional perspectives on gamification.

The journal-wise distribution indicates that *Education and Information Technologies* and *Sustainability* are among the most influential journals in gamification research, underscoring their role in shaping academic discussions on the subject. The presence of specialized journals such as BMC Medical Education and Nurse Education Today suggests a strong focus on gamification in healthcare and medical education, where interactive learning techniques are being increasingly explored.

From an institutional perspective, the University of Hong Kong, Universidad de Granada, and the University of Zaragoza emerge as key contributors to gamification research, reflecting their leadership in advancing the field. The country-wise distribution highlights Spain, China, and the USA as the top contributors, showcasing their commitment to developing gamification applications in education and professional training.

The co-occurrence network analysis indicates that gamification research is deeply interconnected with psychological theories, educational strategies, and technological advancements, suggesting its role in fostering engagement and improving learning experiences across different educational and professional settings.

Despite these promising trends, certain gaps and limitations persist in gamification research. The lower number of publications in professional development suggests that more studies are needed to explore the impact of gamification in workplace training and career advancement. Additionally, future research should focus on long-term effects of gamification, cross-cultural perspectives, and the integration of emerging technologies such as artificial intelligence and virtual reality in gamified learning environments. This study provides valuable insights into the evolving landscape of gamification research, highlighting key contributors, trends, and areas for further exploration. The growing body of literature suggests that gamification will continue to expand across educational and professional domains, shaping the future of learning and skill development.

Conclusion

This bibliometric analysis provides a comprehensive overview of gamification research trends across four key domains: school level, college level, professional development, and professional education. The study highlights the steady growth in gamification-related publications, particularly in school level and professional education, indicating the increasing adoption of gamified strategies in learning and training environments. The dominance of English-language publications and the significant contributions from countries such as Spain, China, and the USA emphasize the global reach and impact of gamification research.

Findings from the study also reveal the influence of key journals, including Education and Information Technologies and Sustainability, in shaping gamification discourse. Additionally, institutions such as the University of Hong Kong, Universidad de Granada, and University of Zaragoza have emerged as leading contributors. The co-occurrence keyword visualizations across school, college, professional development, and professional education contexts demonstrate the widespread impact of gamification on learning, motivation, and engagement. The analysis highlights its interdisciplinary nature, integrating psychology, education, technology, and health sciences. Future research should explore its long-term effectiveness and optimize gamification strategies for diverse educational and professional settings.

The results indicate that gamification is gaining traction across educational and professional sectors, with increasing interest in its potential to enhance engagement, motivation, and learning outcomes. This study underscores the expanding research landscape of gamification and its interdisciplinary relevance. Future research should explore new methodologies, cultural influences, and long-term impacts of gamification in different educational and professional contexts. These insights will help academics, educators, and industry professionals better understand and harness gamification's potential for innovation in learning and skill development.

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