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Gamification and Flipped Classroom Research: A Bibliometric Analysis of Trends of Scopus-Indexed Publications

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Abstract: This study examined 325 scientific articles from Scopus on gamification research within flipped classroom and technology-enhanced learning contexts. The study aimed to identify publication trends, research productivity, and emerging thematic patterns in this field. Bibliometric analysis and systematic mapping are lacking, making it difficult to understand research trends, collaboration patterns, and key themes. A bibliometric approach was employed to map trends in scientific publications. Data were collected using the Scopus database, applying Boolean operators. The selection criteria included questions about elementary, middle, and high school students and publications published between 2014 and 2024. Data analysis was carried out using VOSviewer and Bibliometrix. The findings revealed a clear increase in global research activity, with substantial growth in annual publication output. Keyword analysis revealed six interrelated research trends: New Ways of Teaching, Psychological Dimensions and Learner Engagement, Technology Drivers and Digital Environments, Implementation Context: Learning Environment and Curriculum, Evaluation of Goals and Developing Competencies, and Methods for Studies in Education. Gamification literature grew by 169 papers between 2014 and 2021. Although productivity grew between 2021 and 2024, the total number of papers was 156. This study shows that pedagogy, psychology, and technology are interconnected. It can help teachers and policymakers use gamification and AI- and Virtual Reality-enhanced teaching methods. This study emphasizes the integration of pedagogy, psychology, and technology in a comprehensive bibliometric analysis. The findings can help educators and policymakers develop new pedagogical methods, particularly using Artificial Intelligence and VR.

Keywords: bibliometric analysis, flipped classroom, digital learning, gamification, and innovative classroom.

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INTRODUCTION

The pedagogical framework of 21st-century education is experiencing a significant transformation, propelled by the integration of cognitive learning theory and advancements in digital technology in schools. The innovative classroom paradigm has emerged as a key educational innovation, reshaping how teaching and learning are organized across time and space (Gonzales & Gonzales, 2024; Talbert & Bergmann, 2023). This model effectively changes the classroom from a place where information is delivered to a place where people can talk, ask questions, and develop higher-order thinking skills (Listiqowati et al., 2022; Liu & Zhang, 2022; Wahyudi et al., 2023). It does this by moving traditional ways of teaching knowledge into the realm of self-directed learning (Dewi et al., 2024). The concept successfully changes the classroom from a fundamental information

dissemination environment into an opportunity for collaborative discourse (Chang et al., 2022; Gopinathan et al., 2022; Shin et al., 2022). However, the accuracy of this methodology depends on students' capacity to stay engaged in the pre-class session. To combat any problems in retention and engagement, gamification is being incorporated as an advanced motivational framework (Gómez-Carrasco et al., 2020; Parra-González et al., 2021; Zou, 2020), intended for improving cognitive perseverance and an expertise orientation in students (Huang et al., 2019; Lo & Hew, 2020).

The combination of these two teaching methods creates a synergy that is greater than the sum of the two. Gamification in the classroom works at a psychological-structural level (Huang et al., 2019), which is different from the content-centric approach of game-based learning (Jossan et al., 2021). It does not show content through gameplay; instead, it puts game mechanisms like progression systems, point-based virtual economies, and social validation through badges or leaderboards right into the action of learning itself (Candel et al., 2024). The development of interactive multimedia applications like immersive media, simulation systems, and game-based formative assessments supports more engaging learning experiences and strengthens the technology-enhanced learning ecosystem (Abdallah et al., 2023; Lewis et al., 2019). These technologies are useful tools because, in addition to providing high-quality information, they allow educators to monitor learners' performance and provide immediate feedback. Together, these two strategies are important for maintaining students' motivation to learn (Arifin et al., 2021; Lauc et al., 2020; Septiani et al., 2020).

Due to the popularity and empirically proven nature of this concept, the study of gamification has become widespread in peer-reviewed journals, creating a cluttered yet disorganized research field across multiple fields of study (Ekici, 2021; Jiang et al., 2022). While the growing number of publications suggests that this area is thriving, it represents a significant epistemological obstacle in organizing existing knowledge, developing theoretical agreement, and tracing methodological advancements (Gómez-Carrasco et al., 2020; Siti et al., 2020; Talbert & Bergmann, 2023).

Scholarly writings on classroom gamification reveal a scattered pattern due to the wide range of educational levels, subject areas, and technologies used. There is an expanding pool of scholarly writing demonstrating the benefits associated with classroom gamification through empirical research on gamification in enhancing students' motivation, engagement, and achievement (Cole et al., 2024; Lampropoulos & Kinshuk, 2024; Manzano-León et al., 2021). Despite these contributions, scholarly research in the area often focuses on short-term gamification and does not thoroughly evaluate such efforts in relation to other learning settings or methodologies (Cole et al., 2024; Zeybek & Saygý, 2024). On the other hand, although gamification holds great promise in revolutionizing traditional learning methods, there is some doubt about how it could be implemented successfully or the differences in success rates depending on various disciplines and education levels (Chugh & Turnbull, 2023; Zeybek & Saygý, 2024). This underscores the need for more cohesive research efforts to address this gap and explore the diverse range of gamification activities in education.

Conducting a bibliometric assessment of classroom gamification research is essential because it can reveal significant trends and collaborative patterns within the field. Recent studies indicate a growing interest in gamification, particularly in educational contexts, where it has been linked to enhanced learner engagement and motivation, especially among learners facing various life challenges (Ma, 2024; Rivera & Garden, 2021; Yýldýz et al., 2024). Furthermore,

bibliometric methods have successfully identified emerging themes such as the integration of gamification with technology-enhanced learning, which includes the use of AI and big data (K. C. Li & Wong, 2022; Yan et al., 2024). This comprehensive approach not only highlights the interdisciplinary nature of gamification research but also underscores the need for further exploration of its pedagogical implications and effectiveness in diverse educational settings (Challob, 2021; Qudsi, 2024). Therefore, conducting a bibliometric assessment of classroom gamification research is both timely and necessary to establish a comprehensive understanding of the field's development and future trajectory. In an attempt to fill the research gap stated above, the following research questions will form the basis of this article:

RQ1: How has the scientific publication trend of gamification research in flipped classrooms evolved in Scopus-indexed literature?

RQ2: Which areas produce the most research when it comes to studies on gamification in flipped classrooms?

RQ3: What are the dominant keyword clusters and emerging research trends that characterize the development of gamification research in the flipped classroom?

In summary, this research paper provides an in-depth bibliometric analysis of global scholarship dedicated to classroom gamification, focusing on Scopus-indexed sources. By doing so, it traces the history and evolution of the intellectual and conceptual field, identifies its major contributors and networks, as well as thematic groups influencing current discussions. Through these methods, the theoretical understanding of gamification as a pedagogical tool is advanced, and future directions for scholarly inquiry are highlighted.

METHOD

This research reflects a bibliometric study conducted on the Scopus database to facilitate a systematic mapping. The bibliometric analysis was carried out using the software VOSviewer 1.6.20 and the bibliometrix library on RStudio with the help of the Biblioshiny interface. The science mapping analysis included term co-occurrences, citations, and bibliographic coupling using VOSviewer. VOSviewer provides tools for analyzing research trends, regional productivity, keyword analysis, and future research directions. The bibliometric network was created and normalized based on the association strength normalization approach. The process of gathering and choosing data is a very important step in the research paper extraction technique applied in the bibliometric observation review of the use of gamification by the construction of the best class determined by the approach adopted, with approval (Chamorro-Atalaya et al., 2023). This data extraction process is adapted from PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which requires a selection and extraction process consisting of three phases. In the first phase, the subject and scope of the study are identified and specifically defined, thus producing an initial list of "identified manuscripts". In the next phase, tight addition and display activities are used to narrow down the identification findings and figure out which "written documents in the representation" would be chosen. In the last stage, an in-depth evaluation of the abstracts and content of the selected manuscripts is conducted to select the "included manuscripts" that will become the final data for analysis.

Manuscript Definition, Scoping, and Identification Phase

The initial stage focused on defining the research subject and determining relevant

keywords to construct the search equation. The selection of Scopus was based on several main considerations. First, Scopus provides a comprehensive data composition, including integration with bibliometric tools, multidisciplinary manuscripts, advanced filtering and search options, and is easily accessible (Elsevier, n.d.); Second, Scopus is known for its extensive coverage of different kinds of documents, like conference proceedings, review research papers, research papers, and data-based indexes about a variety of top journals in science (Prahani et al., 2023; Yamunah Vaicondam et al., 2022), so that the articles presented are guaranteed to be credible. Table 1 illustrates the analysis equation applied to obtain the data, which is labeled "identified manuscripts." The results of the first stage of the search, using Boolean indicators, identified 409 manuscripts for further analysis, as shown in Table 1.

Table 1. Search equation through boolean indicators

Database	Search string
Scopus	TITLE-ABS-KEY(((Gamification) OR (Gamified AND learning) OR (Game AND design)) AND ((flipped AND classroom) OR (inverted AND learning) OR (flipped AND learning)))

Manuscript Projection Phase in Strict Detail

This step is about using the selection and rejection criteria on the 409 papers we found before. Setting these criteria is important for reducing bias that would happen if we only relied on search similarities. For example, the relevance of the research subjects' educational levels, comparing school and university students and manuscripts published between 2014 and 2024, is carefully considered to ensure that manuscript projections are more accurate in accordance with the topic being studied. Next, a detailed presentation of the inclusion and exclusion criteria used to identify the final manuscripts is provided. After this phase of manuscript selection, 351 manuscripts were identified as relevant and met te criteria for further analysis, using the manuscript identification criteria shown in Table 2.

Table 2. Criteria employed for manuscript identification

Inclusion	Exclusions
Studies focusing on gamification within flipped classroom in elementary, middle, and secondary school classrooms	Studies focusing on higher education settings (universities, colleges, and undergraduate programs)
Questions about elementary, middle, and high school students	Questions about college, university, and undergraduate students
Manuscripts published between 2014 and 2024	Manuscripts that were published before 2014

Selected Analytical Data Presentation Phase

The final step of this third phase entailed a comprehensive examination of the titles, abstracts, and contents of the manuscripts, resulting in the identification of 325 final manuscripts. The representation process is illustrated in a flowchart that was used continuously until the final manuscripts were identified and subsequently incorporated into the bibliometric analysis phase. Figure 1 illustrates the flow diagram used with PRISMA.

Selected analytical data were systematically extracted from the Scopus database for the period 2014 to 2024. Subsequently, the retrieved data were analyzed and presented. A comprehensive quantitative analysis was conducted using VOSviewer and bibliometrix software to illustrate the clustering and mapping of bibliometric

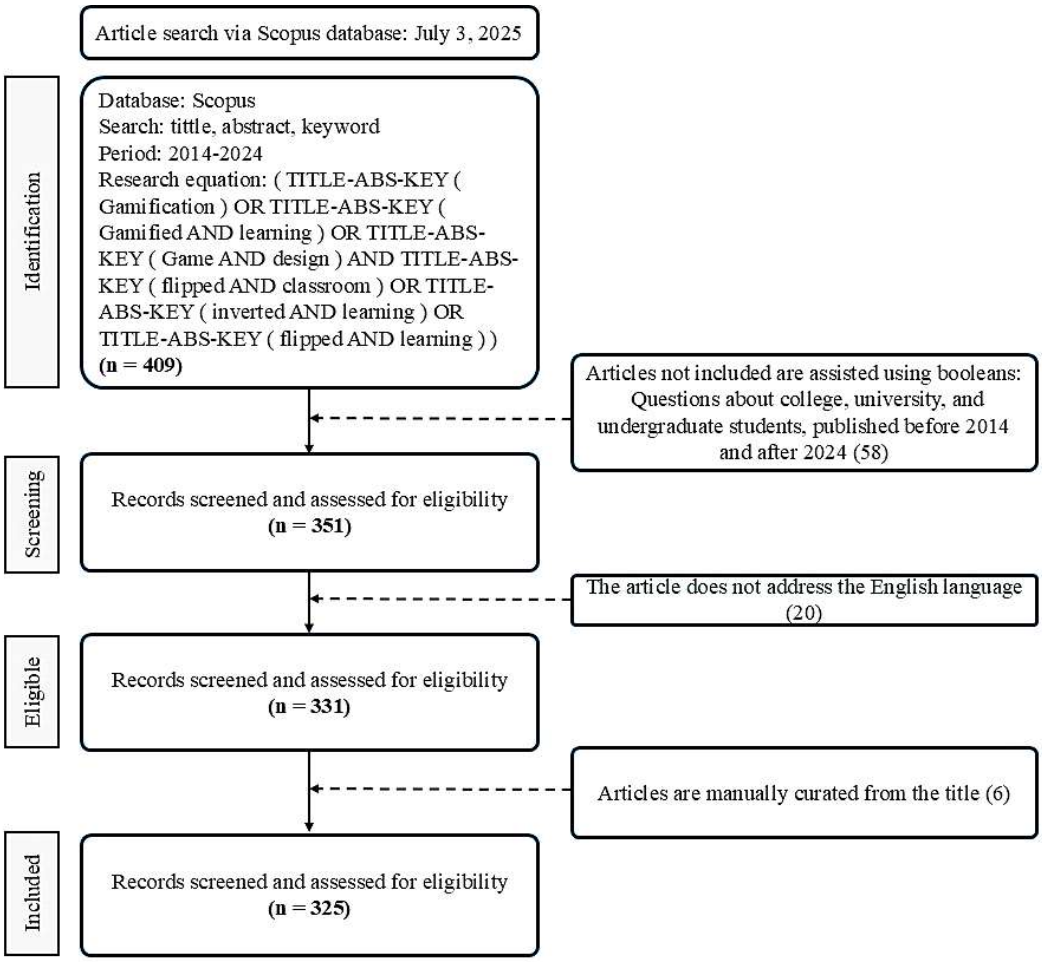

Figure 1. A flowchart using PRISMA showing how the manuscript extraction method works

networks (Jan van Eck & Waltman, 2022). Bibliometric data visualization, encompassing researcher networks and keyword-based visual maps, is essential for identifying significant research topics and exploring collaborative relationships among authors (Al Husaeni & Nandiyanto, 2022). The relevant journal database metadata analyzed includes keyword co-occurrence, citation, and co-citation visualizations, which are derived from bibliographic statistics, research trends, area productivity, author evaluations, publication records, and underlying research frameworks.

■ RESULT AND DISCUSSION

This section presents a bibliometric analysis of innovations in education and examines gamification innovations in flipped classroom settings. The analysis uses data drawn from articles published in Scopus-indexed journals between 2014 and 2024. This study aims to identify research trends, subject area productivity, publication patterns, and research frameworks.

Publication Trends of Gamification Research in Flipped Classroom

Figure 2 shows how the number of annual publications on the use of gamification in the flipped classroom has changed over time. The analysis shows that scientific output has clearly grown from 2014 to 2024. This positive trend strongly suggests that both academics and researchers are becoming more interested in this area of research. During the first two-year period

(2014-2015), there is a marked increase in publications from 1 to 5 papers, which suggests the initial emergence of growing interest in academic research on the topic under discussion. In the second span (2016-2017), publications increased from 8 to 14, showing gradually increasing interest among scholars in gamification in flipped classrooms. There was a marked increase in the third span (2018-2019), where publications went from 28 to 29, followed by another marked increase in 2020, where publications amounted to 39 papers.

For the period 2021-2022, the level of publications did not change much, with 45 publications in 2021 and 44 publications in 2022. Although a slight decrease was observed in 2022, the research trend remained quite promising. Lastly, publication output increased markedly from 45 articles in 2023 to 67 articles in 2024, making 2024 the most productive year throughout the study period. The steep rise indicates growing interest in gamification within flipped classes, particularly in relation to new educational technologies such as AI and VR.

The first five years of the investigation of gamification in education, using 56 published articles, show how the field of study attracts scholarly attention as a new teaching method designed to improve students' motivation and participation. Early studies of gamification's impact focused on analyzing the potential to transform the traditional classroom through various aspects of game design (Ma, 2024; Rivera & Garden, 2021). According to the meta-analysis, there is some evidence that gamification may have a moderate positive effect on students' academic success (Zeng et al., 2024). Nevertheless, scholars indicate that the successful implementation of gamification depends greatly on its careful application based on certain principles of instructional design (Triantafyllou et al., 2025). Additionally, the area seems quite young, so scholars call for further investigation to determine its potential challenges.

The increase in publication output during the subsequent period further indicates the growing scholarly interest in gamification as an educational strategy. This interest is connected to the current conditions related to the COVID-19 pandemic, when educators were forced to introduce changes to the traditional approach and consider how to maintain students' motivation online (Ratinho & Martins, 2023; Shen et al., 2025). In particular, gamification involves using specific motivational aspects, such as points, badges, and leaderboards (Meng et al., 2024; Rahayu et al., 2022). While these aspects may positively impact learners in terms of increased engagement and motivation initially, it was noted that the effect fades over time due to the novelty effect (Ratinho & Martins, 2023). Thus, further research is necessary to address the topic properly and take into account all possible learner characteristics.

Studies on gamification in flipped classrooms have progressed immensely due to the increased availability of educational technologies and their implementation in classroom environments, along with the shift toward digital teaching practices and learner-centered instruction. A bibliometric study shows an increase in the number of publications on gamification in education, particularly in history education, that improve student engagement through technology use and critical thinking (Shen et al., 2025; Wahyudi, Sekar, et al., 2025). In addition, systematic reviews have found that gamification has been used in many educational stages and areas, positively affecting learning performance (Zeybek & Saygý, 2024). Moreover, a bibliometric analysis of more than 4,700 papers identified the main topics studied by scholars in relation to gamification, such as technology-enhanced learning and frameworks for game development (Ayaz et al., 2023).

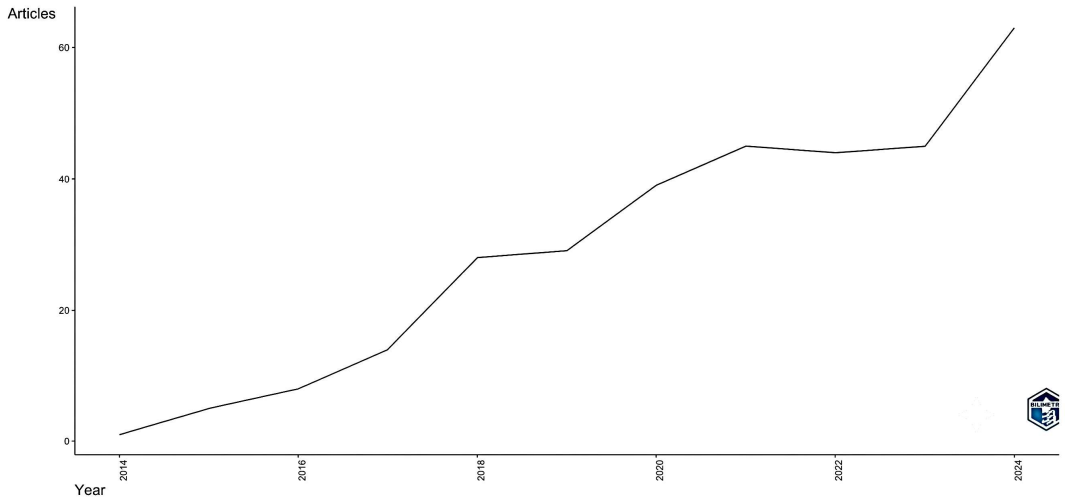

Figure 2. Trends in the yearly distribution of publications

Research Areas Contributing to Gamification Studies in Flipped Classroom

In the current context, a bibliometric analysis that considers productivity is prioritized to identify the top producers of gamification knowledge in the education field. Therefore, the use of bar charts in Figures 3 and 4 is preferred, as they are better suited to demonstrate comparisons concerning publication productivity, contribution frequency, and distribution trends among geographical affiliations and research institutions. Unlike the analysis of collaboration networks, which mainly deals with relational and interactive aspects between geographical affiliations, these statistics are meant to provide a clearer quantitative understanding of research and publishing activities.

Figure 3 demonstrates the geographic pattern of scientific production through the mapping of the ten highest producers of scientific papers according to the affiliation of their corresponding authors. It also reveals the patterns of collaboration strategies among Single-Country Publications (SCPs) and Multiple-Country Publications (MCPs). Among the geographical affiliations represented in the dataset, Spain produced the highest number of publications. The second and third places belong to China and the USA, respectively. A deeper consideration of collaboration patterns suggests that the most productive geographical affiliations, such as Spain and the USA, possess self-sustaining research systems. This is evident through the high number of SCPs. Germany, Turkey, and Brazil can also serve as examples. However, the United Kingdom and China are international collaboration centers where a greater percentage of MCPs is produced than in other geographical affiliations. Consequently, the data demonstrate two strategies for producing knowledge, depending on whether a country has its own internal research capacity or possesses international collaboration potential. Thus, it becomes clear that the collaboration strategies are rather complex, and they differ among the most productive contributing geographical affiliations, see Figure 3.

Besides evaluating scientific productivity, citation impact is another key parameter for assessing scientific influence (see Figure 4). Indeed, citation analysis adds further valuable information regarding the intellectual impact and popularity of research contributions beyond the number of publications alone. Although Spain recorded the highest publication output among the geographic affiliations in the dataset, Hong

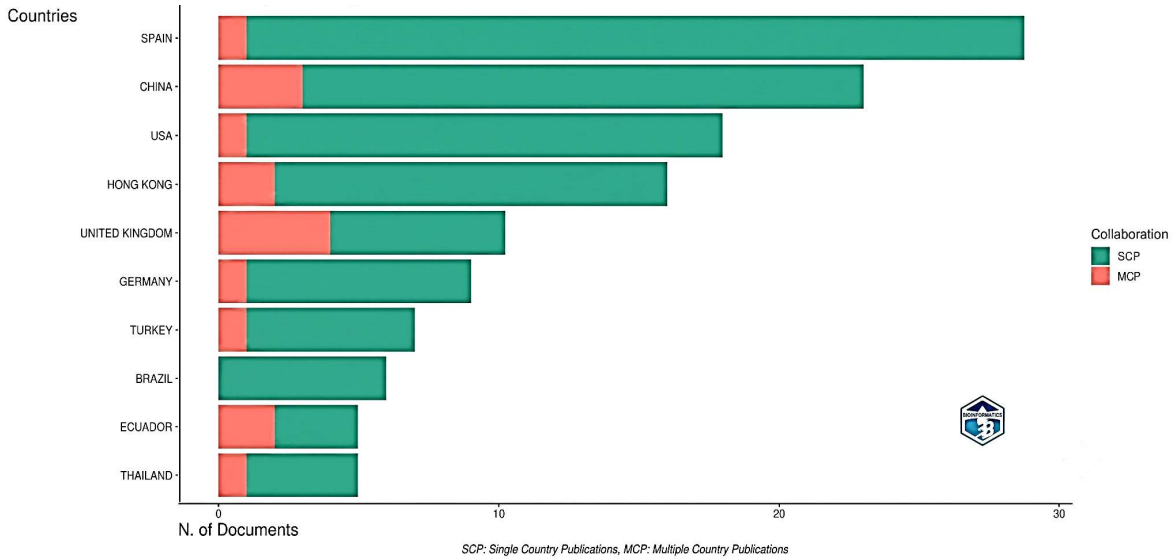

Figure 3. A list of the countries/regions that do the most research in this area

Kong recorded the highest citation impact, with 987 citations, followed by Spain with 816 and China with 609.

Such results imply that there might be no direct correspondence between productivity and intellectual influence of the country. Thus, for

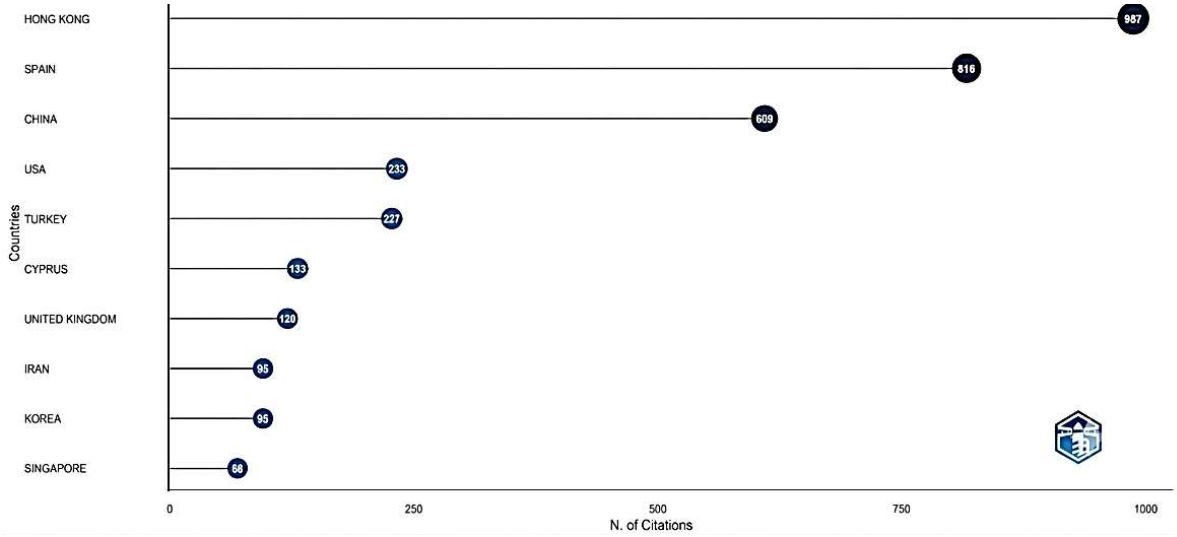

Figure 4. Countries/regions that are most often cited in this field of research

instance, Spain's leading position reflects a balance between productivity and citation impact, indicating a sustainable research field with sufficient research activity. On the contrary, Hong Kong has shown a high-impact efficiency approach. In particular, Hong Kong produces fewer publications but achieves a high citation impact performance.

This pattern may reflect differences in the visibility, thematic focus, or citation performance of publications associated with Hong Kong-based researchers, focusing on the subdomains of gamification and digital pedagogy that enjoy a high citation impact in general. Alternatively, the publications in question might have been published in globally popular and renowned

academic journals. The high citation impact may also reflect the visibility and influence of highly cited publications associated with Hong Kong-based researchers.

Finally, it becomes clear that intellectual influence depends on several factors, such as thematic relevance and novelty, apart from productivity. For example, unlike Spain, the United States shows low citation impact relative to its productivity. Such a result might be related to the broader spectrum of studied topics. As such, the results support the idea that citation impact and productivity are separate metrics of scientific achievement.

Figure 5 presents a ranking of the ten most productive institutions in this research corpus, based on the total number of publications. Thus, in terms of institutional affiliations, this analysis proves that most of the scientific information concerning this issue is generated in only a few locations. The University of Granada is the leading producer of information in this area of research with almost 65 papers published. This number is impressive compared with institutions that have published significantly fewer papers. Another institution on this list that has generated considerable output is the University of Hong Kong, with almost 46 publications, followed by the National Taiwan University of Science and Technology, with about 35 papers. Finally, there is a group of universities that are located in East Asia (Hong Kong and Taiwan). The presence of such institutions emphasizes their role in research activity in this region. Moreover, as a whole, all the information mentioned above clearly suggests that there is no optimal institution for research in this field. Another interpretation of this statement can be the following: in certain geographical affiliations, there are scientific communities that have a significant impact on world science. Therefore, it is possible to state that there are research centers that specialize in aspects such as the analysis of the number of documents in Figure 5 below.

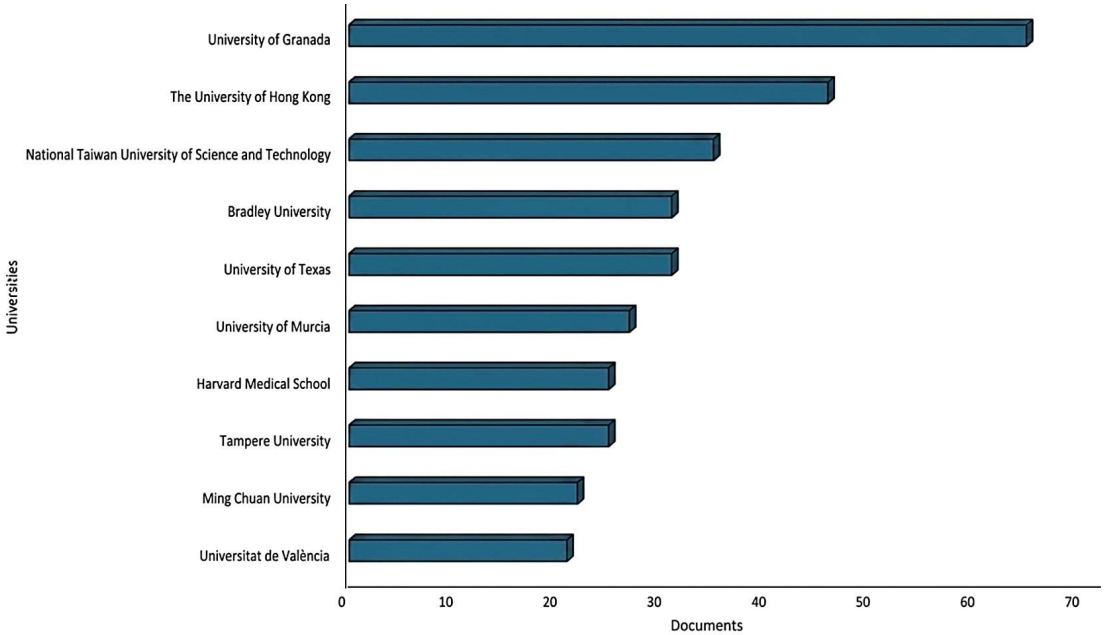

Figure 5. A list of the affiliates that get the most work done

The regions are not the exclusive focus; we also examined the most cited publications within the dataset, as illustrated in Table 3. The publications that are referenced the most are really important for the study of gamification. Flipped classrooms. They are the foundation of this research. Have had a big impact on the studies that came after them.

Table 3. Top 10 most cited publications in gamification and flipped classroom research

Rank	Author	Year	Article Title	Journal	Citations
1	Huang, Biyun; Hew, Khe Foon; Lo, Chung Kwan	2019	Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement.	Interactive Learning Environments	315
2	Zainuddin, Zamzami	2018	Students' learning performance and perceived motivation in gamified flipped-class instruction	Computers and Education	268
3	Huang, Biyun; Hew, Khe Foon	2018	Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts.	Computers and Education	239
4	Tsay, Crystal Han-Huei; Kofinas, Alexander; Luo, Jing	2018	Enhancing student learning experience with technology-mediated gamification: An empirical study	Computers and Education	229
5	Lo, Chung Kwan; Hew, Khe Foon	2020	A comparison of flipped learning with gamification, traditional learning, and online independent study: the effects on students' mathematics achievement and cognitive engagement	Interactive Learning Environments	213
6	Sánchez-Ruiz, Luis M.; Moll-López, Santiago; Núñez-Pérez, Adolfo; Moraño-Fernández, José Antonio); Vega-Fleitas, Erika	2023	ChatGPT Challenges Blended Learning Methodologies in Engineering Education: A Case Study in Mathematics	Applied Sciences (Switzerland)	198
7	Sailer, Michael; Sailer, Maximilian	2021	Gamification of in-class activities in flipped classroom lectures	British Journal of Educational Technology	192
8	Huang, Yueh-Min; Silitonga, Lusia Maryani; Wu, Ting-Ting	2022	Applying a business simulation game in a flipped classroom to enhance engagement, learning achievement, and higher-order thinking skills	Computers and Education	182
9	Ekici, Murat	2021	A systematic review of the use of gamification in flipped learning	Education and Information Technologies	144
10	Hung, Hsiu-Ting	2017	Clickers in the flipped classroom: bring your own device (BYOD) to promote student learning	Interactive Learning Environments	125

Table 3 shows the ten publications that people have cited a lot from our collection of data. These studies mainly focus on student engagement and learning motivation, and how technology can support learning. A lot of these publications were published in journals about educational technology. This means that research on student engagement, learning motivation, and technology-enhanced learning has really helped shape research on gamification and flipped classrooms.

In the institutional analysis, after the highly cited publications analysis, the concern is with the author connections rather than the educational contexts studied in the selected research. Studies of university students were excluded during the screening process. However, the dataset includes academics affiliated with universities as they frequently conduct and publish research in elementary, middle, and secondary school settings.

Dominant Keyword Clusters and Emerging Research Trends in Gamification Research in Flipped Classroom

Keyword co-occurrence analysis was used to identify relationships among frequently occurring research topics and to map the thematic structure of the field. As a frequency-based technique involving the calculation of the number of times one or several keywords appear in literature (Jan van Eck & Waltman, 2022), this approach is very efficient when establishing connections between scientific research topics and constructing the theoretical framework of a particular field of study. To conduct the analysis, first, bibliometric data were extracted from the Scopus database in the RIS format. In the second step, the co-occurrence network analysis was conducted using VOSviewer. The analysis type was set as "co-occurrence," and the counting type was set as "full counting." A threshold of five occurrences was set to ensure that the analyzed keywords were relevant. A total of 325 keywords met the predefined threshold and were included in the subsequent analysis.

The co-occurrence analysis produced a network visualization in which the selected keywords were organized into 13 computational clusters. These 13 computational clusters were subsequently synthesized into six broader thematic categories through manual conceptual coding of the keyword lists. Every category, which is easily distinguishable because of its unique color, corresponds to a specific subfield or area of study. In this visualization, each keyword takes the form of a node, whose size depends on its importance and frequency in the body of literature.

With the help of the VOSviewer program, we can identify the landscape of gamification studies in educational practice and create a Network Visualization to show clusters of related keywords, each assigned a unique color to distinguish between subdomains. Like in Figure 6, this visualization serves as a summary of the research categories, similar to Table 3. Nodes and connections become bigger according to the increased frequency of the joint occurrence of the studied terms.

The network visualization presented in Figure 6 demonstrates the complexity and connectivity of the field, in which keywords such as "flipped classroom" and "gamification" play a crucial role. As the visualization demonstrates, there are many clusters related to two major pedagogic fields supported by technology. The clusters in blue and yellow appear to be the largest. They focus on "flipped classroom" and "gamification", respectively, implying their high relevance to other concepts, including "student motivation", "educational technology", and "learning process". At the same time, an important topic (in red color) is associated with research methodologies and practical applications. These clusters highlight topics such as "problem-based learning", "controlled study", and "simulation".

Meanwhile, other clusters cover instructional design (in green color) and innovative pedagogy (in purple).

The findings of the current bibliometric study contribute to existing knowledge by revealing how contemporary education research transcends the boundaries of its own discipline, intersecting with pedagogy, technology, psychology, and instruction design. Through the mapping of relevant keywords, various themes are presented, directing future research efforts toward areas such as incorporating artificial intelligence in adaptive learning systems or leveraging virtual reality to enhance the model. The clusters identified in this co-occurrence analysis show important themes driving current research, highlight areas that have not been studied enough, and demonstrate how new technologies are shaping learning innovation, as seen in Figure 6.

The network visualization in Figure 6 presents a conceptual map of research on the integration of gamification in classroom, analyzed using VOSviewer using the keyword co-occurrence method by identifying several coherent thematic clusters, which is the primary objective of the scientific mapping analysis (Jan van Eck & Waltman, 2022), This visualization shows a landscape when previous research mostly focused on technical implementation, but contemporary studies increasingly incorporate gamification within pedagogical frameworks. This trend has been confirmed by many systematic reviews in this field (Mabalay, 2025; Parra-González et al., 2020, 2021).

The Synergy of Core Pedagogical Models is one of the most important research trends. This is shown by the close relationship between the three biggest nodes: "gamification," "flipped classroom," and "learning process." This collection of studies demonstrates that research in this area pertains not only to educational technology in general but also to the analysis of execution within the framework of multiple innovative learning models that encourage active learning experiences (Candel et al., 2024; Ruiz-Arroyo et al., 2025; Supnoon & Chonchaiya, 2024). The significant occurrence of terms such as "educational technology" and "learning designs" suggests that considerable planning and design work must be done before implementing a model successfully (Kalana & Junaini, 2025).

The second main upcoming trend will involve the relationship between stimuli and people's cognitive functions and academic achievement. This cluster is characterized by the term "student motivation," though the concept is also related to "gamification" and "satisfaction." It clearly demonstrates that the major aim of gamification intervention is to increase students' involvement and motivation. In turn, these two components are considered the most important factors in explaining students' success (Jiménez-Valverde et al., 2025; Rahmi et al., 2025). The effect of this heightened motivation is subsequently evaluated using outcome variables such as "achievement" and "satisfaction," with various meta-analyses indicating a positive correlation between the two (Mamekova et al., 2021; Zhang et al., 2021).

The next trend is Innovative Learning Technology Applications. This group shows how advanced technology can make learning better (Bobkina et al., 2025; Katona & Gyonyoru, 2025). The notions of "virtual reality," "augmented reality," and "artificial intelligence" indicate that analysis has moved beyond fundamental uses to investigate dynamic and adaptable spaces for learning (Sargent & Casey, 2020; Singh, 2021; D. Wu et al., 2025). These technologies are increasingly being applied in discipline-specific learning contexts. For example, "STEM education" involves various simulations and virtual environments that are effective in improving people's conceptual understanding (Álvarez Ariza & Olatunde-Aiyedun, 2024).

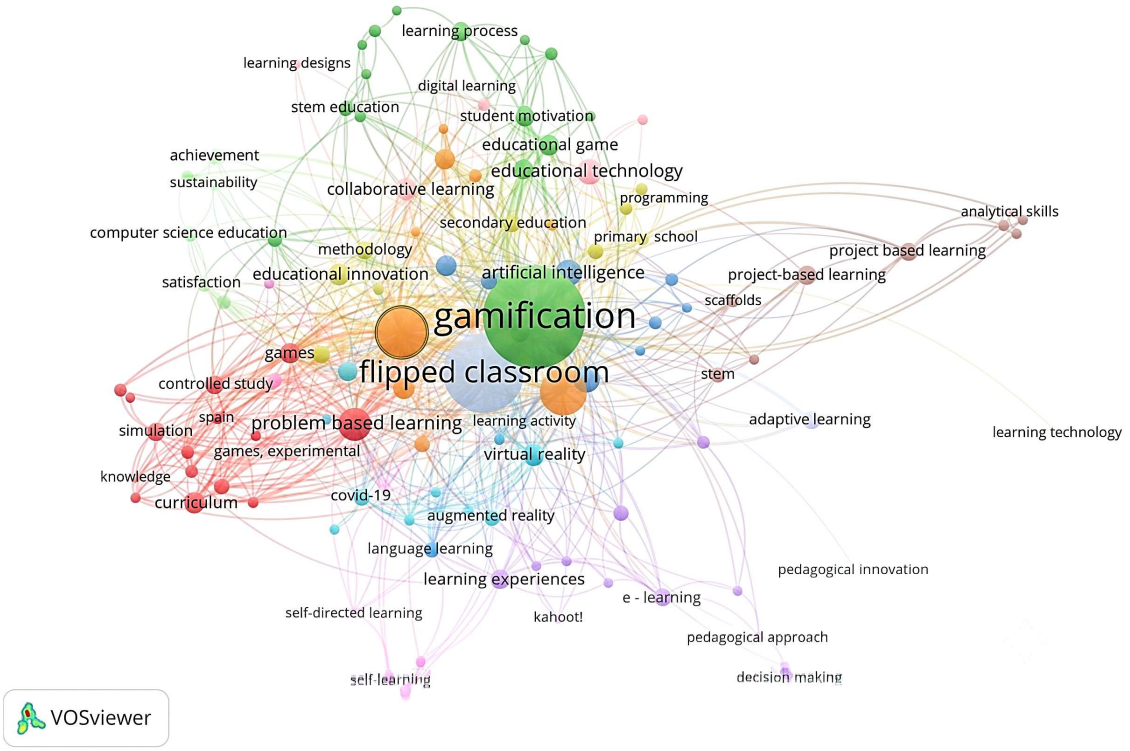

Figure 6. Network visualization of the topic area

Lastly, a trend has been found that focuses on self-directed learning and skills improvement. The development of a network connecting "project-based learning" and "analytical skills" (Khyzhniak et al., 2021; Listiqowati et al., 2022; Liu & Zhang, 2022), in addition to a different group focusing on "self-directed learning" (Ng, 2018; M. Wang et al., 2023), shows an increase in focus. Research seeks to enhance academic performance while also imparting 21st-century skills and fostering students' capacity for self-regulation in their learning (Ekineh & Accra-Jaja, 2022), which is a fundamental objective of numerous active learning methodologies (Howell, 2021; R. Li et al., 2023). Table 3 summarizes the different research clusters, including trends and items related to each one.

Before creating Table 4, the network analysis of the keywords generated from VOSviewer was analyzed using the association strength normalization technique and the VOS clustering technique. Through this process, the keywords were categorized into several clusters based on their association, using the number of co-occurrence connections within the studied literature. Each cluster was represented by different colors in the network to indicate the closeness of themes.

Following the generation of network clusters using VOSviewer, the exported keyword lists were manually organized in Microsoft Excel by grouping keywords with similar concepts and research focus. This iterative process synthesized the computational clusters into six broader research trends. Microsoft Excel was employed as a supplementary tool to facilitate thematic synthesis rather than computational clustering. Accordingly, the themes presented in Table 4 represent a combination of algorithmic network clustering generated by VOSviewer and thematic interpretation based on conceptual similarity conducted by the authors.

Table 4. Summary of gamification research thematic clusters

Research Trends	Clusters	Colors on the Map	Item Concepts
A new way of teaching	1, 3, 4, 5, 12	Red, yellow, purple, orange, and blue	Flipped classroom, gamified in classroom, inquiry-based learning, problem-based learning, project-based learning, cooperative learning, team-based learning, adaptive learning
Psychological Dimensions and Learner Engagement	8, 11	Yellow, green	Student motivation, learning motivation, learning engagement, satisfaction, intrinsic motivation, self-determination theory, self-efficacy, game elements
Technology Drivers and Digital Environment	5, 7, 13	Light Blue, Gray, and Purple	E-learning, virtual reality, augmented reality, digital technology, Kahoot, multimedia systems, m-learning, mobile application, learning technology
Implementation Context: Learning Environment and Curriculum	1, 2, 6	Red, green, yellow	Curriculum, STEM education, mathematics education, computer science education, nursing education, primary education, secondary education, high school students, learning settings, learning environments
Evaluation of Goals and Developing Competencies	1, 2, 9	Red, green, and orange	Academic performance, learning achievement, outcome assessment, analytical skills, collaboration skills, critical thinking, self-directed learning, sustainability, knowledge
Methods for Studies in Education	1, 4, 10	Red, orange, yellow	Controlled study, experimental study, pretest-posttest design, simulation, qualitative analysis, quantitative data, systematic review, bibliometric analysis

In summary, the keyword co-occurrence analysis showed six major research trends that are all connected and help us understand pedagogical innovation and how it fits into digital learning environments. These results show how modern educational research brings together different fields, such as pedagogy, psychology, and technology (Gonzales & Gonzales, 2024; Means, 2022; Sargent & Casey, 2020; Wahyudi, Herwin, et al., 2025). The study points out important areas where new ideas are likely to emerge in the future, such as using artificial intelligence and immersive technologies in evidence-based practice (Bekteshi, 2025; D. Wang & Huang, 2025).

The incorporation of immersive technologies, including virtual reality, augmented reality, and artificial intelligence, signifies a novel advancement in the field of educational gamification research (Bobkina et al., 2025; Rizqia et al., 2024; Sargent & Casey, 2020; D. Wu et al., 2025; N. Wu & Liu, 2021). The findings highlight a significant transition in research from the foundational aspects of e-learning to more innovative and complex frameworks emphasizing personalization and adaptive learning (Lampropoulos, 2025; Sun & Sailer, 2025). Its contribution to gamification-based educational innovation is particularly robust, as it demonstrates the potential of integrating AI and virtual reality

to foster more contextual, emotional, and collaborative learning experiences (Katona & Gyonyoru, 2025; Mabalay, 2025; Majid et al., 2024). This development marks an epistemological change in perception of technology, from being a tool to an intelligent learning platform, which has been revolutionizing the way learning is done post-pandemic.

The general observation from this study shows that there has been progression in gamification studies regarding classroom learning from implementation-oriented technology to more student-centered perspectives. From the results derived through bibliometric visualization, an increase in focus on learner engagement, digital learning environments, and skills development can be observed.

CONCLUSION

The bibliometric analysis presented in this paper provides a detailed exploration of the intellectual structure and development of gamification in flipped classroom settings based on scientific papers listed in the Scopus database. First, the results clearly show a sharp increase in academic interest in this area of knowledge, which may be associated with growing attention to the digitalization of education and student-centered learning strategies. In the course of mapping, various prominent research themes have been identified, among them innovative pedagogical methods, learner motivation and engagement, digital technologies for learning, and educational outcomes based on competency acquisition.

At the same time, the analysis indicates that over time, the field of gamification research has evolved toward adopting integrated instructional designs, compared with a previous focus on technology-driven solutions. The evidence found here shows that gamification research has moved beyond being an engagement strategy into being a pedagogical framework, as seen in the relationship between gamification and flipped learning, active learning, and collaborative learning techniques.

Moreover, the keyword co-occurrence network reveals several promising directions for future research. Although motivation, satisfaction, and gamification elements remain the dominant research themes, the co-occurrence patterns also indicate growing scholarly attention to the relationship between gamification and cognitive outcomes, including analytical skills and self-directed learning. Future research in this domain may focus on exploring the role played by particular gamification designs, digital pedagogical approaches, and advanced technologies like AI and virtual reality in enhancing learners' cognitive achievements.

On the one hand, the results of the analysis can be used as guidance by educators and other professionals dealing with curricular design and technology in teaching. On the other hand, there are limitations to be considered. Specifically, bibliometric mapping was based on the database of scientific papers published in English and retrieved from Scopus. Further bibliometric explorations of the topic may be conducted using several databases and employing thematic evolution analyses over time.

DECLARATION OF GENERATIVE AI USAGE IN THE WRITING PROCESS

The authors used ChatGPT (OpenAI) to improve sentence structures and facilitate the translation process. After using this tool, the authors ensured that the required changes were incorporated and are responsible for the final form of the paper.

REFERENCES

Abdallah, M., Prabhakaran, B., Cai, W., & Hsu, C.-H. (2023). Recent advances in immersive multimedia. *IEEE MultiMedia*, *30*(2), 5–7. https://doi.org/10.1109/

MMUL.2023.3280408

Al Husaeni, D. F., & Nandiyanto, A. B. D. (2022). Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer. *Journal of Engineering Science and Technology*, *17*(2), 1135–1149.

Álvarez Ariza, J., & Olatunde-Aiyedun, T. G. (2024). A systematic literature review on STEAM pre- and in-service teacher education for sustainability: Are teachers ready? *Eurasia Journal of Mathematics, Science and Technology Education*, *20*(9), em2498. https://doi.org/10.29333/ejmste/14982

Arifin, Z., Tegeh, I. M., & Yuda Sukmana, A. I. W. I. (2021). Independent learning through interactive multimedia based on problem based learning. *Jurnal Edutech Undiksha*, *9*(2), 244. https://doi.org/10.23887/jeu.v9i2.41292

Ayaz, A., Ozyurt, O., Al-Rahmi, W. M., Salloum, S. A., Shutaleva, A., Alblehai, F., & Habes, M. (2023). Exploring gamification research trends using topic modeling. *IEEE Access*, *11*, 119676–119692. https://doi.org/10.1109/ACCESS.2023.3326444

Bekteshi, L. (2025). Education in the era of AI and immersive technologies - a systematic review. *Journal of Research in Engineering and Computer Sciences*, *3*(1), 01–14. https://doi.org/10.63002/jrecs.31.779

Bobkina, J., Baluyan, S., & Domínguez Romero, E. (2025). Tech-enhanced vocabulary acquisition: exploring the use of student-created video learning materials in the tertiary-level EFL (English as a foreign language) flipped classroom. *Education Sciences*, *15*(4), 450. https://doi.org/10.3390/educsci15040450

Candel, E. C., de la Peña, C., & Yuste, B. C. (2024). Pre-service teachers' perception of active learning methodologies in history: Flipped classroom and gamification in an e-learning environment. *Education and Information Technologies*, *29*(3), 3365–3387. https://doi.org/10.1007/s10639-023-11924-0

Challob, A. I. (2021). The effect of flipped learning on EFL students' writing performance, autonomy, and motivation. *Education and Information Technologies*, *26*(4), 3743–3769. https://doi.org/10.1007/s10639-021-10434-1

Chamorro-Atalaya, O., Olivares-Zegarra, S., Sobrino-Chunga, L., Guerrero-Carranza, R., Vargas-Díaz, A., Huarcaya-Godoy, M., Rasilla-Rovegno, J., Suárez-Bazalar, R., Poma-García, J., & Cruz-Telada, Y. (2023). Application of the chatbot in university education: a bibliometric analysis of indexed scientific production in SCOPUS, 2013-2023. *International Journal of Learning, Teaching and Educational Research*, *22*(7), 281–304. https://doi.org/10.26803/ijlter.22.7.15

Chang, Y.-H., Yan, Y.-C., & Lu, Y.-T. (2022). Effects of combining different collaborative learning strategies with problem-based learning in a flipped classroom on program language learning. *Sustainability*, *14*(9), 5282. https://doi.org/10.3390/su14095282

Chugh, R., & Turnbull, D. (2023). Gamification in education: A citation network analysis using CitNetExplorer. *Contemporary Educational Technology*, *15*(2), ep405. https://doi.org/10.30935/cedtech/12863

Cole, C., Parada, R. H., & Mackenzie, E. (2024). A scoping review of video games and learning in secondary classrooms. *Journal of Research on Technology in Education*, *56*(5), 544–577. https://

doi.org/10.1080/15391523.2023.2186546

Dewi, F., Afrida, A., & Ekaputra, F. (2024). Implementation of whimsical application using project based learning model integrated flipped classroom in improving student self efficacy. *Journal of Applied Science, Engineering, Technology, and Education*, *6*(1), 88–95. https://doi.org/10.35877/454RI.asci3026

Ekici, M. (2021). A systematic review of the use of gamification in flipped learning. *Education and Information Technologies*, *26*(3), 3327–3346. https://doi.org/10.1007/s10639-020-10394-y

Ekineh, D. R., & Accra-Jaja, F. (2022). Flipped learning as an innovative teaching model in the 21st century. *Faculty of Natural and Applied Sciences Journal of Mathematics, and Science Education*, 11–19.

Elsevier. (n.d.). *Scopus: comprehensive, multidisciplinary, trusted abstract and citation database*. https://www.elsevier.com/products/scopus.

Gómez-Carrasco, C. J., Monteagudo-Fernández, J., Moreno-Vera, J. R., & Sainz-Gómez, M. (2020). Evaluation of a gamification and flipped-classroom program used in teacher training: Perception of learning and outcome. *PLOS ONE*, *15*(7), e0236083. https://doi.org/10.1371/journal.pone.0236083

Gonzales, G., & Gonzales, R. (2024). Enhancing educational research pedagogy: Integrating in-house peer review in a flipped/hybrid classroom environment. *Social Sciences & Humanities Open*, *9*, 100889. https://doi.org/10.1016/j.ssaho.2024.100889

Gopinathan, S., Kaur, A. H., Veeraya, S., & Raman, M. (2022). The role of digital collaboration in student engagement towards enhancing student participation during COVID-19. *Sustainability*, *14*(11), 6844. https://doi.org/10.3390/su14116844

Howell, R. A. (2021). Engaging students in education for sustainable development: The benefits of active learning, reflective practices and flipped classroom pedagogies. *Journal of Cleaner Production*, *325*, 129318. https://doi.org/10.1016/j.jclepro.2021.129318

Huang, B., Hew, K. F., & Lo, C. K. (2019). Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement. *Interactive Learning Environments*, *27*(8). https://doi.org/10.1080/10494820.2018.1495653

Jan van Eck, N., & Waltman, L. (2022). *VOSviewer manual*.

Jiang, M. Y., Jong, M. S., Lau, W. W., Chai, C., Liu, K. S., & Park, M. (2022). A Scoping review on flipped classroom approach in language education: Challenges, implications and an interaction model. *Computer Assisted Language Learning*, *35*(5–6). https://doi.org/10.1080/09588221.2020.1789171

Jiménez-Valverde, G., Fabre-Mitjans, N., Heras-Paniagua, C., & Guimerà-Ballesta, G. (2025). Tailoring gamification in a science course to enhance intrinsic motivation in preservice primary teachers. *Education Sciences*, *15*(3), 300. https://doi.org/10.3390/educsci15030300

Jossan, K. S., Gauthier, A., & Jenkinson, J. (2021). Cultural implications in the acceptability of game-based learning. *Computers & Education*, *174*, 104305. https://doi.org/10.1016/j.compedu.2021.104305

Kalana, M. H. A., & Junaini, S. N. (2025). Gamification and technology acceptance model: a systematic review and future

research directions. *Journal of Education and Learning (EduLearn)*, *19*(3), 1606–1614. https://doi.org/10.11591/edulearn.v19i3.22154

Katona, J., & Gyonyoru, K. I. K. (2025). Integrating AI-based adaptive learning into the flipped classroom model to enhance engagement and learning outcomes. *Computers and Education: Artificial Intelligence*, *8*, 100392. https://doi.org/10.1016/j.caeai.2025.100392

Khyzhniak, I., Tsybulko, L., Viktorenko, I., & Mohyliova, N. (2021). Implementing the theory of multiple intelligences onto project-based multimedia learning at primary school. *Information Technologies and Learning Tools*, *82*(2), 18–31. https://doi.org/10.33407/itlt.v82i2.4326

Lampropoulos, G. (2025). Combining artificial intelligence with augmented reality and virtual reality in education: Current trends and future perspectives. *Multimodal Technologies and Interaction*, *9*(2), 11. https://doi.org/10.3390/mti9020011

Lampropoulos, G., & Kinshuk. (2024). Virtual reality and gamification in education: a systematic review. *Educational Technology Research and Development*, *72*(3), 1691–1785. https://doi.org/10.1007/s11423-024-10351-3

Lauc, T., Jagodiæ, G. K., & Bistroviæ, J. (2020). Effects of multimedia instructional message on motivation and academic performance of elementary school students in Croatia. *International Journal of Instruction*, *13*(4), 491–508. https://doi.org/10.29333/iji.2020.13431a

Lewis, S., Lindgren, R., Wang, S., & Pea, R. D. (2019). Learning with media. *Journal of Media Psychology*, *31*(3), 128–136. https://doi.org/10.1027/1864-1105/a000235

Li, K. C., & Wong, B. T.-M. (2022). Research landscape of smart education: a bibliometric analysis. *Interactive Technology and Smart Education*, *19*(1), 3–19. https://doi.org/10.1108/ITSE-05-2021-0083

Li, R., Lund, A., & Nordsteien, A. (2023). The link between flipped and active learning: A scoping review. *Teaching in Higher Education*, *28*(8), 1993–2027. https://doi.org/10.1080/13562517.2021.1943655

Listiqowati, I., Budijanto, B., Sumarmi, S., & Ruja, I. N. (2022). The Impact of Project-Based Flipped Classroom (PjBFC) on Critical Thinking Skills. *International Journal of Instruction*, *15*(3), 853–868. https://doi.org/10.29333/iji.2022.15346a

Liu, D., & Zhang, H. (2022). Improving students' higher order thinking skills and achievement using WeChat based flipped classroom in higher education. *Education and Information Technologies*, *27*(5), 7281–7302. https://doi.org/10.1007/s10639-022-10922-y

Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: the effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments*, *28*(4), 464–481. https://doi.org/10.1080/10494820.2018.1541910

Ma, J. (2024). Educational gamification: motivation and engagement strategies. *Applied Mathematics and Nonlinear Sciences*, *9*(1). https://doi.org/10.2478/amns-2024-3249

Mabalay, A. A. (2025). Gamification for sustainability: A systematic review of applications, trends, and opportunities. *Computers in Human Behavior*, *165*, 108529. https://doi.org/10.1016/j.chb.

2024.108529

Majid, W. M. W., Zain, F. M., & Ismail, S. N. (2024). Gamified flipped classroom in education: a systematic review. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(3), 1610. https://doi.org/10.11591/ijere.v13i3.26721

Mamekova, A. T., Toxanbayeva, N. K., Naubaeva, K. T., Ongarbayeva, S. S., & Akhmediyeva, K. N. (2021). A meta-analysis on the impact of gamification over students' motivation. *Journal of Intellectual Disability - Diagnosis and Treatment*, *9*(4), 417–422. https://doi.org/10.6000/2292-2598.2021.09.04.9

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

Means, B. (2022). Making insights from educational psychology and educational technology research more useful for practice. *Educational Psychologist*, *57*(3), 226–230. https://doi.org/10.1080/00461520.2022.2061974

Meng, C., Zhao, M., Pan, Z., Pan, Q., & Bonk, C. J. (2024). Investigating the impact of gamification components on online learners' engagement. *Smart Learning Environments*, *11*(1), 47. https://doi.org/10.1186/s40561-024-00336-3

Ng, E. M. W. (2018). Integrating self-regulation principles with flipped classroom pedagogy for first year university students. *Computers & Education*, *126*, 65–74. https://doi.org/10.1016/j.compedu.2018.07.002

Parra-González, M. E., López Belmonte, J., Segura-Robles, A., & Fuentes Cabrera, A. (2020). Active and emerging methodologies for ubiquitous education: potentials of flipped learning and gamification. *Sustainability*, *12*(2), 602. https://doi.org/10.3390/su12020602

Parra-González, M. E., López-Belmonte, J., Segura-Robles, A., & Moreno-Guerrero, A.-J. (2021). Gamification and flipped learning and their influence on aspects related to the teaching-learning process. *Heliyon*, *7*(2), e06254. https://doi.org/10.1016/j.heliyon.2021.e06254

Prahani, B. K., Dawana, I. R., Jatmiko, B., & Amelia, T. (2023). Research trend of big data in education during the last 10 years. *International Journal of Emerging Technologies in Learning (IJET)*, *18*(10), 39–64. https://doi.org/10.3991/ijet.v18i10.38453

Qudsi, H. (2024). Gamification in education: boosting student engagement and learning outcomes. *ShodhKosh: Journal of Visual and Performing Arts*, *5*(4). https://doi.org/10.29121/shodhkosh.v5.i4.2024.2542

Rahayu, F. S., Nugroho, L. E., Ferdiana, R., & Setyohadi, D. B. (2022). Motivation and engagement of final-year students when using e-learning: A qualitative study of gamification in pandemic situation. *Sustainability*, *14*(14), 8906. https://doi.org/10.3390/su14148906

Rahmi, I., Rimenda, T., & Ariyanti, T. D. (2025). Gamification as an alternative to increase students' motivation: a scoping review. *Journal of Education and Learning (EduLearn)*, *19*(2), 1125–1133. https://doi.org/10.11591/edulearn.v19i2.21771

Ratinho, E., & Martins, C. (2023). The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review. *Heliyon*, *9*(8), e19033. https://doi.org/10.1016/j.heliyon.2023.e19033

Rivera, E. S., & Garden, C. L. P. (2021). Gamification for student engagement: a framework. *Journal of Further and Higher Education*, *45*(7), 999–1012. https://doi.org/10.1080/0309877X.2021.1875201

Rizqia, N., Fathurrahman, Moh., & Mahroini, Z. (2024). Development of augmented reality learning media based on culturally responsive teaching (CRT) to improve learning outcomes in science material. *Studies in Learning and Teaching*, *5*(2), 453–465. https://doi.org/10.46627/silet.v5i2.432

Ruiz-Arroyo, M., Castillo, A., & Gutiérrez, L. (2025). Active learning and authentic assessment through gamification: A board game experience in *The Emerald Handbook of Active Learning for Authentic Assessment* (pp. 125–146). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83797-857-120251007

Sargent, J., & Casey, A. (2020). Flipped learning, pedagogy and digital technology: Establishing consistent practice to optimise lesson time. *European Physical Education Review*, *26*(1). https://doi.org/10.1177/1356336X19826603

Septiani, A. N. S. I., Rejekiningsih, T., Triyanto, T., & Rusnaini, R. (2020). Development of interactive multimedia learning courseware to strengthen students' character. *European Journal of Educational Research*, *volume-9-2020*(volume-9-issue-3-july-2020), 1267–1279. https://doi.org/10.12973/eu-jer.9.3.1267

Shen, X., Li, J., Li, M., & Karimi, A. (2025). A 29 year (1994–2023) bibliometrics analysis of usage of the gamification in history education. *European Journal of Education*, *60*(4). https://doi.org/10.1111/ejed.70256

Shin, S., Kwon, K., & Jung, J. (2022). Collaborative learning in the flipped university classroom: identifying team process factors. *Sustainability*, *14*(12), 7173. https://doi.org/10.3390/su14127173

Singh, M. N. (2021). Inroad of digital technology in education: Age of digital classroom. *Higher Education for the Future*, *8*(1), 20–30. https://doi.org/10.1177/2347631120980272

Siti, F. A. R., Melor, M. Y., & Harwati, H. (2020). The uniqueness of flipped learning approach. *International Journal of Education and Practice*, *8*(3). https://doi.org/10.18488/journal.61.2020.83.394.404

Sun, X., & Sailer, M. (2025). Students' behavioural, cognitive and affective outcomes in gamified flipped classrooms: A meta analysis. *Review of Education*, *13*(1). https://doi.org/10.1002/rev3.70039

Supnoon, A., & Chonchaiya, R. (2024). A study on the development of eleventh grade students' critical thinking skills and self-efficacy using active learning pedagogy with gamification. *International Journal of Education and Practice*, *12*(2), 447–466. https://doi.org/10.18488/61.v12i2.3718

Talbert, R., & Bergmann, J. (2023). *Flipped Learning* (1st ed.). Routledge. https://doi.org/10.4324/9781003444848

Triantafyllou, S. A., Georgiadis, C., & Sapounidis, T. (2025). Gamification in education and training: A literature review. *International Review of Education*, *71*(3), 483–517. https://doi.org/10.1007/s11159-024-10111-8

Wahyudi, I., Herwin, H., Wuryandani, W., & Utami, C. T. (2025). Integrating local wisdom in elementary school to strengthen cultural identity in the digital era. *Journal*

of Community Independence, *4*(2), 359–369. https://doi.org/10.46843/jpm.v4i2.458

Wahyudi, I., Sekar, & Kawuryan, P. (2025). Interactive multimedia for pancasila education: development and feasibility study in primary education. *Jurnal Ilmiah Pendidikan*, *6*(3), 1915–1934. https://doi.org/10.51276/edu.v6i3.1408

Wahyudi, I., Supartinah, & Nadziroh. (2023). Challenges and strategies: Online learning for elementary school teacher education students. *MIMBAR PGSD Undiksha*, *11*(3), 410–418. https://doi.org/10.23887/jjpgsd.v11i3.64466

Wang, D., & Huang, X. (2025). Transforming education through artificial intelligence and immersive technologies: enhancing learning experiences. *Interactive Learning Environments*, *33*(7), 4546–4565. https://doi.org/10.1080/10494820.2025.24654

Wang, M., Liu, F., & Yu, Z. (2023). Exploring engagement, learning satisfaction, and learning outcomes in a technology-aided self-paced flipped model. *International Journal of Adult Education and Technology*, *14*(1), 1–15. https://doi.org/10.4018/IJAET.319807

Wu, D., Sitthiworachart, J., & Ratanaolarn, T. (2025). Flipped classroom with virtual reality technology learning model for chinese college Students in psychological education: a need assessment study. *Journal of Curriculum and Teaching*, *14*(2), 219. https://doi.org/10.5430/jct.v14n2p219

Wu, N., & Liu, Z. (2021). Higher education development, technological innovation and industrial structure upgrade. *Technological Forecasting and Social Change*, *162*, 120400. https://doi.org/10.1016/j.techfore.2020.120400

Yamunah Vaicondam, Huma Sikandar, Sobia Irum, Nohman Khan, & Muhammad Imran Qureshi. (2022). Research landscape of digital learning over the past 20 years: a bibliometric and visualisation analysis. *International Journal of Online and Biomedical Engineering (IJOE)*, *18*(08), 4–22. https://doi.org/10.3991/ijoe.v18i08.31963

Yan, Z., Liu, Q., & Chen, Y. (2024). Examining the impact of flipped learning on second language development: A quasi-experiment in higher education. *Heliyon*, *10*(13), e33593. https://doi.org/10.1016/j.heliyon.2024.e33593

Yýldýz, M., YILDIZ, M., & Kayacýk, A. D. (2024). Rising gamification in health education: A bibliometric study. *Nurse Education in Practice*, *78*, 103993. https://doi.org/10.1016/j.nepr.2024.103993

Zeng, J., Sun, D., Looi, C., & Fan, A. C. W. (2024). Exploring the impact of gamification on students' academic performance: A comprehensive meta analysis of studies from the year 2008 to 2023. *British Journal of Educational Technology*, *55*(6), 2478–2502. https://doi.org/10.1111/bjet.13471

Zeybek, N., & Saygý, E. (2024). Gamification in education: Why, where, when, and how? A systematic review. *Games and Culture*, *19*(2), 237–264. https://doi.org/10.1177/15554120231158625

Zhang, Q., Yu, L., & Yu, Z. (2021). A content analysis and meta-analysis on the effects of classcraft on gamification learning experiences in terms of learning achievement and motivation. *Education Research International*, *2021*, 1–21. https://doi.org/10.1155/2021/9429112

Zou, D. (2020). Gamified flipped EFL classroom for primary education: student and teacher perceptions. *Journal of Computers in Education*, *7*(2), 213–228. https://doi.org/10.1007/s40692-020-00153-w