Bibliometric Analysis of Gamification-Based Learning Media

🆔 Arthur Muhamad Taufan Herlambang

Universitas Bengkulu
Bengkulu, Indonesia
✉ arthurherlambang6@gmail.com *

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Abstract

This research aims to analyze the Gamification learning method's impact and the trends in research regarding Gamification. The research method used is a qualitative descriptive method using a bibliometric approach starting from defining the keywords "Gamifikasi (Gamification)" and "Jurnal" in the Publish or Perish application using the Scopus database. Article selection was carried out based on predetermined categories and a total of 21 articles were obtained that fit the predetermined categories. Then the articles obtained are compiled based on metadata using the Mendeley and the Vosviewer application to create visualizations. The research results show that based on bibliometric analysis gamification has been categorized into ten clusters. The application of gamification in the education sector is needed in the learning process to support the learning process and improve students' skills or learning outcomes at the upper secondary level. Previous research also shows that the use of gamification-based learning media in the world of education, more precisely at the high school level, provides benefits or influence for both teachers and students. The results of the bibliometric research that has been carried out show that there are quite a lot of articles discussing gamification-based learning media on the Scopus platform and are already in the top Quartile, namely Quartile 1. However, for articles discussing gamification-based learning media, especially those that originating from Indonesia, there are still very few found there. Therefore, the research results show that the topic of gamification-based learning media, especially in Indonesia, is still very amenable to research and discussion in the future.

A. Introduction

In the current era of globalization, the rapid development of technology and communication technology means that distance is no longer an obstacle to obtaining information from various parts of the world. Various technological advances are available. Along with advances in time and technology, humans have developed ways of communicating through various tools or platforms. One of them is done through refreshment facilities such as playing online games which in itself has a big impact on the world of education. Internet-equipped laptops, tablets and smartphones allow people to play games along with talking to someone on the other side of the world in real-time (Fitria, 2023).

The current period of the industrial revolution, known as the 5.0 generation, is marked by increased connectedness, the development and interaction of other systems, digital and information technologies, artificial intelligence, and virtualization. In the age of Revolution 5.0, the internet serves as a lifeline as well as a source of information. Technology has become ingrained in human society, and advancements in the field can reduce future economic disparities and human gaps. The educational component is one of the main effects of the difficulties presented by the Fifth Industrial Revolution (Risdianto, 2022). There is no

denying that technology has significantly changed schooling around the globe. New learning systems and methodologies have been made possible by technological advancements in the digital domain. With this development, the globalization period ends and the Society 5.0 age begins. Since people are the foundation of Education 5.0, enhancing human resources is the main idea. This means that teachers need to help pupils develop their soft skills, which include creativity, teamwork, and critical thinking. But it is unfortunate that educators continue to employ antiquated techniques that lag behind modern technological advancements (Julita, 2023).

Over the past ten years, the field of education has encountered numerous noteworthy obstacles that call for innovative strategies to improve the efficacy of learning. The way higher education institutions teach their students has changed as a result of the pervasive use of technology, including the internet, social media, mobile phones, landlines, and other devices. This is because of the advantages that contemporary educational technology offers, such raising the degree of involvement during the teaching and learning process (Kamis al., 2022). The development of technology has opened up new avenues for creating engaging and interactive curricula and teaching strategies. Making learning interesting and motivating for students is becoming more and more important, and it's one of the biggest problems the education sector is facing. Because it is directly linked to enhancing learning outcomes and creating pleasant learning experiences, educators and curriculum creators are now primarily focused on student involvement in the learning process (Syawaluddinet al., 2024).

The generation that was born in the 21st century was born in the same era as the internet. They would rather learn things in an engaging and useful way. This generation, being digital natives, is constantly eager to try new things, learn in a creative way, engage with the outside world, and adapt to new technology advancements. Students can access the internet to learn at any time and from any location. Teachers in the twenty-first century must design interactive lessons for their pupils, which can inspire creativity and help them think through solutions to challenges (Jannahet al., 2023). Media is a tool that can be utilized to enhance the quality of the learning process, increase student enthusiasm, and help students recall the material being taught (Rohman & Fauziati, 2022).

Traditional instruction that makes use of interactive modules only results in a cursory knowledge of the material and highlights the cognitive abilities of the pupils. Pupils are bored and merely passive. From this explanation, it is clear that teachers who adhere to traditional learning methods and rely solely on books as their primary knowledge source risk having their students get disinterested and bored with the material (Sasonoet al., 2023). The majority of the education sector has been hosting courses on e-learning platforms in recent years. E-learning as a teaching method is a contemporary addition to, and occasionally even a substitute for, traditional education (Khaldiet al., 2023). However, most students still feel bored with this kind of teaching method.

Research in statistics education indicates that students may find, build, and comprehend key statistical concepts and engage in statistical thinking when active learning strategies, humor, and computer and information technologies are used. This method can also boost self-esteem, make statistical ideas easier to understand, improve knowledge retention, and enhance student performance (Khoshnoodifaret al., 2023). In today's era, computer games are one of the things that digital culture has brought into modern life (Nadi-Ravandi & Batooli, 2022). Consequently, educational gamification is a tactic to boost engagement by introducing game components into the classroom in order to combat students' lack of incentive to study (Oliveiraet al., 2023). A level of engagement that is comparable to what a game would typically provide is the aim. Gamification's primary objectives are to enhance particular skills, add learning objectives, engage students, maximize learning, encourage behavior modification, and foster social interaction (Smiderleet al., 2020).

The phenomenon of using games in the business world is not new and has been around for a long time, but gamification as a concept is different and much newer. It is precisely defined as the act of improving a particular process by incorporating it into a game component (such as a leaderboard, points, career graph, and so on) to increase the amount of interest generated by that process, thereby increasing the person's productivity. carry out tasks. Recent research suggests that gamification of training components, such as the use of points, badges, and leaderboards, as well as other more complex characteristics such as challenges and storylines, can be used to improve learning outcomes (Gaonkaret al., 2022).

Beyond secondary education, the opportunities provided by educational gamification are increasingly being acknowledged. Games are used in many aspects of daily life by people of all ages and backgrounds to attain this softening. Games may make learning materials more engaging and inspiring when used in the

classroom (Hutsonet al., 2022). In order to encourage desirable learning behaviors or outcomes, gamification of learning usually focuses on learning activities (e.g., engaging in discussion forums, practicing problem solving, attending lectures, etc.). Contextual elements are widely acknowledged as being essential in the creation of gamification systems that cater to the real demands of students (Dichevet al., 2020).

The use of gamification in a variety of fields may be traced back to psychologist Jean Piaget, who promoted the use of games as a means of meaningful engagement and learning for kids. Since Piaget initially promoted gamification, the educational landscape for kids, teens, and adults has shifted due to the impact of video games and virtual reality. Still, there is a tight connection between gamification and the psychology of human motivation. The psychologist Mihaly Csíkszentmihályi established Flow Theory in 1990. According to his theory, Flow is described as "an experience that is both rewarding and demanding." Additionally, being in a state of flow is highly productive and attractive. There are three requirements for the existence of Flow. First, set specific objectives that provide the work direction and organization. The second is quick, unambiguous feedback that enables individuals to modify their performance to satisfy expectations. The right mix of challenge and expertise is the third crucial requirement. When these components are combined, users are more engaged. In the context of gamification, this could imply that participants must be in a state of flow in order to be completely engaged in an activity (Zahra, 2020). By generating positive feelings and raising student engagement, gamification techniques can enhance the learning experiences of students. Gamification is the process of developing entertaining, customized, and gamified educational resources that promote a positive attitude toward learning. Students can learn in a comfortable and distraction-free environment thanks to gamification. Students can use educational learning applications to learn whenever and wherever they desire (Mui Lee & Loo, 2021).

Experts claim that a discussion of students' habits, feelings of curiosity, and stimulation is all included in the definition of motivation. Extrinsic and intrinsic motivation are the two categories into which most experts classify motivation. The drive to take action due to internal motivators is known as intrinsic motivation. On the other hand, if learning activities are founded on something other than intrinsic drive, they frequently happen. Students' intellectual, emotional, and social immaturity might also be a contributing factor to their lack of intrinsic desire. Motivation resulting from the effect of outside stimuli is known as extrinsic motivation. Extrinsic motivation refers to a person's primary objective of engaging in activities to accomplish objectives outside of learning activities, or objectives that are unrelated to learning activities (Zafaret al., 2022). An essential component that propels learning is motivation. Since the primary objective of education is for students to pay attention and interact with the information, it is crucial to inspire them to do so. One important component of learning behavior is motivation, which can be raised in students by using games in the classroom. Furthermore, games are crucial in transforming conventional teacher-centered classrooms into student-centered learning environments. Students are able to engage in class activities more as a result. It provides kids with a fun learning environment as a result (Anisa, 2020).

Based on the explanation previously provided, this paper or article aims to research "Bibliometric Analysis of the Impact of Technology in Gamification Learning" where the main issues in this research are: (1) What is the impact of using Gamification-based learning methods?; (2) What are the trends in research regarding Gamification-based learning methods?

B. Research Methods

The research method used in conducting this research is a literature review or qualitative descriptive method with a bibliometric approach. Bibliometric analysis is commonly used in scientific disciplines and focuses on the quantitative study of journal papers, books, or other types of written communication (Lobo, 2022).

There are five steps in the bibliometric analysis method in this research. These five methods include defining the word "Gamification" as the initial search key (Defining Search Keywords). Initial search results (Initial Search Result), Refinement of the Search Result, compilation of statistics on initial data (Compiling Statistics on the Initial Data), and data analysis (Data Analysis).

Defining Search Keywords

The literature search was carried out in May 2024. Initially, enter the keywords, namely "Gamification" and the keyword "Journal" using the Scopus database. After that, 21 related articles were obtained for review from a total of 200 article lists that appeared in the search. Article selection was carried out based on predetermined categories and a total of 21 articles were obtained that fit the predetermined categories.
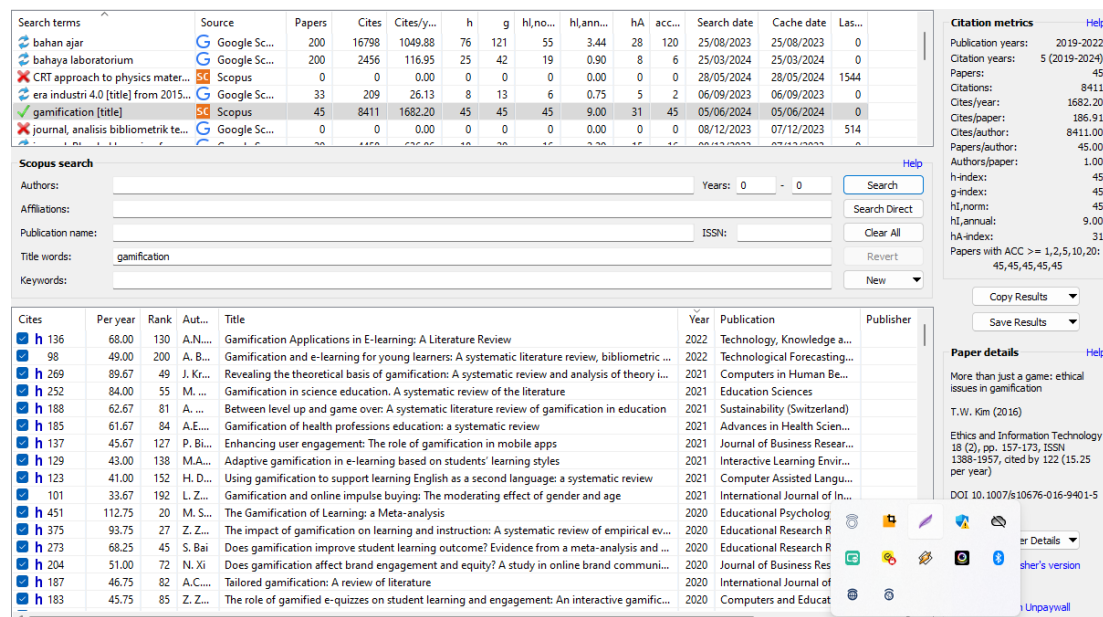
Figure 1. The initial search used the title "Gamification" with a database from Scopus

Initial Search Results

After getting a database from PoP sourced from Scopus with 200 articles published from 2019-2024, then filtering the top 5 articles that appeared in the Pop database. Table 1 shows a list of the top ten articles identified by PoP (Unrefined Search).

Table 1. List of 10 Most Rated Articles from an Initial Search of the Scopus Database

Rating	Writer's name	Article Title	Cites
1	M. Sailer	The Gamification of Learning: a Meta-analysis	451
2	Z. Zainuddin	The impact of gamification on learning and instruction: A systematic review of empirical evidence	375
3	DR Sanchez	Gamification in science education. A systematic review of the literature	252
4	F. Almeida	Gamification: A key determinant of massive open online course (MOOC) success	202
5	NZ Legaki	Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement	198

Refinement of the Search Results

After carrying out the first search with PoP, a database of 200 articles was obtained from Scopus sources, then screening or filtering the database was carried out manually and filtering or separating articles that fell into several categories "Irrelevant, Not a Journal, and publications under the year 2019". It can be seen in table 2 that from the 200 articles from the first search data, it was found that 21 articles were categorized as irrelevant, 155 articles were categorized as publications under 2019, 21 articles were categorized as educational topics, and 3 articles were categorized as not journals or none were not journals.

Table 2. Article Screening Results from 133 Articles Recorded in the Scopus Source Pop database

Search Screening	Number of Articles
Irrelevant	21
Not a Journal	3
Educational Topics	21
Publication <2019	155
Total	200

Compiling Statistics on the Initial Data

After filtering, the second search results are then downloaded, saved in the Mendeley application, and exported in RIS format. This export includes complete details about the article, including title, author name, abstract, keywords, and journal features such as year, volume, issue, and pages. So it can be concluded that the first search which obtained 200 articles and then carried out detailed screening resulted in 21 articles that were relevant to the discussion topic "Gamification" and 179 articles were removed from the Scopus source PoP database in the second search.

Data Analysis

In this research, an educational analysis was carried out with the title "Gamification" then the search was limited to the field of "education" in the Scopus database. The initial search produced 200 articles with 54,546 citations (4195.85 citations per year) using the PoP application. After refining the search results based on previously determined categories, there were still 21 articles remaining that were categorized as educational topics and were relevant to the research of this article. Then the data on citations also changed to 3698 citations and (739.60 citations per year). Comparative data between the citation matrix in the initial search and the final search can be seen in table 3.

Table 3. Comparison Matrix of Initial Search and Second Search

Data Matrix	Initial Search	Refinement Search
Title	Gamification	Gamification
Source	Scopus	Scopus
Citation years	2019-2024	2019-2024
Article	200	21
Citations	54546	3698
Cites Per Year	4195.85	739.60
Cites Perarticle	275.48	176.10
Article Writer	1.00	21.00
h-index	132	21
g-index	198	21
hI, norm	132	21
hI, annual	10.15	4.20
hA, index	42	21

C. Results and Discussion

Based on a search for Scopus indexed articles with the help of PoP, search data results regarding the use of gamification as a learning medium in the period 2019 to 2024 experienced changes as shown in the image below.
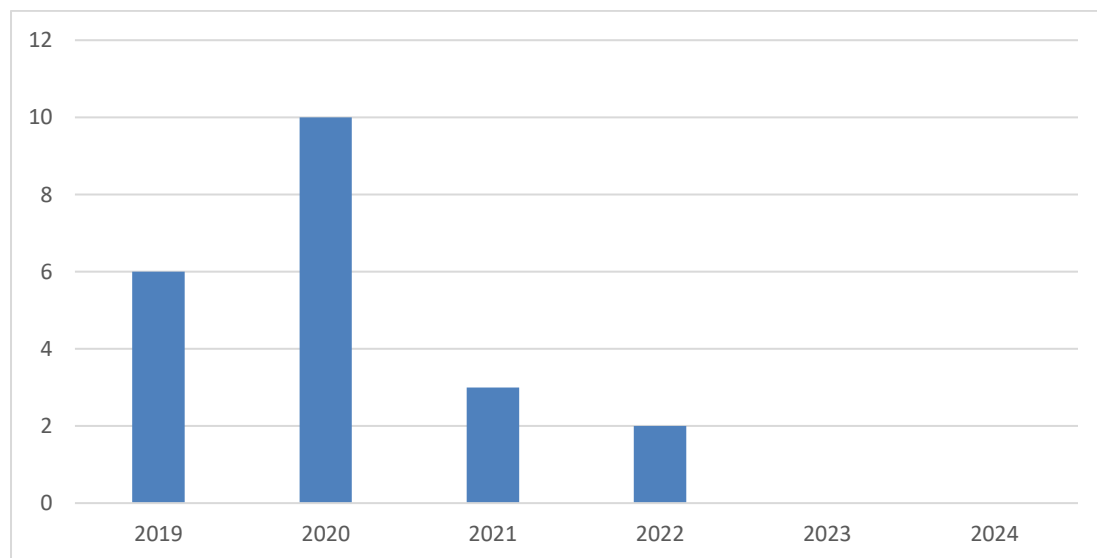

Figure 2. Number of Article Publications About Gamification in Learning

The data shown in Figure 2 illustrates that in 2019 there were six published, then in 2020 there was an increase in published articles about learning gamification, namely there were ten published articles, then in 2021 there was a decrease to only three published articles. and in 2022 it will decrease again to two published articles until from 2023 to 2024 there will be no published articles about gamification in learning. However, in 2024 there is still the possibility of an increase due to ongoing research and the journal publication process usually takes several months after the journal is accepted, so the possibility of increasing the number of journal publications in 2024 is still very possible.

Scopus indexed articles about the use of Gamification as a physics learning medium are written in international journals. Below is a table of international journal publications with the number of published articles.

Table 4. International Journal Publications with Number of Published Articles

No	Publisher's Journal Name	Number of Articles
1	Technology, Knowledge and Learning	1
2	Technological Forecasting and Social Change	1
3	Education Sciences	1
4	Sustainability (Switzerland)	1
5	Interactive Learning Environments	1
6	Educational Psychology Review	1
7	Educational Research Review	1
6	Computers and Education	2
9	International Journal of Human Computer Studies	1
10	Smart Learning Environments	1
11	Interactive Learning Environments	1
12	Educational Technology Research and Development	1
13	Computers in Human Behavior	1
14	IEEE Access	1
15	Information and Management	1
16	Interactive Learning Environments	1
17	Contemporary Educational Technology	1
18	Journal of Cleaner Production	1
19	IEEE Transactions on Learning Technologies	1
20	International Journal of Information Management	1

Table 4 shows the name of the publishing journal and the number of articles indexed by Scopus regarding the use of Gamification as a learning medium. "Computers and Education" was recorded as the publisher of the most articles about the use of Gamification as a learning medium, namely 2 articles. Every international publisher's journal definitely has a Quartile level (Q) and can be found out via the website https://www.scimagojr.com. Below is a table of Quartile levels for each international publisher's journal that has been obtained.

Table 5. International Journal Publications with Quartile Levels (Q)

No	Publisher's Journal Name	Quartile Level (Q)
1	Technology, Knowledge and Learning	Q1
2	Technological Forecasting and Social Change	Q1
3	Education Sciences	Q2
4	Sustainability (Switzerland)	Q1
5	Interactive Learning Environments	Q1
6	Educational Psychology Review	Q1
7	Educational Research Review	Q1
8	Computers and Education	Q1
9	International Journal of Human Computer Studies	Q1
10	Smart Learning Environments	Q1
11	Interactive Learning Environments	Q1
12	Educational Technology Research and Development	Q1
13	Computers in Human Behavior	Q1
14	IEEE Access	Q1
15	Information and Management	Q1

No	Publisher's Journal Name	Quartile Level (Q)
16	Interactive Learning Environments	Q1
17	Contemporary Educational Technology	Q2
18	Journal of Cleaner Production	Q1
19	IEEE Transactions on Learning Technologies	Q1
20	International Journal of Information Management	Q1

The Scimago website also provides data about the country of origin of these journals. The graphic image below presents data from the journal publishing country regarding the use of gamification-based learning media.
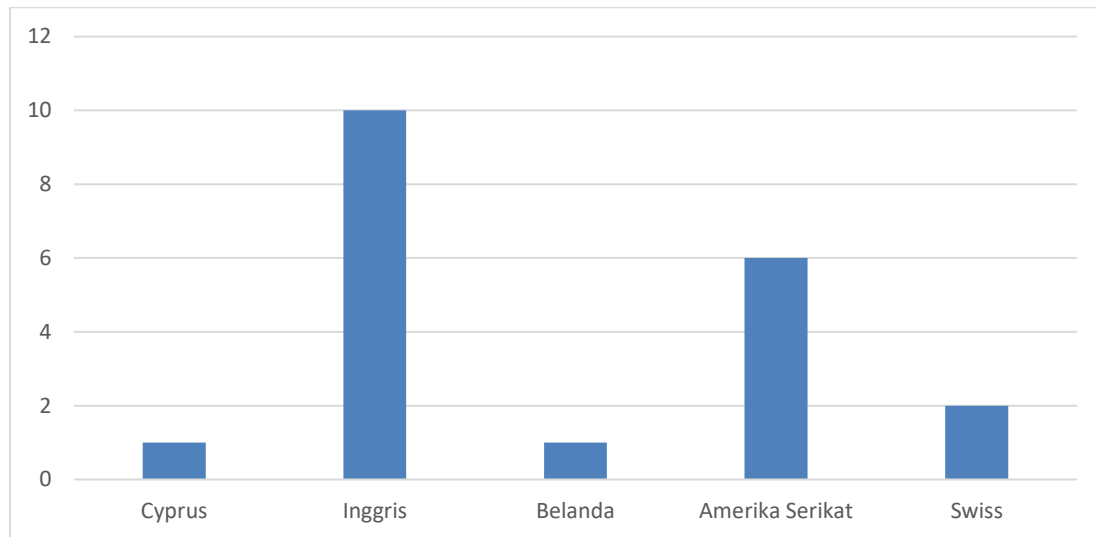

Figure 2. Country of Origin Journal of Use of Gamification-Based Learning Media

Based on the data presented in Figure 2, it shows that England is the country that has published the most articles about the use of gamification-based learning media, with 10 articles in the 2019-2024 period. This was followed by the United States in second place with a total of 6 published articles, then Switzerland with 2 articles and followed by Cyprus and the Netherlands with 2 journals.

Then the articles obtained were compiled based on meta data using several applications, namely the Mendeley application and the Vosviewer application. The Vosviewer application is used to create visualizations of research trends regarding Gamification. It was found that of the 21 articles that passed the filtering, there was no same author for each article. It can be seen in Figure 2 with Netwok Visualization using the Vosviewer application.

Figure 3. Popular author of 21 articles that passed filtering using Netwok Visualization

As can be seen in Figure 3, there are absolutely no authors from Indonesia, this indicates that there is an opportunity to conduct in-depth research on the development of Gamification-based learning media.

The data that has been obtained in the PoP application is then saved in RIS format, then bibliometric analysis will be carried out using the Vosviewer application and then visualized into 2 types of visualization, namely Network Visualization and Density Visualization based on words that frequently appear and can be seen in figures 3 and 4.
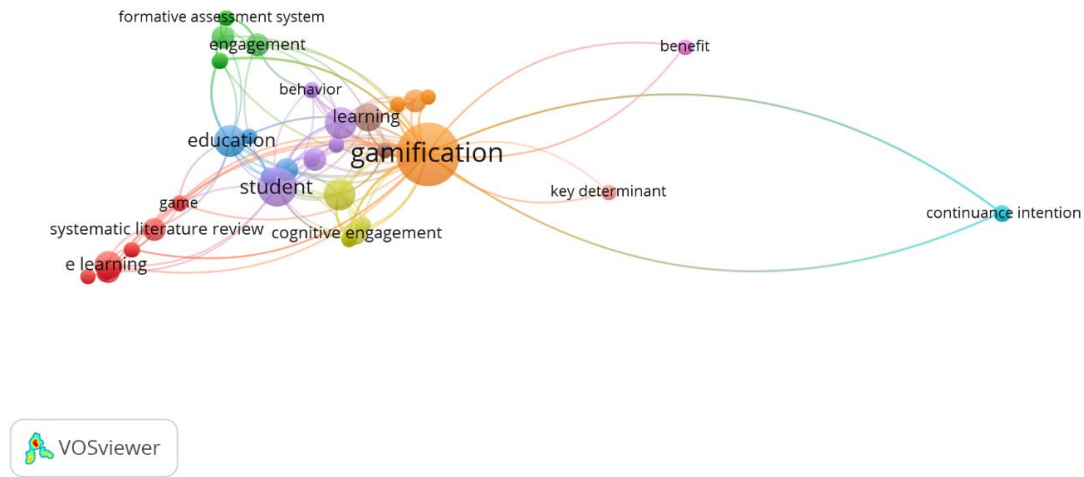

Figure 4. Network Visualization

The size of the circle for each term that appears will differ according to the number of times the term appears in the title or abstract. The results shown by the Vosviewer application also show clusters of various themes that are connected in a coherent network. The results of data analysis based on Figure 4 show that there are 10 clusters consisting of 70 themes related to the use of gamification-based learning media. Below is a cluster table and the number of themes in each cluster that have been obtained.

Table 6. Clusters and the Number of Themes in Each Cluster That Have Been Obtained

Cluster	Number of Themes Per Cluster
Cluster 1	11
Cluster 2	9

Cluster	Number of Themes Per Cluster
Cluster 3	8
Cluster 4	8
Cluster 5	8
Cluster 6	6
Cluster 7	6
Cluster 8	4
Cluster 9	4
Cluster 10	4

Cluster 1, which is characterized in red, consists of 11 themes, namely gamification application, literature review, environment, adaptive gamification, e-learning, learning style, games, systematic literature review, young learner, future research agenda and bibliometric analysis. Cluster 2, which is characterized by the color green, consists of 9 themes, namely gamification, literature, science education, systematic review, instruction, empirical evidence, impact, classroom and gamified quiz. Cluster 3, which is characterized by the color blue, consists of 8 themes, namely student, exploratory study, sustainable gamification, sustainable development, simulation game, outcome, meta analysis and educational setting. Cluster 4, which is characterized by yellow, consists of 8 themes, namely effect, undergraduate student, cognitive engagement, online independent study, comparison, flipped learning, mathematics achievement and traditional learning. Cluster 5, which is characterized by the color purple, consists of 8 themes, namely student learning, gamified, formative assessment system, interactive gamification solution, role, engagement, behavior and personality traits. Cluster 6, which is characterized by light blue, consists of 6 themes, namely training, higher education, task technology fit, continuity intention, social motivation and technology acceptance model. Cluster 7, which is characterized by the color orange, consists of 6 themes, namely education, longitudinal study, industry, serious games, paradigm and tools. Cluster 8, which is characterized by the color brown, consists of 4 themes, namely learning, experiment, statistics education and challenge. Cluster 9, which is characterized by the color pink, consists of 4 themes, namely key determinant, mooc, success and massive open online course. Cluster 10, which is characterized by the color brown and cream, consists of 4 themes, namely study, benefits, motivational feedback and social networking.
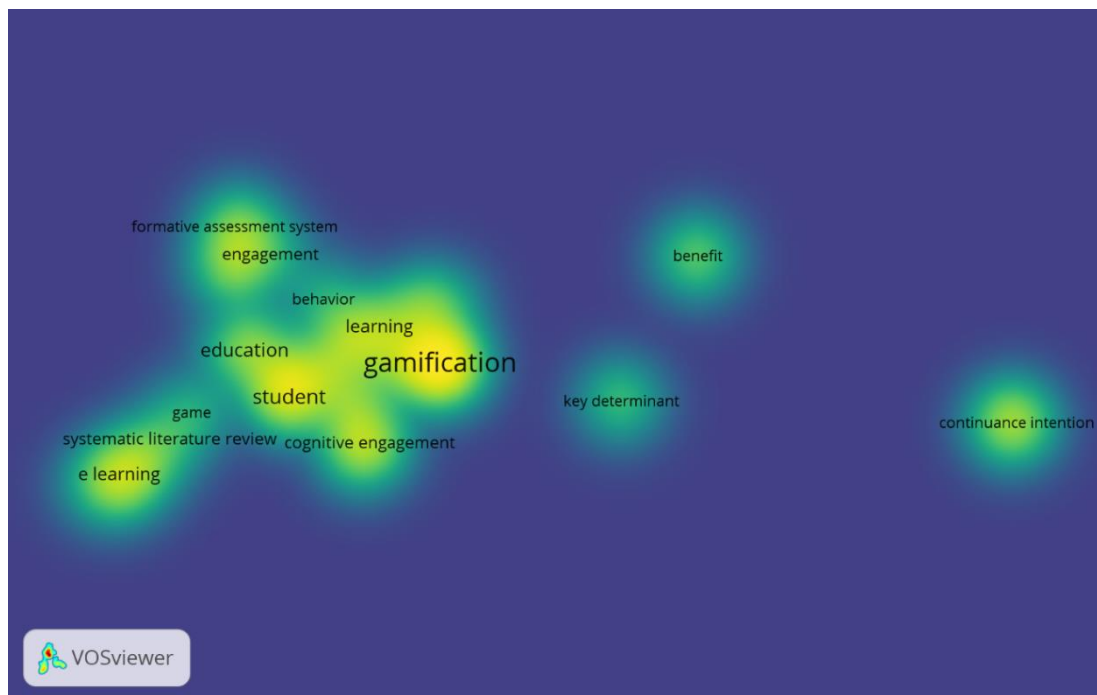

Figure 5. Density Visualization

The results of the density visualization in Figure 5 show that the brighter the yellow color and the larger the circle of a term, the more frequently the term appears in a quote.

There are exciting new chances to engage students in learning through the use of modern technologies. "The use of game design elements in non-game contexts" is gamification, a potentially revolutionary technique that could encourage kids to learn (Welberet al., 2019). In addition to being a significant part of human culture and civilization, games also boost motivation and engagement. Because of this, gaming mechanics are being incorporated into situations that don't often involve games, like elementary and secondary schooling (Krathet al., 2021). Despite the fact that the name "game" can be misleading and that educators and academics have employed a variety of game forms. The use of gaming features to promote learning in a non-entertainment setting is known as gamification. Additional motivation to learn is provided by the fact that games contain numerous components that are inherently appealing to children and adults and have a significant impact on their lives (Nieto-Escamez & Roldán- Tapia, 2021).

The term "gamification" refers to the use of game aspects to non-gaming activities. Every component of a game has applications in a variety of domains, including education. In the field of education, game components are incorporated to guarantee that learners are engaged with the content and have a desire to learn. Instead than requiring students to play games like Scrable or other titles that attempt to polish specific skills, gamification in education focuses on applying game features to learning activities (Limantaraet al., 2019). A relatively recent idea called "gamification" seeks to improve people's motivation and involvement in a variety of spheres of their lives. It is described as the application of components of game design to non-gaming contexts, when features more frequently seen in games are incorporated into the redesign of a specific procedure. The pyramid structure that most modern game design aspects have is made up of three layers: components, mechanics, and dynamics (Jaftha, 2020). Gamification is the process of "engaging people, motivating action, encouraging learning, and solving problems through the mechanics, aesthetics, and thinking of game-based games." The application of elements, strategies, and game thinking to various play environments is known as gamification. In both formal and informal contexts, the use of game elements boosts motivation and learning (Kiryakovaet al., 2018). The use of game concepts to alter behavior in contexts other than games is known as gamification. The term "gamification" refers to a playful, self-serving idea that is frequently exploited for hedonistic purposes (Yazdiet al., 2024).

Educational systems have great potential for the application of the concept of "gamification", which seeks to improve user experience and engagement with the system. This is an active area of study as researchers continue to look for new ways to improve the educational experience for students (Supriyadiet al., 2023). Educational experts are now interested in gamification because of its rise to popularity in the early 2010s. Gamification not only serves as the best method for developing an engaging learning environment, but it also provides the mechanism, aesthetics, and justification for game-based experiences that engage players, spur them to action, promote learning, and help them solve problems. This highlights gamification's primary benefit, which is the capacity to increase motivation and engagement (Swacha, 2021).

Therefore, the use of gamification as a learning medium is something that must be analyzed more deeply based on a review of existing literature. It can be seen from the analysis that has been carried out that research on gamification still needs to be improved. This is because gamification-based learning media can increase students' motivation to learn because students feel fun every time they play a game

D. Conclusion

When conducting this research, we reviewed 21 journals that had themes related to gamification-based learning media. The data in this article was obtained using Publish or Perish software using the Google Scholar database and 21 journals were obtained from a total of 200 articles obtained in the search that was carried out. The selection of journals or articles was carried out based on predetermined categories and left around 21 articles. The results of the research that has been carried out show that the bibliometric analysis shows that the application of gamification has been categorized into ten clusters. The results of the bibliometric research that has been carried out show that there are quite a lot of articles discussing gamification-based learning media on the Scopus platform and are already in the top quartile, namely Quartile 1, Quartile 2 and Quartile 3. However, for articles discussing about Gamification-based learning media, especially those originating from Indonesia, are still very few to be found there.

The technological developments experienced have brought many changes, including in the education sector, where the education sector has experienced changes in learning processes and methods. The research results show that the application of gamification in the education sector is needed in the learning process to

support the learning process and improve students' skills or learning outcomes at the upper secondary level. Previous research also shows that the use of gamification-based learning media in the world of education, more precisely at the high school level, provides benefits or influence for both teachers and students. Therefore, the research results show that the topic of gamification-based learning media, especially in Indonesia, is still very amenable to research and discussion in the future

E. Acknowledgment

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