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Gamified Flipped Classroom and Effective Learning Outcomes Through Bibliometric and Systematic Literature Review Toward SDGs 4

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Abstract: The use of appropriate approaches or methods in learning can increase the effectiveness of learning outcomes in accordance with the goals of quality education in SDGs 4. The development of flipped classroom or flipped learning and gamification is increasing year by year. So it is necessary to know the application of flipped classroom with the help of gamification in learning for effective learning outcomes toward SDGs 4. The research on gamified flipped classroom uses systematic methods of literature review and bibliometrics to determine the development of trends GFC over a period of 10 years from 2015- October 26, 2025. Data was taken from the Scopus database with the inclusion criteria of English-language journal articles and was all open access. The results of bibliometric analysis show that research on gamification and flipped classroom or flipped learning began in 2016, while research on flipped classroom with the help of gamification began in 2018. Several countries conduct GFC research quantitatively, such as Spain, Thailand, Hong Kong, Indonesia. GFC is mostly carried out at the university level and is widely applied to the subject areas of social science (30.20%) and computer science (22.60%).

Keywords: Flipped classroom; Gamification; Gamified flipped classroom; SDGs

Introduction

Quality education is one of the global agendas approved by many countries in the Sustainable Development Goals (SDGs). The quality education of the SDGs 4 is inclusive and equitable education and provides lifelong learning opportunities for all. Sustainable Development Goals (SDGs) are a series of development goals designed to protect financial security and living standards in society, including education. In the 4th SDGs, namely quality education, there are 3 goals, namely cognitive, socio-emotional, behavioral (Trisanti et al., 2025; UNESCO, 2017). Cognitive-based goals can be seen from the effectiveness of student learning outcomes. Learning outcomes can be influenced by the diversity of students' learning styles. To achieve the inclusive educational goals of the SDGs, teachers need to pay attention to the diversity of student learning styles in order to obtain effective learning outcomes (Armayanti et al., 2025). Therefore, teachers need to design appropriate learning approaches or methods in order to obtain effective learning outcomes.

Changes that have occurred globally in a decade such as the existence of internet technology, economic development and population demographics have affected the world of education that exists today (Rotellar & Cain, 2016). Changes in education due to the technological environment, such as the new methodology of flipped classroom have begun to attract attention in recent years (Huang et al., 2019). In addition to flipped classrooms, a new methodology has also emerged, namely gamification. The method that has developed since 2013 is then applied in flipped classroom learning (Majid et al., 2024). The Flipped classroom and gamification learning model are among the top three out of 18 widely used active learning

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methods and lately Flipped classroom and gamification are applied together in the implementation of learning (Calderon et al., 2024).

Flipped classroom learning has attracted more attention in recent years. However, there are challenges in maintaining students' interest, motivation and interest as well as student interactivity or involvement in activities outside the classroom while in a virtual learning environment (Huang et al., 2019; Tsay et al., 2018). In addition to these challenges, there are other challenges in the implementation of flipped classrooms, namely lack of collaboration and digital fatigue in students (Lo & Hew, 2020; Sanz-Angulo et al., 2025; Segura-Robles et al., 2020). To overcome this, a gamification strategy has emerged in flipped classrooms that has been carried out in several universities and mostly focuses on increasing student motivation and involvement (Aguiar-Castillo et al., 2021; Asiksoy & Canbolat, 2021; Carrasco et al., 2019; Huang & Hew, 2018; Zainuddin, 2018).

The objectives of this study are to find out the trend of GFC research publications in 2015 – October 26, 2025 based on annual scientific production and co-occurrences author keywords, to map the location of GFC implementation during the period 2015 – October 26, 2025, to find out the subject area and level of education that implemented GFC since 2015 – October 26, 2025, to explain the impact of GFC based on the number of citations, cluster, the strength of the network against future GFC research.

In order to answer the purpose of this research, the following research questions were prepared: What are the trends in research publications regarding Gamified Flipped Classroom from 2015 – October 26, 2025 based on annual scientific production and co-Authors: Keywords? Wherever it is applied Gamified Flipped Classroom Carried out in the period 2015 – October 26, 2025? Arbitrary Subject Area and the level of education that applies Gamified Flipped Classroom Period 2015 – October 26, 2025? How does it impact Gamified Flipped Classroom based on the number of citations, clusters, network strength against future GFC research?.

Method

This research was carried out using the systematic literature Review with a bibliometric analysis approach. According to Janah et al. (2024) systematic literature Review is research that collects, assesses, synthesizes, and presents data from various studies related to a study question or topic. Bibliometric analysis is a method used to review and evaluate scientific literature using data visualization from the literature (Yuan, 2024). The subject of GFC is reviewed from a variety of perspectives. Framework The one used in this study is PRISMA for the extraction of scientific literature. The criteria for scientific literature extraction are as seen in Table 1.

Table 1. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Year of writing	2015 – 2025 (until October 26)	< 2015
Types of publications	Article	Book chapter, conference Proceedings, Book
Accessibility	All Open access	Gold, green, hybrid gold, bronze
Language	English	Non English

Meanwhile, the bibliometric analysis uses VOSviewer software, Bibliometrix (R)-Biblioshiny and the results of the Scopus analysis. The data source used is the Scopus database until October 26, 2025. Search using the search keyword TITLE-ABS-KEY ("gamified flipped classroom" OR "flipped classroom gamification" OR "gamified learning" OR "gamified flipped learning" OR "game based flipped classroom" OR "game based flipped learning").

Result and Discussion

Based on the results of searches in the Scopus database until October 26, 2025, the results of 1195 scientific publications were obtained. Furthermore, extraction was carried out according to the inclusion and exclusion criteria using the PRISMA method Haddaway et al. (2022) with the results as shown in figure 1. Extraction is performed using the filtering options from the Scopus database. The results of the inclusion and exclusion extraction were obtained as many as 292 corresponding articles. Before the bibliometric analysis was carried out, the results were first tidied up with data, specifically keyword data from the author using Openrefine software. This is done to avoid the appearance of keywords that have the same meaning but are written differently when bibliometric analysis is carried out both using VOSviewer (van Eck & Waltman, 2023) and Biblioshiny-Bibliometrix (R) (Aria & Cuccurullo, 2017).

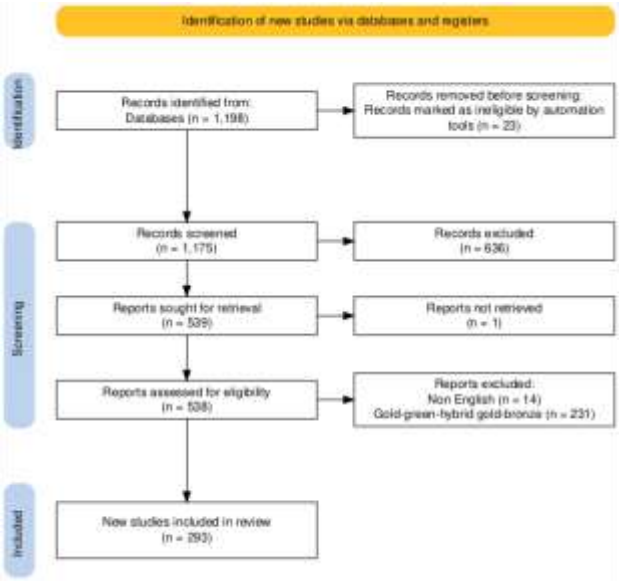

Figure 1. Scientific Literature Extraction

Research Publication Trends Regarding Gamified Flipped Classroom from 2015 – October 26, 2025 based on annual scientific production and the most frequently appearing Keywords (Occurrences Author Keyword)

The trend of research publications regarding GFC can be seen from the results of bibliometric analysis of 292 articles using VOSviewer can be seen in Figure 2. Publications about gamification and flipped classrooms are increasing year by year. The first publication began in 2016 on activities carried out by students in online learning (Paiva et al., 2016).

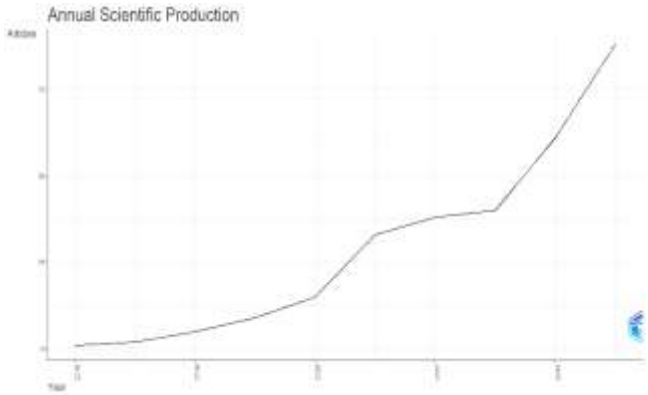

Figure 2. Scientific publications per year Countries that implement gamified flipped classrooms for the period 2015 – October 26, 2025

Frequently Recurring Keywords, data obtained on 10 keywords that have the most occurrences with a minimum of 4 keyword occurrences, namely gamification with 170 occurrences with a total link strength of 335; gamified learning with 70 occurrences and total link strength 125; Educational Technology with 30 occurrences and total link strength 68; Motivation with 28 occurrences and total link strength 72; Higher education with 21 occurrences and total link strength 50; engagement with occurrences 19 and total link strength 48; learning motivation with 18 occurrences and total link strength 43; game-based learning with 17 occurrences and total link strength 44; learning outcomes with 13 occurrences and total link strength 36; Student engagement with 12 occurrences and 34 total link strength. The trend of GFC publications in 2015 – October 26, 2025 can be seen in Figure 2.

Many countries have implemented the GFC either separately i.e. Gamification or flipped classroom as seen in Figure 3. There are 10 countries with the most publications according to Bibliometrix, namely Malaysia (115), Spain (98), China (93), USA (65), Indonesia (53), Saudi Arabia (50), United Kingdom (37), the Philippines (35), Germany (34), and Thailand (34). However, specific research on GFC has only been conducted in 4 countries, namely Spain (Arias & Esteve-Mon, 2025)Thailand (Phanwiriyarat et al., 2025) Hong Kong (Zainuddin, 2018; Zainuddin et al., 2019), and Indonesia (Zainuddin et al., 2019).

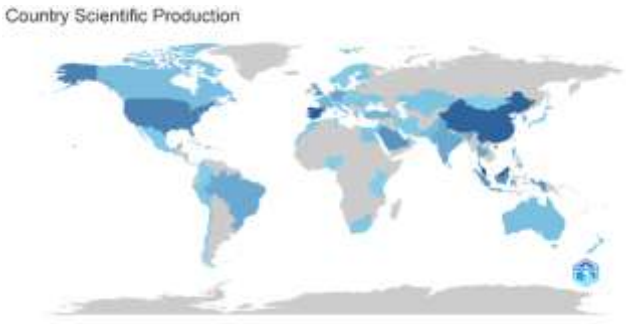

Figure 3. Articles Distribution

Bibliographic analysis of coupling countries using VOSviewer shows a network of several new studies on GFC between countries in 2023-2024 as shown in Figure 4.

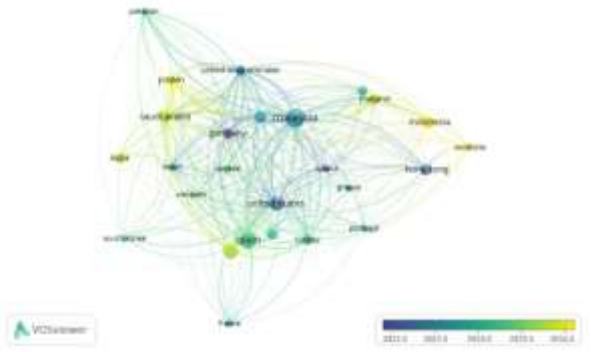

Figure 4. Overlay Visualization Bibliographic Coupling Countries

Countries with scientific publications for 2023-2024 are shown to have greenish-yellow and yellow nodes, namely Saudi Arabia, India, China, Thailand, Jordan, Indonesia, and Australia.

The analysis of Co-authorship countries using VOSviewer, obtained the results of 10 countries that have authors jointly publishing documents as shown in the following Table 2.

Table 2. Co-Authorship Countries

Country	Document	Citation	TLS
Malaysia	39	455	14
Spain	28	349	5
China	25	237	15
USA	23	759	11
English	17	408	17
Saudi Arabia	15	212	12
Indonesia	15	75	6
Hongkong	13	305	3
Germany	13	1270	2
Taiwan	13	142	1

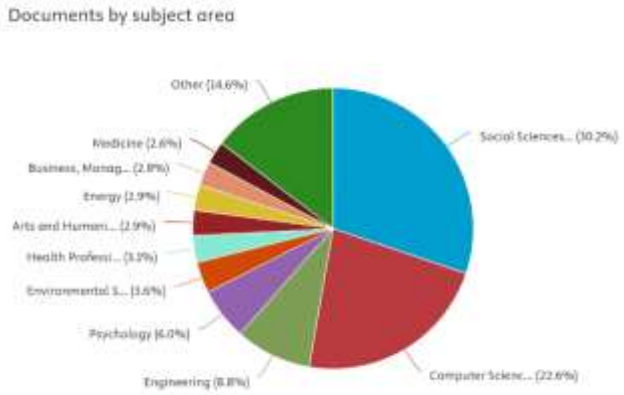

Figure 5. Subject area

Subject areas and education levels that implement Gamified Flipped Classroom for the period 2015 – October 26, 2025. There are 5 subject areas with the most publications of documents related to GFC based on the results of analysis from the Scopus database, namely Social Science with a total of 186 documents (30.2%). Next is Computer Science as many as 139 documents (22.6%), Engineering 54 documents (8.8%), Psychology 37 documents (6.0%), Environmental Science 22 documents (3.6%). Overall GFC has been applied to many subject areas as shown in Figure 5.

Meanwhile, the subject area that still has documents with less than 8 documents can be seen in Table 3.

Table 3. Subject Area with less than 8 documents

Subject Area	Number of documents
Decision Science	7
Chemical Engineering	5
Nursing	5
Agricultural and Biological Sciences	4
Neuroscience	4
Chemistry	3
Economics, Econometrics and Finance	3
Dentistry	2
Immunology and Microbiology	2

The level of education that applies a lot of GFC is the university level as seen in figure 6. The universities with the most publications are Universiti Kebangsaan Malaysia (16), Imam Abdulrahman Bin Faisal University (14), King Faisal University (14), Universitat D'Alacant (14), Universiti Teknologi Mara (14), State University of Malang (13), Hong Kong Baptist University (11), The University of Hong Kong (11), University Of The Philippines Los Banos (10), Multimedia University (9).

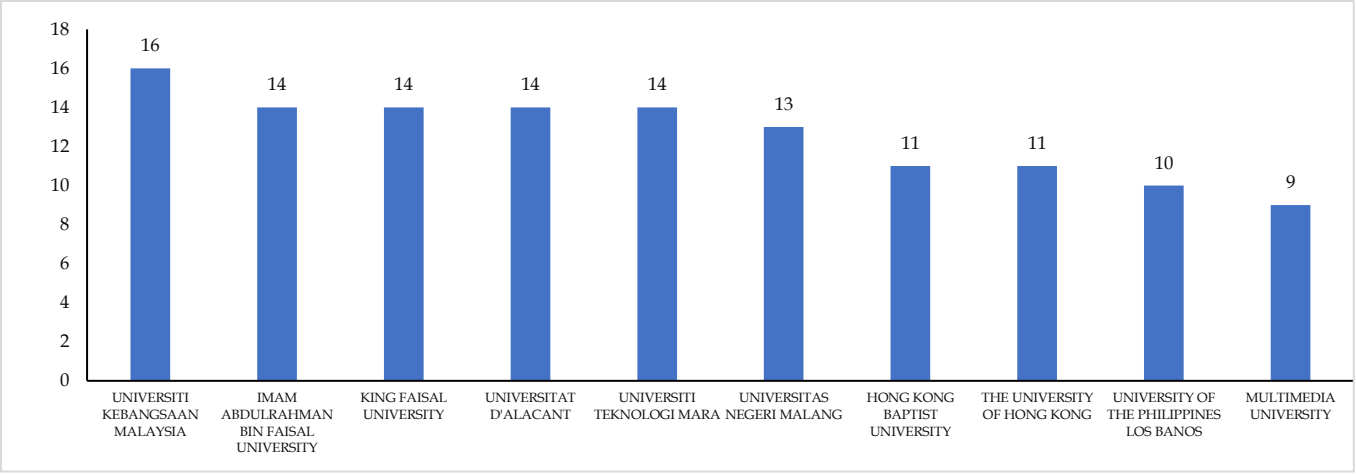

Figure 6. Universities with the most Publications

The impact of Gamified Flipped Classroom based on the number of citations, clusters, total link strength on future GFC research

The impact of the 293 inclusion articles on GFC can be seen based on the number of citations, clusters and total link strength. The number of citations, clusters and total link strength describe the extent of the influence of the document or author on other documents or other authors. The number of citations from the six inclusion articles can be seen in Table 4.

Table 4. Bibliographic Coupling Documents by VOSviewer and Bibliometrix

Document	TC	TLS	TC per Year	Normalized TC
Sailer (2020)	820	12	136.67	8.75
R Sanchez (2020)	230	5	38.33	2.45
Aldemir (2018)	172	14	21.50	3.33
Sailer (2021)	157	38	31.40	7.00
Stuart (2020)	127	12	21.17	1.35
Rivera (2021)	86	21	17.20	3.84
Owojori (2022)	72	0	18.00	3.55
Grivokostopoulou (2019)	72	4	10.29	2.36
Oluwajana (2019)	71	12	10.14	2.32

Article with the title "The Gamification of Learning: A Meta-Analysis" (Sailer & Homner, 2020) It is the most cited document with a total of 820 citations, and an average of 136.67 citations per year, and the number of joint references totals 12. This shows that the article is very influential because it has a lot of citations, but conceptually its relationship with other articles is still weak. While the article with the title "Gamification of In-Class Activities in Flipped Classroom Lectures" (Sailer & Sailer, 2021) has been cited by 157 other articles, and has had a high conceptual relationship with 38 other articles (TLS=38). Cluster-based analysis using Biblioshiny obtained the following results (in Figure 7).

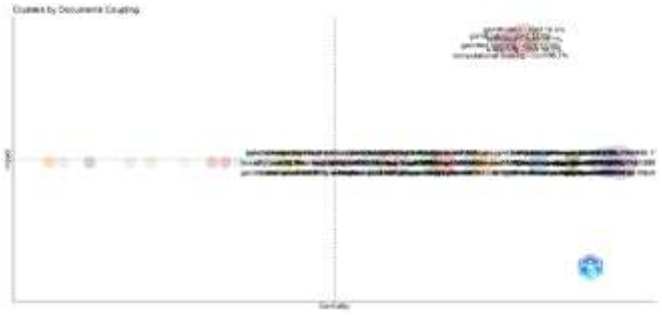

Figure 7. Cluster by Documents Coupling

In figure 6 there are 43 groups in 2 clusters. GFC is in group 1 with the label gamification-conf 3.90% flipped learning-conf 75% achievement-conf 40%, has a total of 9 articles published (Ahmed & Aşıksoy, 2021; Alshiha & Al-Abdullatif, 2024; Anane, 2022; Arsyad et al., 2024; Aynsley et al., 2018; Jdaitawi et al., 2025; Katanosaka et al., 2024; Ma, 2024; Mutiva et al., 2025) and Centrality of 0.292 and Impact of 1,000. Both clusters, namely the right cluster and the left cluster, have the meaning that the X axis indicates centrality while the Y axis indicates the impact. The size of the bubble describes the number of documents that belong to the cluster or the strength of its association. The cluster on the right shows centrality which means it has an important role in the research, while the cluster on the left shows a lack of centrality which means it has a more specific topic. Based on the label owned by the GFC, it can be concluded that the cluster is a strong research trend on the flipped learning approach with the help of gamification with indicators of success in achievement. Keyword research of GFC is referred to as a strong and still growing research trend strengthened by figure 8 which shows visualizations from research in 2018 -2023. This visualization is needed to find out the latest studies that have been carried out and that have become trends over the last 10 years.

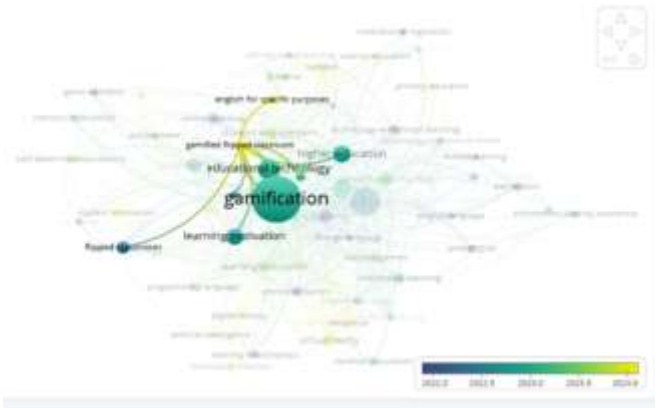

Figure 8. Overlay Visualization Keyword Gamified Flipped Classroom

In figure 8 it is seen that GFC a lot of work is done at the Higher Education or at the higher education level (Arias & Esteve-Mon, 2025; Phanwiriyarat et al., 2025; Zainuddin, 2018; Zainuddin et al., 2019). GFC research is currently still in the subject area of social science and computer science as well as at the university level. There are still opportunities to conduct research in other subject areas such as natural science and high school level. According to (Yu & Yu, 2024), Gamified flipped classroom has a big impact at the university level and has a middle to upper impact at the junior and senior high school levels.

Conclusion

The results of bibliometric analysis and systematic literature review show that the trend of GFC research in the 10 years has increased. The implementation of the GFC has been carried out in several countries such as Spain, Hong Kong, Thailand, and Indonesia. The implementation of GFC has a significant impact on the subjects of social science and computer science and at the university level. There are opportunities for research on the application of GFC in the future in the subject area of natural science and high school level.

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Author Contributions
This article was compiled by 3 people with their respective roles. All authors have read and agreed to the published version of the manuscript."

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Conflicts of Interest
The authors declare no conflict of interest.

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