Scientific Mapping of Research on Application of Gamification in Higher Education

Jiaxin Ren[1*], Yee Hock Tan[2], Juncheng Guo[3]

[1,2,3]Faculty of Social Science and Liberal Arts, UCSI University, Kuala Lumpur, Malaysia, Email: Jiaxin0776@gmail.com; alantyh22@gmail.com; guojuncheng926@gmail.com

***Corresponding Author:** Jiaxin Ren
*Email: Jiaxin0776@gmail.com

ARTICLE INFO	ABSTRACT
	Gamification significantly enhances educational objectives, with existing literature affirming its widespread use to improve student performance across various disciplines. This bibliometric mapping analysis investigates the realm of gamification within higher education, utilising the Scopus database as a source for the review. Through a systematic selection process, the study encompasses an examination of 609 scholarly articles. The bibliometric analysis, performed using the VOSviewer tool, aimed to ascertain trends in publications, the contributions of various countries, the most influential authors, journals, articles, and research methodologies employed, as well as the topics that have garnered the most attention and the research areas for future exploration. The results indicate a rising trend in the number of publications since 2016, peaking in 2023 with 146 articles. Spain, the United States, and the United Kingdom made significant contributions to the research output. Moreover, in this field, "Computers and Education" has been recognised as the leading journal, with Juho Hamari emerging as the most frequently cited author. Researchers in this field may find these findings beneficial, offering a comprehensive understanding of the current research landscape. **Keywords:** Gamification; Higher Education; Review; Bibliometric Mapping Analysis

Introduction

Higher education institutions globally have acknowledged the significance of utilising technology to boost student engagement (Bedenlier et al., 2020). This recognition likely stems from the successful implementation of Information and Communication Technologies (ICT) in technology-enhanced learning settings, providing students with valuable and authentic learning experiences (Rashid & Asghar, 2016).

With the rapid advancement of technology and the diversification of educational demands, it has become particularly crucial for the higher education sector to seek innovative teaching methods to improve learning efficiency and student engagement (Dunn & Kennedy, 2019). In recent years, gamification in education has emerged as an innovative pedagogical strategy, gaining widespread attention for its ability to significantly enhance student motivation and participation (Portela, 2020). Gamification refers to using game elements (such as points, badges, levels, and a leader board) in non-game contexts (Deterding et al., 2011; Schöbel et al., 2020; Simões et al., 2013; Zainuddin et al., 2020). Gamification demonstrates how game mechanics, aesthetics, and game thinking can be utilised to engage people, motivate action, promote learning, and solve problems (Tuparov et al., 2018).

Existing studies indicate that gamification positively influences the stimulation of students' learning motivation and knowledge retention abilities (Fuster-Guilló et al., 2019). Gamification captures engagement, encourages action, fosters learning, and addresses problems by incorporating game mechanics, aesthetics, and

game thinking (Tuparov et al., 2018). Additionally, the use of game elements such as progress bars, textual or verbal feedback, points, medals, or trophies further enhances the learning process by providing a visual representation of learning activities (Marczewski, 2013), offering a novel approach to education in an unconventional manner.

Despite the significance of researching gamification in higher education, there has been limited effort to compile comprehensive statistics on global scientific research output in this area. Few bibliographic analyses have examined the application of gamification in higher education. Considering the limited recent bibliometric analyses on this topic, this study aims to address this gap by providing a bibliometric mapping analysis of research on the application of gamification in higher education, utilising the Scopus database. This study seeks to offer a comprehensive understanding of the current state of research in this field and contribute to the expanding body of literature. Additionally, this study seeks to address the following research questions:

RQ 1. What are the trends in publication and the contributions of various countries to research on the application of gamification in higher education?
RQ 2. Who are the most influential authors, and which journals, articles, and research methodologies have significantly contributed to the field of application of gamification in higher education?
RQ 3. Which topics have garnered the most attention, and what are the research areas for future exploration in the research on the application of gamification in higher education?

Literature Review

Currently, numerous articles explore the application of gamification. Some scholars have conducted bibliometric analyses using the Web of Science (WoS) database. For instance, Trinidad et al. (2021) reviewed 4,706 documents on gamification from the WoS database (1900–2019), highlighting the rapid growth in research on this topic (Trinidad et al., 2021). López-Belmonte et al. (2020) examined the relationship and progress of the concepts "gamification" and "learning" from 2011 to 2019 using bibliometric methods and thematic analysis (López-Belmonte et al., 2020). While their study provided an overview of the development of gamification, it was limited to the context of learning and did not consider the broader concept of education. This limitation confined their results to those related to training methodologies and learning aspects. Additionally, Mustafa and Selahattin (2021) explored the academic development of gamification in education from 2010 to 2020 using the WoS database (Mustafa & Selahattin, 2021). Although their study was systematic, it was restricted to only data from the WoS database. The authors further suggested that more comprehensive research can be conducted by including other databases into the analysis (Mustafa & Selahattin, 2021).

Recently, Behl et al. (2022) studied emerging trends in gamification and e-learning for young learners. They conducted a systematic review to explore future research perspectives in gamification and e-learning for young consumers. Additionally, they used bibliometric analysis to review current publication trends and prominent research themes through cluster analysis, with data sourced from Google Scholar. Although their study covered a broad range of data sources, it focused more on young consumers rather than specific educational stages or disciplines (Behl et al., 2022).

Overall, the aforementioned researches has provided valuable insights into the field of gamification, significantly enhancing our understanding of its evolution over the past few decades. The systematic reviews have undoubtedly provided the insights to encourage more researchers to explore the application of gamification in learning, teaching, and education. Higher education, as a crucial stage of education, offers advanced knowledge and skill training, enabling students to master deep knowledge in specific fields (Mehralizadeh et al., 2008). These advanced knowledge often transcends what is acquired during primary or secondary education, especially in specialised areas like science, technology, engineering, medicine, and law. However, there is currently a scarcity of systematic literature on application of gamification in higher education.

Today, while applications of gamification in higher education are burgeoning, there have been few recent bibliometric studies in this field, particularly using the Scopus database. Given that Scopus updates daily, executing search queries at different times using the same commands may yield slightly different results. Scopus is generally regarded as one of the largest curated databases, encompassing scientific journals, books, and conference proceedings (Singh et al., 2021). Consequently, this study provides the most recent systematic bibliometric review on the application of gamification in higher education, offering a foundational point for future researchers in this field.

Methodology

This study employs a descriptive design with bibliometric analysis to investigate the meta-data and content of gamification research in higher education over the past decade, utilising the Scopus databases. Bibliometric analysis involves the graphical examination of specific knowledge domains through quantitative statistics and is essential for deciphering research trends and the state of scholarly inquiry. This method facilitates the evaluation of scientific achievements and academic developments within the research community. Although bibliometric analysis, also known as science mapping, is prevalent across various research fields (Okumuş Dağdeler, 2023), its adoption in educational research is relatively recent (Linling & Abdullah, 2022). The Scopus database was selected for this study because it is widely recognized and extensively used as the most comprehensive abstract and citation database for peer-reviewed literature. It includes approximately 23,452 active journals, 120,000 conferences, and 206,000 books from over 5,000 international publishers (Singh et al., 2021). Scopus stands out for its broad compilation of documents and abstracts, making it superior in citation and abstract searches. It also boasts a significantly higher number of publications (by 70%) compared to the Web of Science and offers a wider variety of products than other databases (Shareefa & Moosa, 2020). Consequently, Scopus has been a critical resource in compiling databases for review research (Mongeon & PaulHus, 2016).

Search Parameters

In the development of the working dataset and the process of record retrieval, the Boolean search expression utilised was TITLE-ABS-KEY ("gamification" AND "higher education" OR "tertiary education" OR "university education"). This keyword search strategy aimed to capture a comprehensive set of relevant articles on gamification in higher education, striving to encompass all pertinent findings to minimise bias in review outcomes (Booth et al., 2016). On May 22, 2024, this search query was executed in the Scopus database and showed 1,454 articles distributed over the past 10 years from 2013 to May 2024. Only publications in English were considered, narrowing down the collection to a curated set of 1,369 documents. The search was specifically limited to journal articles, excluding books, book chapters, and conference papers, based on the premise that a database rich in peer-reviewed journal articles would ensure more reliable results. Consequently, 609 publications met the criteria to be included in the database. Table 1 outlines the inclusion and exclusion criteria used.

Table 1. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
A complete article written in English.	Articles that are written in other languages
Journal articles	Books, book chapters, and conference papers

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The process of the search is detailed and summarised in the PRISMA flow chart (Page et al., 2021), depicted in Figure 1.
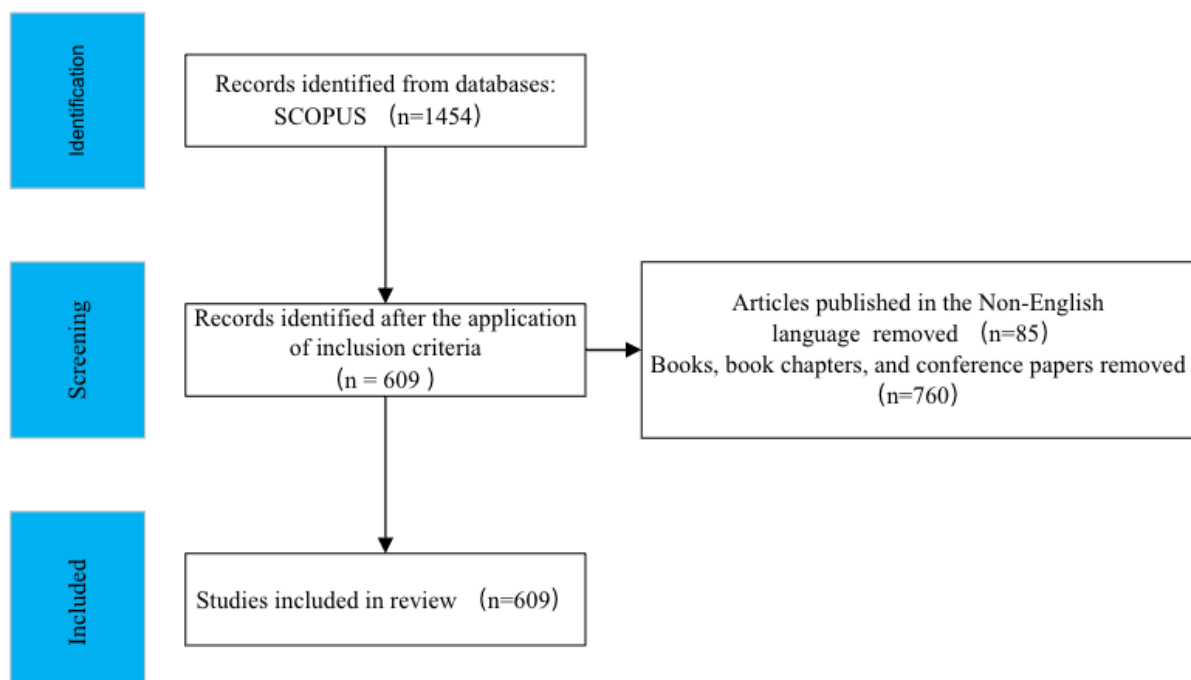

Figure 1. Flow diagram of systemic review

Data retrieved from the Scopus database, which included the publication date, author's name, affiliation, country, publisher, article title, author keywords, abstracts, and citations, was analysed and visualised using VOS viewer software. This tool is engineered to handle large datasets effectively and offers a diverse array of visualisations and analytical options. The VOSviewer enables the creation of publication maps, author or journal networks based on co-citation platforms, and keyword maps cantered around distribution channels derived from a co-citation distribution map (Donthu et al., 2021).

Results

To address the study questions raised in the previous section, the data shown below provide a descriptive overview of the 609 published journal articles using bibliometric methodology.

Trends in publication and the contributions of various countries

The first research question aims to demonstrate the trends in publication and the contributions of various countries to research on the application of gamification in higher education. Figure 2 illustrates the publication trends in the application of gamification in higher education from 2013 onwards, revealing a gradual increase in the number of related publications. The earliest significant work in this field was authored by Domínguez, A. et al. (2013), which garnered 2,787 citations and focused on the practical implications and outcomes of gamifying learning experiences. Notably, the number of publications has continued to grow since 2016. There was a sharp increase starting in 2019, with 43 documents, and this growth has continued, reaching 146 documents by 2023.
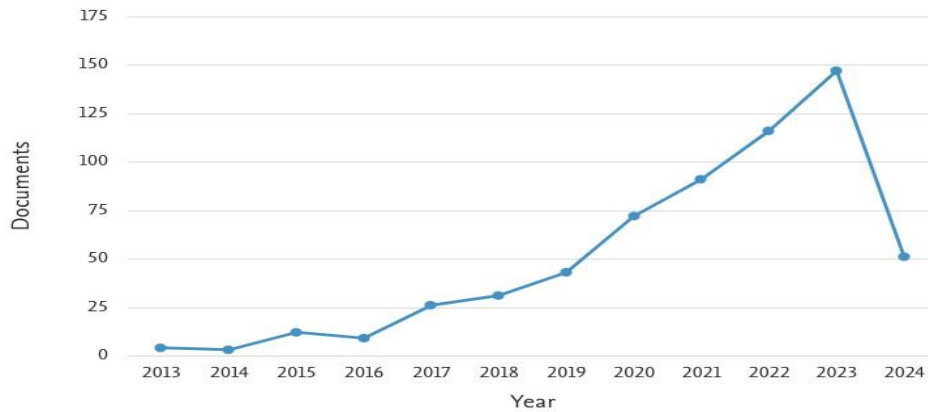

Figure 2. The publication trends from 2013-2024

The citation analysis was conducted based on specific criteria: countries must have at least five published documents and a minimum of 50 citations. The results indicate that Spain leads both in citations and the number of documents. This is followed by the United States and the United Kingdom. Figure 3 displays the top 33 contributing countries with the highest citation rates in this field.
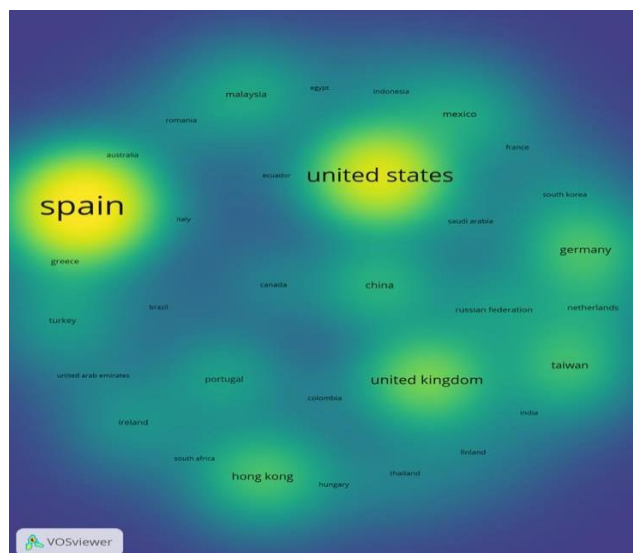

Figure 3. Citation analysis (by countries)

Most influential authors, and journals, articles, and research methodologies

The second research question was intended to explore the most influential authors, and which journals, articles, and research methodologies have significantly contributed to the field of application of gamification in higher education. The VOS viewer software was used to create a visual map of co-authorship and writers in order to identify the most significant authors. The minimum number of citations for an author was selected by the 100 to demonstrate the most co-cited authors. Referring to the network visualisation (Figure 4), it shows that there are four clusters with 19 authors. It is noteworthy that the most frequently co-cited author is Juho Hamari, who is also the most cited author.
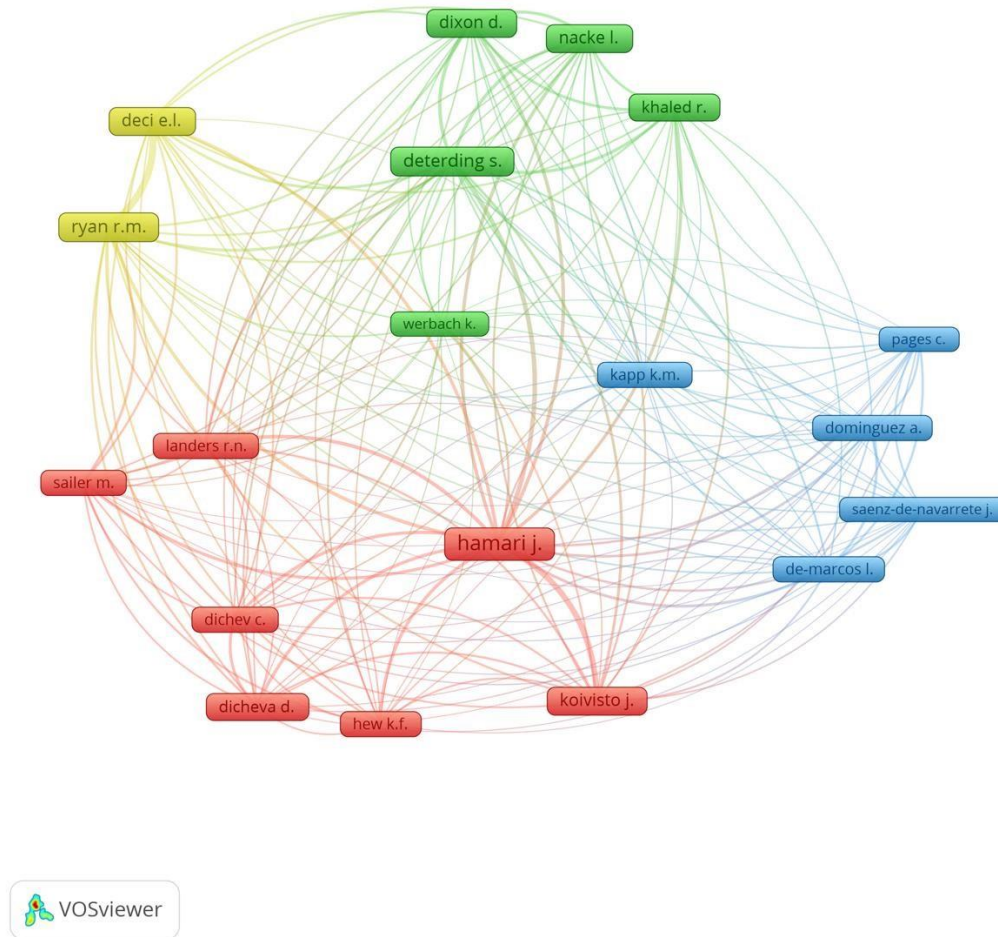

Figure 4. Visualization of co-cited authors network

Table 2 provides detailed information about the authors based on their positions and connectivity within the co-citation network. Hamari J. is positioned at the centre of a dense cluster and is frequently co-cited with other key researchers, indicating his significant influence in the field of the application of gamification in higher education. Additionally, the cluster, including Deci E.L., Ryan R.M., Koivisto J., and Sailer M., is notable for its strong internal connections, suggesting that their research topics are closely related within the same field. Deci E.L. and Ryan R.M. are particularly renowned for their work on self-determination theory. Another cluster, involving Deterding S., Dixon D., Nacke L., and Khaled R., highlights a potential focus on game design and gamification, areas where these authors have made substantial contributions.

Table 2. The Most Influential Authors (with over 100 citations in total)

Number	Author	Number of Citations	Research Areas (Refer from the Google Scholar Label, if any)
1	Hamari J.	408	Gamification, game studies, esports, metaverse, virtual reality
2	Deterding S.	280	Motivational design, game design, gamification, design ethics, computational creativity
3	Ryan R.M.	258	Self-determination theory, psychology, intrinsic motivation, education, organizational behavior
4	Deci E.L.	226	Self-determination theory, motivation, psychology
5	Dixon D.	216	Game Studies, HCI, design research

6	Koivisto J.	202	Gamification, game studies, technology acceptance
7	Nacke L.	201	Human-computer interaction, user experience, player experience, games user research, gamification
8	Khaled R.	187	Medical, ophthalmology, public health
9	Dicheva D.	161	HCl, semantic web, social web, gamification in education, digital libraries
10	Dichiev C.	156	*(not available)*
11	Sailer M.	147	Gamification, simulations, Al in education, technology-enhanced learning, learning analytics
12	Hew K.F.	142	*(not available)*
13	De-Marcos L,	140	Gamification, educational technology, learning technologies, graph analysis, social network analysis
14	Landers R.N.	126	Industrial organizational psychology, artificial intelligence, gamification, psychological assessment
15	Dominguez A.	126	*(not available)*
16	Kapp K.M.	125	Gamification, learning strategy , learning design, games
17	Pages C.	110	Agent-based simulation, participatory modelling, role-playing games, renewable natural resources, social learning
18	Werbach K.	108	Internet policy blockchain, ethics of artificial intelligence, telecommunications regulation, gamification
19	Saenz-de-Navarrete J.	106	*(not available)*

A citation analysis was conducted to create a map of the most-cited journals, setting the minimum document count per source at 5, with 21 sources meeting this criterion. Additionally, the minimum citation count per source was set at 100, with 11 sources achieving this threshold. Table 3 lists 11 journals that each have at least 100 citations. Notably, the journals with the highest citations include Computers and Education, which has 2,716 citations across 13 documents; Computers in Human Behaviour, with 582 citations from 5 documents; and Sustainability (Switzerland), which has 538 citations from 26 documents.

Table 3. The Most Influential Journals (with over 100 citations in total)

Number	Journal	Number of Citations	Number of Documents
1	Computers and Education	2716	13
2	Computers in Human Behaviour	582	5
3	Sustainability (Switzerland)	538	26
4	International Journal of Emerging Technologies in Learning	352	16
5	International Journal of Educational Technology in Higher Education	321	6
6	International Journal of Environmental Research and Public Health	209	8
7	IEEE Access	206	6
8	Education Sciences	158	21
9	Education and Information Technologies	143	19
10	Computer Applications in Engineering Education	139	9
11	BMC Medical Education	103	12

Further examination of the most impactful articles on the application of gamification in higher education was conducted using citation analysis to assess their influence. The impact of the literature was gauged by the number of citations received. Table 4 presents the articles that have been cited at least 50 to 100 times, highlighting the most highly cited works.

Table 4. Most Influential Articles (with over 100 citations)

Number	Author(s)	Article Title	Year of Publication	Number of Citation	Methodological approaches
1	Domínguez A.; Saenz-De-Navarrete J.; De-Marcos L.; Fernández-Sanz L.; Pagés C.; Martínez-Herráiz J.-J.	Gamifying learning experiences: Practical implications and outcomes	2013	1172	Mixed method
2	Subhash S.; Cudney E.A.	Gamified learning in higher education: A systematic review of the literature	2018	408	Systematic review
3	Su C.-H.; Cheng C.-H.	A mobile gamification learning system for improving the learning motivation and achievements	2015	376	Quantitative method
4	Xu F.; Buhalis D.; Weber J.	Serious games and the gamification of tourism	2017	296	Conceptual Methods
5	Attali Y.; Arieli-Attali M.	Gamification in assessment: Do points affect test performance?	2015	269	Quantitative method
6	Buckley P.; Doyle E.	Individualizing gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market	2017	214	Mixed method
7	Christy K.R.; Fox J.	Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance	2014	195	Quantitative method
8	Huang B.; Hew K.F.; Lo C.K.	Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement	2019	193	Quantitative method
9	Hew K.F.; Huang B.; Chu K.W.S.; Chiu D.K.W.	Engaging Asian students through game mechanics: Findings from two experiment studies	2016	193	Quantitative method
10	Mora A.; Riera D.; González C.; Arnedo-Moreno J.	Gamification: a systematic review of design frameworks	2017	186	Systematic review
11	Kyewski E.; Krämer N.C.	To gamify or not to gamify? An experimental field study of the influence of badges on motivation, activity, and	2018	181	Quantitative method

		performance in an online learning course			
12	Tsay C.H.-H.; Kofinas A.; Luo J.	Enhancing student learning experience with technology-mediated gamification: An empirical study	2018	161	Quantitative method
13	Sanchez D.R.; Langer M.; Kaur R.	Gamification in the classroom: Examining the impact of gamified quizzes on student learning	2020	153	Quantitative method
14	Fotaris P.; Mastoras T.; Leinfellner R.; Rosunally Y.	Climbing up the leaderboard: An empirical study of applying gamification techniques to a computer programming class	2016	148	Mixed method
15	Wiggins B.E.	An overview and study on the use of games, simulations, and gamification in higher education	2016	143	Quantitative method
16	Almeida F.; Simoes J.	The role of serious games, gamification, and industry 4.0 tools in the education 4.0 paradigm	2019	139	Qualitative method
17	Huang B.; Hew K.F.	Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts	2018	138	Quantitative method
18	Cózar-Gutiérrez R.; Sáez-López J.M.	Game-based learning and gamification in initial teacher training in the social sciences: an experiment with MinecraftEdu	2016	122	Quantitative method
19	Vanduhe V.Z.; Nat M.; Hasan H.F.	Continuance intentions to use gamification for training in higher education: integrating the Technology Acceptance Model (TAM), Social Motivation, and Task Technology Fit (TTF)	2020	120	Quantitative method
20	Lin D.T.A.; Ganapathy M.; Kaur M.	Kahoot! It: Gamification in higher education	2018	106	Quantitative method
21	Turan Z.; Avinc Z.; Kara K.; Goktas Y.	Gamification and education: Achievements, cognitive loads, and views of students	2016	104	Mixed method

Topics that have garnered the most attention, and areas for future exploration

Researchers have acknowledged the significance of author keywords in identifying research trends and benchmarks (Duvvuru et al., 2012). These keywords also serve as indicators of the evolution of a research theme within a specific field, given their close association with the underlying concepts, particularly when they appear frequently in documents. To address the third research question, an analysis of the co-occurrences of author keywords was performed using VOSviewer. This analysis helps delineate the topical foci and overall development of a particular research area.

For the purpose of identification with the keywords that authors prefer most often, co-occurrences of author keywords were analysed. Because there were 1622 keywords that authors used, the minimum number of occurrences of a keyword set is 10. The results demonstrate that there were six clusters with 26 keywords. Table 5 shows that apart from the keywords "gamification" (f = 420) and "higher education" (f = 184), the most frequent keywords are "motivation" (f = 70), "game-based learning "(f = 49), and " education"(f = 31).

Table 5. The Most Frequent Keywords

Clusters	Items
Clusters 1 (7 items)	Gamification (f=420), active learning (f=28), escape room (f=10), game-based learning (f=49), medical education (f=11), serious games (f=21), simulation (f=10)
Clusters 2 (6 items)	Higher education (f=184), e-learning (f=30), flipped classroom (f=20), online learning (f=20), student engagement (f=16), Kahoot (f=10),
Clusters 3 (5 items)	Augmented reality (f=10), education (f=31), learning (f=16), students (f=12), virtual reality (f=17),
Clusters 4 (4 items)	Educational innovation (f=14), educational technology (f=16), engineering education (f=10), innovation (f=14),
Clusters 5 (3 items)	Engagement (f=39), games (f=10), motivation (f=70),
Clusters 6 (1 item)	Mobile learning (f=16),

Furthermore, Figure 5 illustrates the distribution and dissemination of keywords in recent years. The analysis reveals that while most keywords are associated with gamification from 2020 to 2022, there are notable shifts in emphasis over these years. In 2020, scholars predominantly focused on e-learning and student engagement. This may reflect a growing interest in digital educational methods, accelerated by the COVID-19 pandemic (Stan & Mandy, 2023), which likely expedited the global shift towards online learning. In 2021, academic articles highlighted motivation, game-based learning, and serious games. This suggests a deeper exploration of gamification techniques, particularly how games can be employed for serious educational purposes, likely continuing to adapt to more engaging forms of online education (Arias-Calderón et al., 2022). In 2022, the focus shifted to online learning, innovation, escape rooms, and augmented reality. This shift indicates that while online learning has proven to be effective, there is still a need for new and engaging methods to further enhance educational outcomes (Castro & Tumibay, 2021). These changes suggest that integrating more sophisticated and varied technological solutions in educational settings to improve engagement and learning outcomes through gamification has become a general trend. From basic e-learning to the incorporation of advanced technologies such as augmented reality, there is an increasing recognition of the potential of gamification as a valuable educational tool.
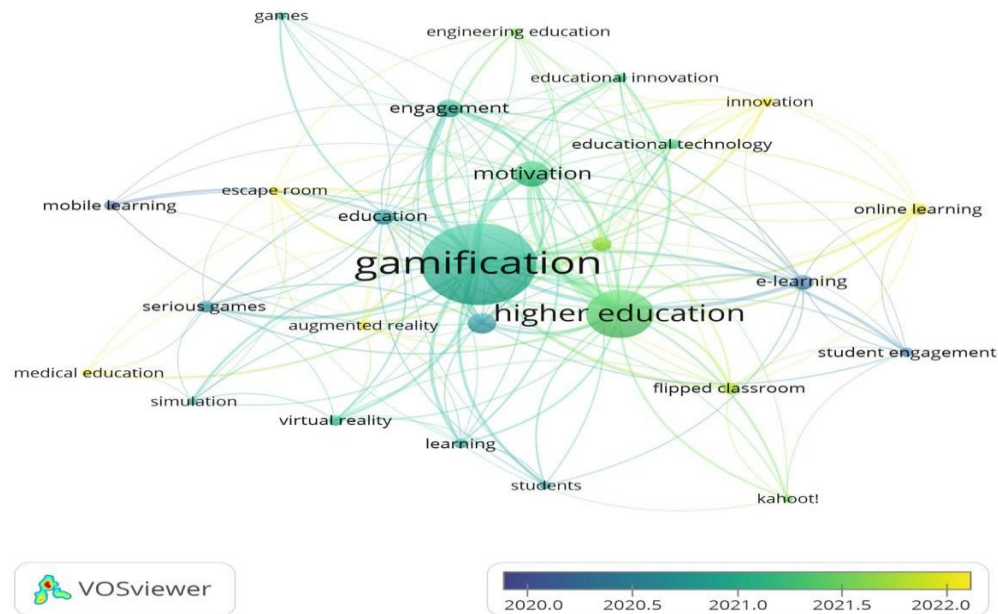
Figure 5. Visualization of the most frequent keywords

Discussion

A systematic review concerning the application of gamification in higher education has uncovered numerous significant insights, demonstrating a growing impact and acceptance of gamification within this sector. Recent years have seen an increase in research within this field, with the benefits of gamification in higher education becoming more established and accepted. Tracking the trends in publication over recent years reveals a continuous increase in the number of papers on gamification in higher education since 2016. From 2017 to 2019, there was a steady growth in the number of publications. This growth accelerated significantly between 2021 and 2022, exhibiting a sharp upward trend. This increase highlights the growing interest in and recognition of the importance of gamification technologies in enhancing educational experiences. Notably, the past few years have seen an intensified focus on the application of gamification in higher education, which is also potentially driven by the global shift to online learning.

Another finding is that Spain, the United States, and the United Kingdom have been identified as the primary contributing countries. Spain leads in terms of citation frequency and the number of publications, indicating its prominence in the application of gamification in higher education. This is further supported by Irwanto et al. (2023) who reported that the Spanish language is the second most commonly used language in publications relating to gamification.
The prolific application of gamification in higher education in Spain can be attributed to a supportive academic environment and favourable policies. For instance, many Spanish universities have dedicated game research centres or labs (Planells De La Maza, 2014). The University of Barcelona, for example, is involved in managing several research institutions that span science, technology, and the arts. Additionally, the Open University of Catalonia (UOC) has specialised research groups focused on technology-mediated language learning and gamification, which conduct relevant teaching and research projects.

According to the results, Table 3 lists 11 of the most cited journals. The top two journals, 'Computers and Education' and 'Computers in Human Behaviour', are both ranked Q1 by Scimago Journal Rank (ResearchBite, 2023), indicating their authoritative status and the recognition of the significance of gamification in higher education. An additional interesting observation is that seven of these journals are closely related to computer technology, illustrating that gamification is also a manifestation of computer technology applications in education. The remaining journals focus on diverse topics, including the environmental, economic, and social impacts of sustainable development; the effects of environmental factors on public health; educational theory, policy, and practice, as well as their applications in society; and medical education.

Furthermore, the most highly cited article by Domínguez A., et al. (2013), which has 1172 citations. This article experimented with gamification plugins in university courses, collecting both quantitative and qualitative data to verify whether gamification can enhance student motivation and engagement in online education. The experiment revealed that while students participating in gamified learning performed better in practical tasks, they showed poorer performance in written assignments and classroom activity engagement (Dominguez et al., 2013). This finding challenges the common belief that gamification in education invariably yields benefits,

thereby opening further research avenues into the impact and effectiveness of gamification in higher education. Furthermore, among these 21 influential articles, 13 employed quantitative research methodologies, 4 undertook mixed-method research, and just one implemented a qualitative research approach. There were also two papers that employed systematic review and conceptual methods. The literature increasingly supports the effectiveness of gamification in higher education with empirical evidence at the quantitative level. However, there is a need for more qualitative research to understand the underlying mechanisms and contextual factors that drive these effects. Qualitative studies could provide deeper insights into the specific features of gamification that are most effective, how different student populations respond to gamification, and the ways in which gamification influences student attitudes and behaviours. This comprehensive understanding is crucial for designing more effective gamified learning experiences and maximising their potential benefits.

The results also suggest that implementing gamification in higher education corresponds with specific topical focuses and reveals research areas for future exploration. In this field, there is a marked emphasis on motivation, e-learning, and engagement. These topics include 'online learning,' 'innovation,' 'augmented reality,' 'escape room,' 'flipped classroom,' and 'active learning.' Additionally, in recent years, gamification has been increasingly studied within the domains of engineering and medical education.

Limitation

This study presents a thorough quantitative analysis of the body of knowledge on gamification in higher education, yet it is not without its limitations. A notable limitation arises from the reliance on a single Scopus database to source the research documents. Moreover, the selection criteria were confined solely to Englishlanguage journal articles, potentially overlooking crucial data relevant to the primary research focus due to this restriction. The production and interpretation of citation maps vary based on the established thresholds for their creation and explanation. Hence, while this bibliometric analysis is intended to complement other review methods; it possesses inherent constraints. Nonetheless, this research offers valuable insights and substantial perspectives for scholars interested in the application of gamification in higher education, despite these limitations.

Conclusion

Finally, this bibliometric evaluation provides a complete summary of the evolution of publications on gamification in higher education between 2013 and 2023. The search within this domain yielded 609 documents. It includes scientific mapping that covers various aspects such as the trends of publications, the contributions of various countries, the most influential authors, journals, and articles, and the research methodologies employed. Additionally, this study identifies the primary topics of focus and research areas for further exploration.

The bibliometric analysis reveals several key findings: 1) A modest growth in publications from 2019 to 2023 suggests ongoing development in the field. 2) Significant contributions have emerged predominantly from Spain, the United States, and the United Kingdom. 3) The journals 'Computers and Education,' 'Computers in Human Behaviour,' and 'Sustainability (Switzerland)" are among the most influential in this domain, having published a total of 44 documents and being cited 3836 times. 4) The analysis highlights the most cited paper by Domínguez et al., (2013), which has received 1,172 citations, with Hamari J. recognised as the most cited author, accumulating 408 citations. 5) Keyword co-occurrence analysis has identified primary research foci including 'motivation,' 'e-learning,' and 'engagement,' while pinpointing 'online learning,' 'innovation,' 'augmented reality,' 'escape room,' 'flipped classroom,' and 'active learning' as underexplored themes.

Future Recommendation

This bibliometric analysis not only enhances the existing literature on gamification in higher education but also serves as a tool to guide newcomers to the field by delineating the research priorities necessary for future investigations. In response to the current gaps in research within this domain, the researcher encourages scholars globally to form an international collaborative network committed to ongoing efforts to address these gaps.

Based on the findings of this study, the following recommendations are made: 1) Future research should employ alternative bibliometric approaches and incorporate thematic analyses, such as comprehensive examinations of empirical studies. 2) Future inquiries may also explore the role of gamification in interdisciplinary education through the use of qualitative research methodologies.

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