ISSN: XXXX-XXXX

INTERNATIONAL PARTNERSHIP JOURNAL ON EDUCATION

Vol. 1 Issue 1. March 2025

Submitted: 24 December 2024 Accepted: 2 February 2025 Published: 25 March 2025

Gamification Research Trends in Science Learning in Elementary Schools

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Abstract

The discussion of gamification is currently being widely discussed, including in the field of education. By looking at the rapid development of the world of online games, this study wants to see the trends that emerge from the term gamification, especially those related to the world of education, especially its application in science learning in elementary schools. The data source in this study was obtained from Scopus data on October 26, 2024 and analyzed using the R and RStudio programs. The results of this study indicate that the current gamification trend is an interesting issue and is also relevant to current conditions. Gamification is starting to get attention from the world, including academics and education practitioners in Indonesia. The gamification trend has the potential to grow further this year considering the increasing number of discussions about gamification in international proceedings and also the support of the gamification trend in Indonesia which is very likely to start increasing in international journals indexed by Scopus.

Keywords: *Socio-Scientific Issue, Bibliometrics, Elementary school*

Introduction

The development of gamification in the world of education, especially in learning, has become a topic that is increasingly attracting attention from all elements of education. Gamification itself involves the use of game design elements in real-world contexts to increase student motivation and performance. Elements such as badges, leaderboards, and other rewards are

used to create a more engaging and enjoyable learning environment. Some of the positive values of using gamification in science learning are increasing student motivation, encouraging active participation, creating a fun learning environment, improving learning outcomes, developing social skills and collaboration (Hursen & Bas, 2019) . Gamification is the application of game elements in a non-game context to increase user engagement, motivation and experience. One non-game context that currently uses a lot of gamification is the field of education. In the world of education, gamification is used to create a more interesting and interactive learning experience by giving scores or points, giving badges, displaying rankings based on points collected, and containing challenges that must be completed or participated in by students both in groups and individually. The impact of integrating game content into learning includes increasing active participation and learning motivation (Park & Kim, 2023) .

The application of gamification can significantly increase students' learning motivation, which will ultimately have a positive impact on their academic performance (Puspitasari & Arifin, 2023) (Manzano-León et al., 2021) . In addition, research related to gamification also shows that gamification can help teachers create a more inclusive and engaging learning environment, which is very important in the context of increasingly digital modern education (Bennani et al., 2021; Handayani et al., 2021). The integration of game elements in learning needs to be adjusted to the learning objectives that will be used with the aim of providing positive student experiences and encouraging expected behavior in students (Febriansah et al., 2021) . Various forms of development of the application of gamification in education have given rise to various learning innovations towards enjoyable learning. Various forms of gamification that are currently widely used by elementary school teachers in Indonesia include wordwall (Miftah & Lamasitudju, 2022) , Kahoot! (Mattawang & Syarif, 2023) , Padlet (Twiningsih, 2023) , baamboozle (Siti Marwah & Nurul Ain, 2022) , *head quiz* (Anggraini et al., 2021) , or other forms of games according to learning needs.

In the development of gamification, there are several key elements in adapting to education, including the design of the experience gained by students, determining the mission or level of difficulty of the challenges in the game, learning patterns, and the level of student participation expected (Park & Kim, 2022) . With these considerations, the focus of developing learning using gamification becomes very diverse. Research trends on gamification are very interesting to study to see the development of gamification in the world of education. In elementary school learning, encouragement of students' interest in learning is needed. By applying gamification in the learning process, it will increase student motivation which will affect student learning outcomes. The higher the student's motivation to learn about a learning, the learning outcomes will also increase (Mulyanti et al., 2023) . Where when students have not participated in learning activities with gamification, many values are not yet complete. After learning applies gamification, the results show that students' final abilities fall into the complete category (Asmarani et al., 2024) . According to (Mattawang & Syarif, 2023) gamification can help improve student learning outcomes; raise students' learning motivation. Proven by the existence of quite significant differences between the control group and the experimental group, increasing students' understanding of the learning material, and attracting students' interest in learning.

The purpose of implementing gamification in learning is to increase student learning motivation and increase student focus to understand the material being delivered or studied (Heni Jusuf, 2016) . With gamification involving visualization, it will increase student understanding from abstract to realistic understanding. Because gamification can explain abstract things and can provide a more realistic picture (Fatharani et al., 2022) . Gamification

can also increase cooperation and increase information references that increase student knowledge (Ardiawati et al., 2024) . Gamification that is collaborated with interactive game or quiz applications can improve the development of students' thinking and sensitivity skills. For example, with various types of games such as filling in blank sentences, matching images, anagram games, etc. In addition, it also improves students' logical reasoning and understanding skills. Through games to determine truth or not, random cards and grouping data (Fitriana et al., 2024) .

Method

The method used in this study is bibliometric analysis using the R and RStudio programs. The search for Scopus data in this study was conducted on October 23, 2024 using the keywords: *gamification OR "game based learning" OR gamified OR "education games" OR edugame OR "game design" AND education OR teaching OR learning OR elementary OR primary OR school AND science OR "natural science"* . The selection of these data search keywords is intended to obtain information about gamification applied in elementary schools. From the data search process, 3442 documents were obtained, then the process of limiting the subject area of social sciences was carried out so that 1711 documents were obtained. Furthermore, reduction was carried out through restrictions on documents in the form of articles and conference papers so that 1479 were obtained, the next restriction was on articles in English only so that 1412 data were obtained in the form of 720 articles, 684 conference papers. Furthermore, specifically for the purpose of seeing trends in the last 10 years, it is limited to data from 2015 to 2024 so that only 1164 data are used.

Figure 1. Main Information Data for the Last 10 Years

Results and Discussion

The first discussion in this study focuses on the analysis of the position of the *gamification* theme in relation to the level of development and its relevance to current conditions. The description of the position of the theme for each search keyword in this study is presented in the following figure:

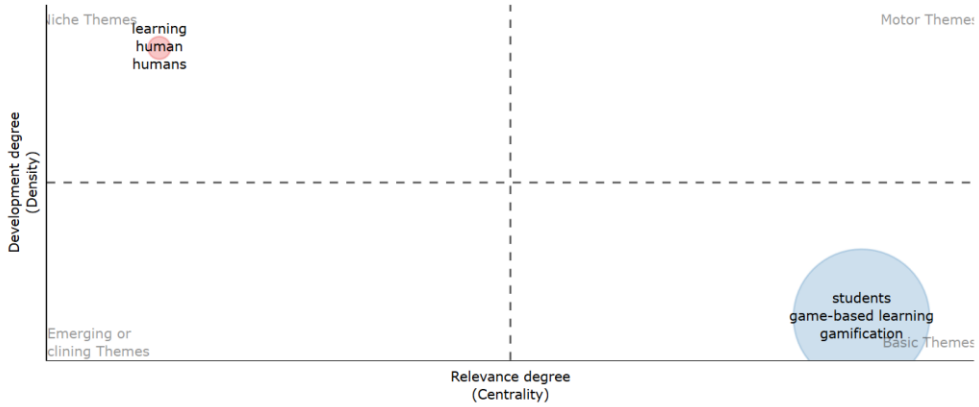

Figure 2. Thematic Map

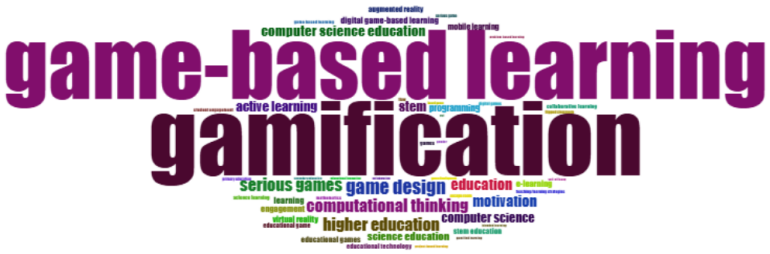

Figure 3. Wordcloud

If we look at the emerging trends for *gamification,* they are in the basic theme area, which means that in terms of development, this theme has a level that has received little attention from researchers, but is very relevant to current conditions.

Next, to see the trend of the relationship between keywords, it can be presented in the following image:

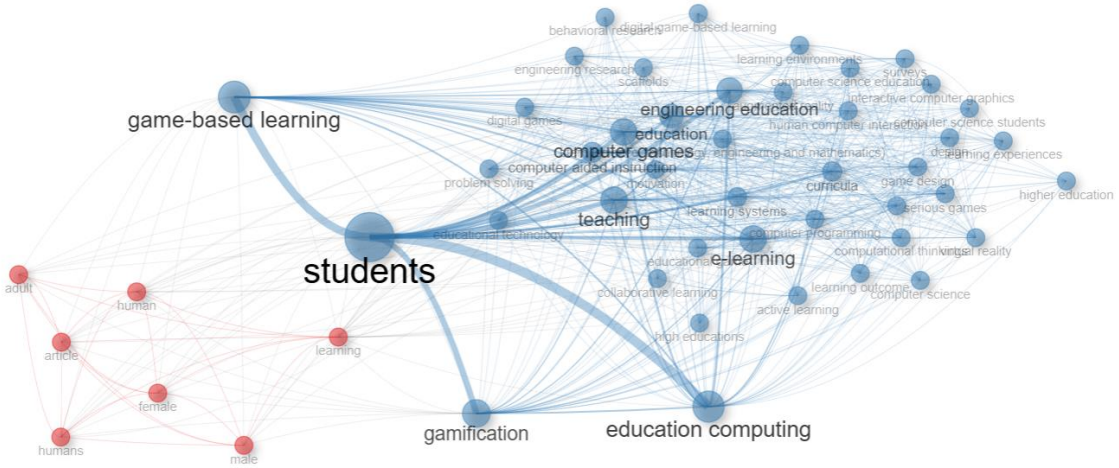

Figure 4. Trend of Relationships Between Keywords

The information we can get from this data is that gamification and game based learning have a very close relationship with students and also have a relationship with learning. Meanwhile, from the aspect of research productivity, it can be seen from the following picture:

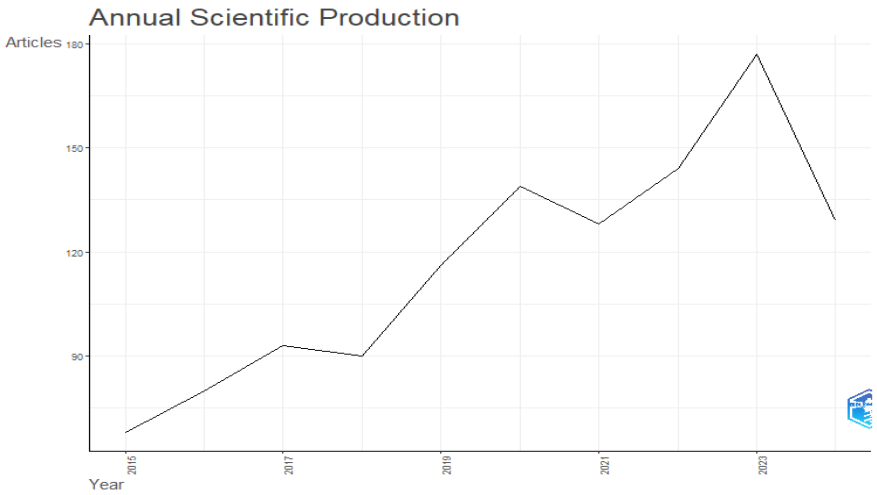

Figure 5. Annual Scientific Production

The trend of research results production on gamification has also increased from year to year to peak in 2023 with 177 data. By the end of 2024, 129 articles have been reached and it is very likely that it will continue to increase until December 2024. Meanwhile, it was also explained that most of the articles taken were still in proceedings and it was very possible to get research results and be published in journals. More detailed information about the publisher of each data is presented in the following table:

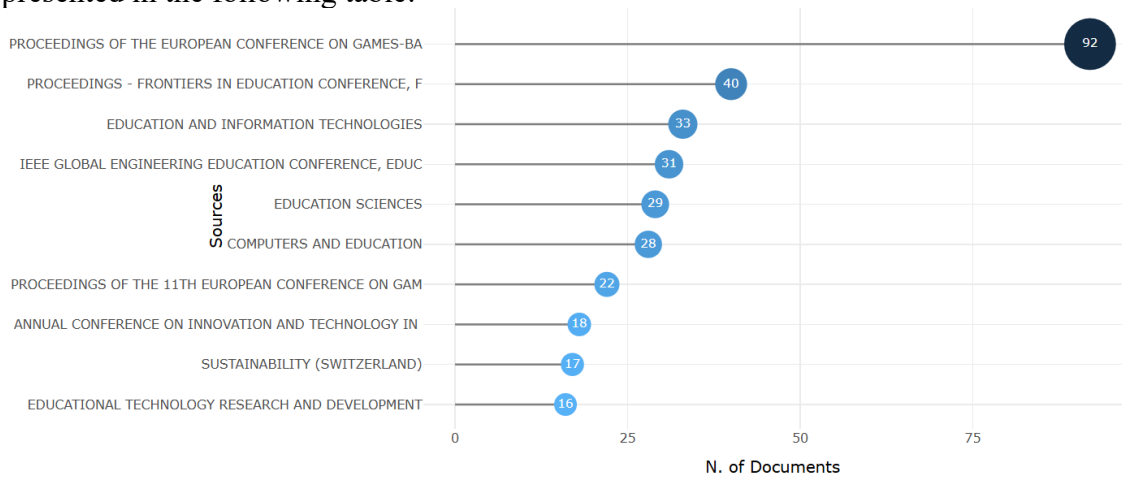

Figure 6. Most Data Sources

This data source distribution information shows that research on gamification is a global concern and also a global issue. Articles that focus on gamification are widely echoed in international journals, especially in journals that focus on educational development and are published in international seminars that produce proceedings. Furthermore, if we look at Figure 5, it appears that the trend of discussions on game-based learning and gamification shows an increasing trend from year to year, as well as for game design. This shows that the development of game design is in line with the development of gamification, including in the world of education.

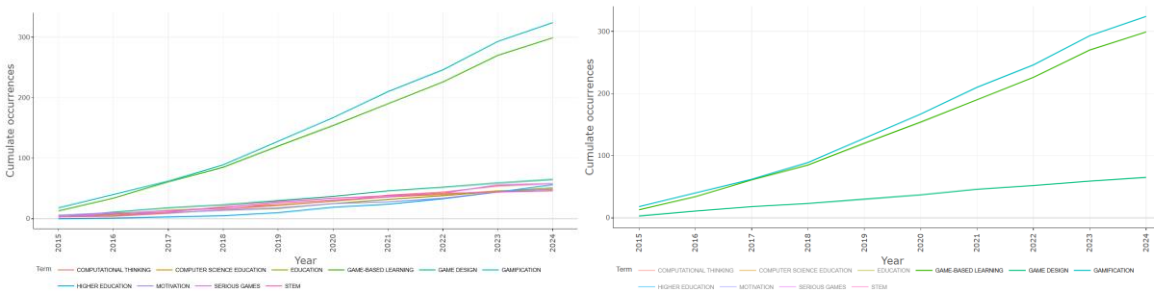

Figure 7. Publication trends by keywords

Next, the focus of the data analysis from this study is directed at information about the affiliation of the authors about gamification. This information will be able to provide us with an overview of the institutions of origin of the authors who have an interest in research around gamification. The following is a table about the affiliation of the gamification authors:

Table 1. Gamification Author Affiliation trends in Indonesia

Affiliation	Articles
Yogyakarta State University	8
Malang State University	4
Semarang State University	4
Universitas Terbuka	2
Muhammadiyah University of Purwokerto	1
State University of Medan	1

Based on the table above, it appears that research on gamification with the author's affiliation being an institution in Indonesia has begun to emerge. Articles that are not indexed by Scopus or that are national journals have begun to be found. The following is a complete overview of the trend of author collaboration on gamification in the world.

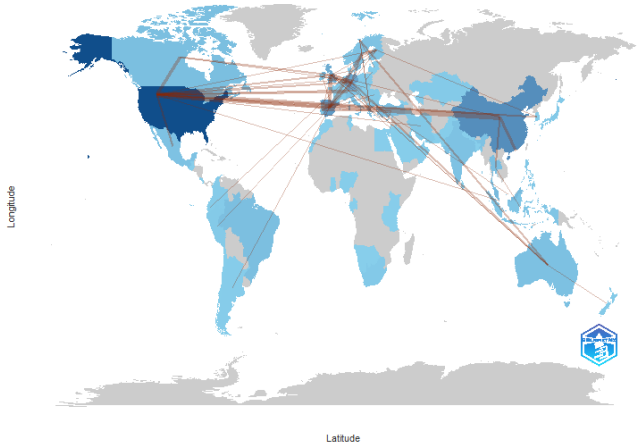

Figure 8. Countries' Collaboration World Map

In the context of discussing gamification trends in Indonesia itself, we have begun to find many alternatives for implementing gamification in the world of education, including learning in elementary schools, in national journals. The first is gamification in the form of Wordwall. Learning in the current era must be able to adapt to the use of technology that can improve the learning process to be more interesting, such as the use of gamification learning with the wordwall application. Wordwall is a web-based digital platform that collaborates gamification

elements. In it there are quizzes and games that can be adjusted to the theme, learning style and music (Fitriana et al., 2024) . In the wardwall there are many educational games that can be used directly without teachers having to learn coding to make them, so it really helps teachers in the learning process to be more interesting and enjoyable (Miftah & Lamasitudju, 2022) .

The second alternative choice for gamification is gamification in Kahoot format. Through Kahoot, teachers can design interactive quizzes that are visually appealing (Mattawang & Syarif, 2023) . Kahoot is a visual learning media that can meet the learning styles of the digital generation (Asmarani et al., 2024) . This application can attract students' attention to learning and provide a positive influence, this is in line with research conducted by Bicen and Kocakoyun (2018) in (Mertayasa et al., 2022) entitled "Perceptions of Students for Gamification Approach: Kahoot as a Case Study". The implications of learning with HOTS-based Kahoot gamification media for students are the joy and interest in the teaching and learning process with competitions to become winners in this Kahoot. Apart from Kahoot, the Quizizz application can also attract students. Quizizz is a website that can create interactive quiz games that can be applied in learning (Mudiana et al., 2022) . Quizizz gamification is a combination of game and non-game aspects, in the form of a game with the aim of making learning more fun and interactive (Permatasari et al., 2024) . Furthermore, gamification is in padlet format. Padlet is an Android-based media that can be used to interact online (Twiningsih, 2023) . Padlet has a social media interface, cloud storage, and can be used on various systems connected to the internet. Students can comment, send images, audio, video, various other multimedia files and chat (Anunpattana et al., 2021) .

The next gamification format is baamboozle which is a web-based application to create interactive learning with learning materials presented in an interesting quiz game (Siti Marwah & Nurul Ain, 2022) . This baamboozle gamification has an effect on student motivation because it can foster positive emotional feelings and can increase students' psychomotor activities (Ibad, 2024) . Another application that can be applied in gamification learning is Instagram. By utilizing the features available on Instagram, namely the story page and we can choose an educational game filter that suits the learning. This filter is in the form of a head quiz, with a certain duration to be answered by the user, this filter can also be easily accessed by anyone who has an Instagram account (Anggraini et al., 2021) . The Android-based educational game "Physics Words" can also be applied in learning. This game is related to physics where this application is in the form of words or terms that exist in science learning, especially physics concepts with various levels from the easiest, medium, and difficult levels. What differentiates the levels is the number of distractor letters (Erfan et al., 2020) .

One of the subjects that can be applied with gamification is science learning. Such as digestive system material by utilizing *wordwall with the selection of labeled diagram* features that connect lines from one point that has a statement label to a point that matches the image object (Fitriana et al., 2024) . It can also be used in the sub-theme of Indonesiaku kaya raya in grade V of elementary school (Permatasari et al., 2024) . In grade V, temperature and heat material can also be applied with gamification learning using gamification-based padlet media (Twiningsih, 2023) . After completing the padlet, students can do the quizzes in the padlet class. Gamification can also be applied to solar system material in grade VI of elementary school, by utilizing the development procedure of the *Rapid Prototyping model* and the use of voice ocer (Fatharani et al., 2022) . By using *Fun Science* in learning, it can be collaborated with the topics of plants, animals and humans according to the second year science activities (Suhaimi et al., 2022) . The material on light in grade IV can also be applied with gamification learning using snakes and ladders, where there are quizzes that have levels. The closer to the

winning number, the more difficult the quiz will be (Ardiawati et al., 2024) . The material on human respiratory organs can also be applied to the snakes and ladders game through the operation game, which provides freedom of speech in class so that students can interact freely in learning (Qurrotaini et al., 2021) . In addition, the material on energy sources, namely biogas, solar power and wind power in theme 2 with *adventure- based games* . To complete it, you have to go on an adventure to collect and search for alternative biogas energy, such as collecting rotten fruit, solar power that can become solar power, wind that can become alternative energy for electricity using windmills (Yuliati et al., 2022) . The concept of force in science learning can be combined with gamification through the educational game "Physics Words" with terms of force concepts such as inertia, pull, push, gravitational force and various types of force (Erfan et al., 2020) .

Conclusion

From the results of this study, it can be concluded that the current gamification trend is an interesting issue and also relevant to the current conditions. Gamification is starting to get attention from the world including academics and education practitioners in Indonesia. The gamification trend has the potential to grow further this year considering the increasing number of gamification discussions in international proceedings and also the support of the gamification trend in Indonesia which is very likely to start increasing in international journals indexed by Scopus.

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