Trends in Gamification Based Pedagogy Innovation using Bibliometrics Analysis

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ABSTRACT

Gamification is a new breakthrough in education. The main context of gamification is to incorporate game elements in a non-game environment to enhance the user experience. The demands of Industry 4.0 require innovation in all sectors, including education. Gamification can be used as an innovation in learning (pedagogics) in answering these challenges. In this era, the task of a teacher is as a facilitator, so every teacher is expected to make a teaching innovation to attract students. This research aims to map the research trend on gamification in the learning process (pedagogics) by using bibliometric analysis. The data obtained came from the Scopus database as many as 1,680 articles from 2018-2023 which were then analyzed. The results of this study show that this research topic is interesting to study as evidenced by the annual increase in the number of publications. The author with the greatest contribution in this field is Hamari J. with the highest number of publications and citations. Visualization of research trends because of this research shows potential research in the future.

Keywords: Gamification, Innovation, Pedagogy

INTRODUCTION

The new trend in education has changed along with the rapid advancement of technology amidst the increasingly complex needs of society. The challenges in education are also getting bigger where teachers are faced with presenting teaching with demands for interesting, relevant, and effective learning for students. This is a challenge in 21st century learning and requires specific competencies, for which pedagogics must be designed to foster these competencies [1]. An educator or teacher must have adequate skills in using digital technology and communication tools to access, use, and even evaluate digital-based learning processes [2]

Pandemic conditions have accelerated technological development throughout the world and occur in various sectors. One sector that is also affected is the education sector. Apart from the pandemic factor, the demands of industry 4.0 also make all sectors, including education, require a very large ICT. Industry 4.0 is an era where technology is needed to advance industrial transformation [3]. The world of education is faced with various media that help the education process. Learners who are certainly also more adept at using technology are a challenge for teachers. Various types of new learning are part of the pedagogical innovation itself, one of which is gamification. Gamification is an approach to learning by using elements in games or videos with the aim of motivating learners in the learning process [4]. Gamification in teaching also has an important role in achieving learning objectives [5].

In the face of these challenges, the concept of gamification has emerged as an approach that has caught the attention of educators and researchers. Gamification has quickly emerged as one of the favorite persuasive technologies widely used with the aim to promote positive changes in user behavior by incorporating game-like elements in non-game contexts [6]. With the use of game elements in non-game contexts, gamification exists to improve motivation, participation, and learning outcomes. In the context of education, gamification applies game principles such as goals, challenges, rewards, and competition to the learning process which brings a new color to education as well as pedagogics.

The implementation of gamification in education in Indonesia began to be widely implemented during the pandemic. This is because learning is done online, thus forcing teachers to create something fresh that makes the atmosphere of learning even though school is from home. The emergence of companies in the field of online education is quite common such as Ruang Guru, Quipper, Rumah Belajar and so on. Each of them provides various learning facilities including games in the learning activities. The learning process through gamification greatly increases the learning motivation of students [7]. Similar research results which states that the application of gamification in learning has a good effect in increasing student motivation and engagement in the learning process [8]. So, seeing the many benefits felt from gamification in the education process, it is necessary to increase research on gamification in the learning process (pedagogics). In connection with this, this research was made to map the trend of research on gamification in the learning process (pedagogics) using bibliometric analysis. The purpose of this research is to see research trends related to educational innovation through gamification. Some of the issues raised in this research are:

- What is the trend of research articles on pedagogical education innovation through gamification?
- Who are the most influential authors in research on pedagogical education innovation through gamification?
- What are the research trends in pedagogical education innovation through gamification, based on relevant keywords?

LITERATURE REVIEW

Educational Innovation

Educational innovation can be defined as the process of improving educational practices and student outcomes through the strategic use of digital tools and resources [9]. Educational innovation refers to the implementation of new ideas, methods, and technologies in educational settings to enhance learning outcomes [10]. Educational innovation is also an effort to improve aspects of education in practice and lead to something new. Educational innovation refers to the development and use of new technologies, methods, or strategies in carrying out the educational process to improve the effectiveness and efficiency of such learning. Educational innovation aims to improve the quality of education and address evolving educational issues. Examples of educational innovation can be the use of digital technology in learning such as e-learning, simulation-based learning, or game-based learning. Since the contextualization of learning innovation is close to the use of technology, then in the contextualization of learning innovation, there is a need to understand the contextualization of learning innovation [1] explained that there are six technology-based pedagogical approaches, namely:

Organizing teaching and learning, in and out of school (blended learning)

- The relevance of games in teaching (gamification).
- Individuals as problem solvers (computational thinking)
- The wider environment and ways to experience and learn about it (experiential learning)
- The whole person, including social, emotional, artistic, and physical (embodied learning)
- The diverse and contested nature of literacy (multiliteracies)

Gamification in Pedagogics

Gamification is the implementation of game mechanics in a non-game environment with the aim of enhancing the user experience [11]. Gamification in education is the concept of games (such as game design techniques, thinking games, and game mechanics) for educational purposes. Gamification method is an example of an online learning process [12]. Gamification in learning is a learning strategy using game features to encourage students to be more excited about learning and increase student engagement in the learning process [8]. Gamification is

a technique in the learning process that utilizes game elements [13]. There are four pedagogical sequences that are the indices of teaching through gamification, namely:

- Learning through stories: Integrating narratives to make educational content relatable and enhance comprehension.
- Assessment for learning: Continuous evaluation and feedback during the learning process to motivate and track progress.
- Problem solving: Presenting challenges that require critical thinking and creativity to overcome within the learning environment.
- Experiential learning: Learning through direct experience and reflection, often in simulated environments, to connect theory with real-world application.

Gamification has been widely used to increase participant motivation, engagement, and performance in gamified experiences, often in combination with other technologies, especially social media, AR and VR, and mobile applications. It has been found that gamification has been implemented in many different domains, but the education domain is the domain that has attracted the most research interest [6].

METHOD

This research uses bibliometric analysis and according to [14] bibliometric analysis combines two procedures, namely performance analysis and science mapping. The following are the three stages of bibliometric analysis adopted from [15]:

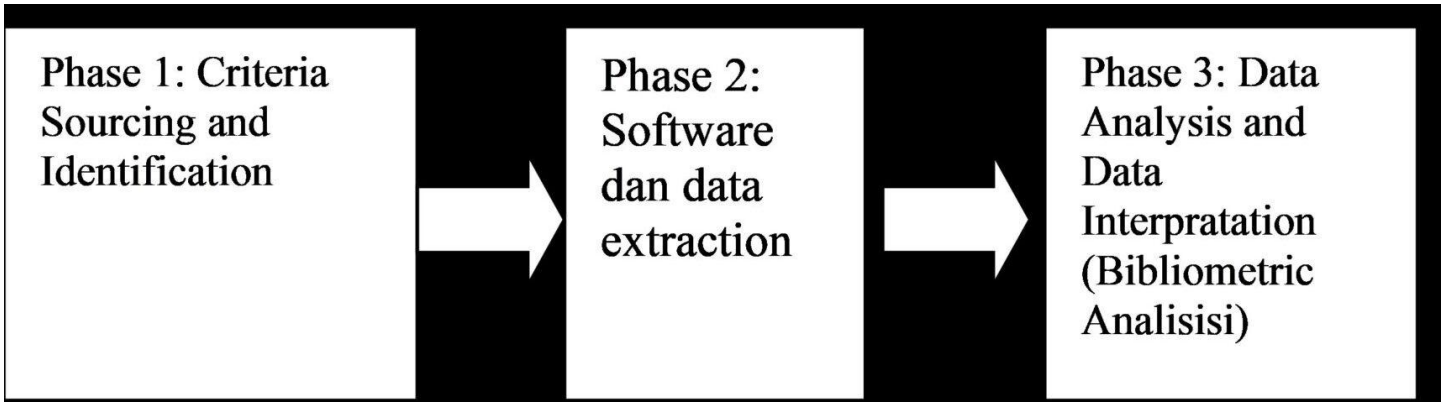

Fig. 1 - Methodological Process of Bibliometric Analysis

Phase 1 - In this study, data was searched on the Scopus database. In phase one by filtering through keywords: Gamification pedagogy, gamification learning, gamification, gamification teaching, innovation pedagogy, innovation learning, innovation teaching obtained a total of 13,343 articles. Then the filtering process was carried out again through several criteria. First, filtering is done through the publication year in this study, namely the year (2018-2023), then filtering the language by selecting English and some selection of appropriate keywords, then the final number of articles to be sampled is 1,680 articles. By writing keywords using the Boolean operator used in the Scopus database is as follows:

TITLE-ABS-KEY (“gamification pedagogy" OR "gamification learning" OR gamification OR "gamification teaching" OR "innovation pedagogy" OR "innovation learning" OR "innovation teaching”).

Phase 2: The data in this study were retrieved from the Scopus database on May 17, 2023. Data processing in this study used VOS Viewer software. VOS Viewer is used to analyze the network relationship between article keywords.

Phase 3: Data analysis and data interpretation were carried out after finding the connection that has been obtained from the VOS Viewer application with the problems raised in this research.

FINDINGS AND DISCUSSION

Findings

Articles on Pedagogical Education Innovation Through Gamification with Most Citations

The following are research results from data obtained from the Scopus database with a total of 1,680 data and a period of 2018-2023. The results of the 10 most popular articles on pedagogical education innovation through gamification can be explained in the table below

Table 1. 10 Articles on Pedagogical Education Innovation through Gamification with the Most Citations

Year	Citation	Title	Source
2020	256	The Gamification of Learning: a Meta-analysis	Educational Psychology Review
2018	177	Students' perception of Kahoot!'s influence on teaching and learning	Research and Practice in Technology Enhanced Learning
2018	173	How to design gamification? A method for engineering gamified software	Information and Software Technology
2021	157	Gamification in science education. A systematic review of the literature	Education Sciences
2019	146	Gamification: A key determinant of massive open online course (MOOC) success	Information and Management
2018	143	Perceptions of students for gamification approach: Kahoot as a case study	International Journal of Emerging Technologies in Learning
2020	132	Does gamification affect brand engagement and equity? A study in online brand communities	Journal of Business Research
2018	126	Enhancing student learning experience with technology-mediated gamification: An empirical study	Computers and Education
2018	120	Gamification in software engineering education: A systematic mapping	Journal of Systems and Software
2020	114	Tailored gamification: A review of literature	International Journal of Human Computer Studies

Most Influential Researcher in Pedagogical Education Innovation through Gamification

The analysis continued by looking at the most influential authors in this research on gamification in learning (pedagogics). The following are the results of data processing from VOS Viewer:

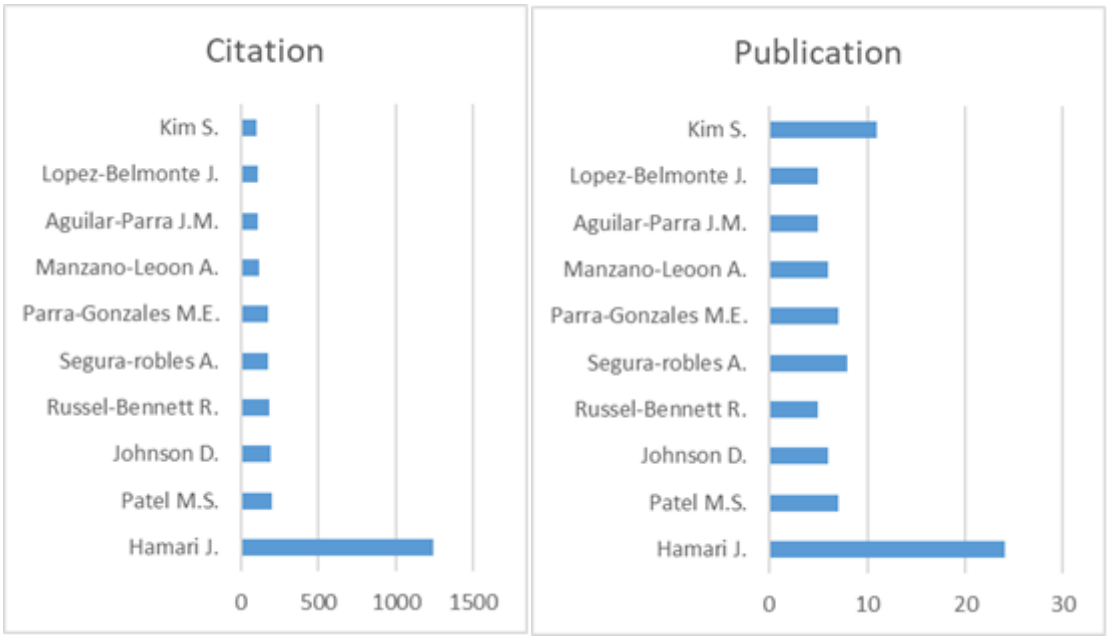

Fig 2. Top 10 Researchers in Publication of Pedagogical Education Innovation through Gamification

In the figure above, it can be explained that there are 10 researchers with the highest number of publications and the highest number of citations in research on pedagogy education innovation through gamification. Based on the results of data processing, the researcher with the highest number of publications and citations is Hamari J. with a total of 24 publications in this field and 1,243 citations. In the research results there are 26 researchers with these studies, the data above are the 10 most publications and citations. From the graph, the most citations and publications were made by Hamari J., while for the next between the number of publications and citations there are differences from each researcher.

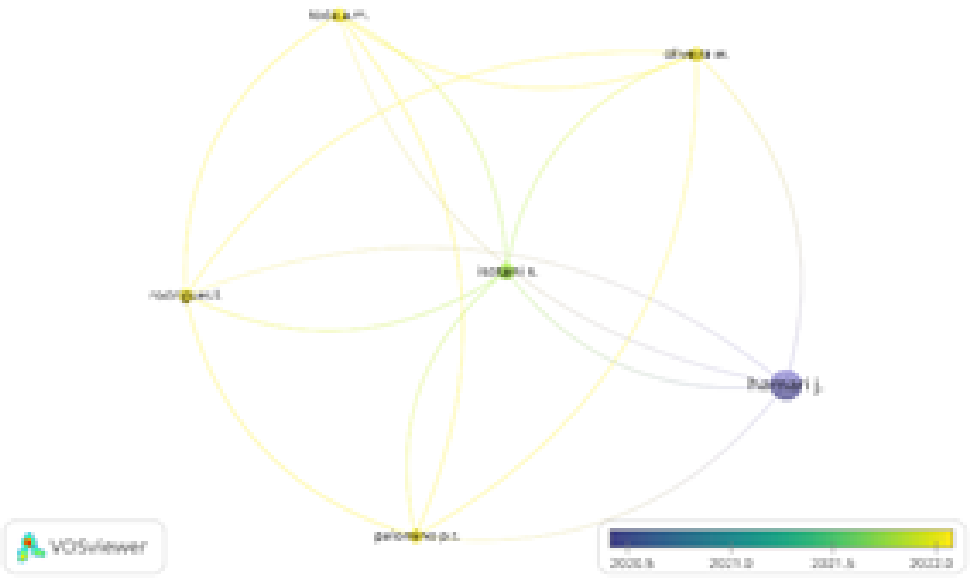

Fig. 3 - Author Visualization Overlay

In the figure, it can be explained about the relevance of the discussion in the research topic.

The darkest color identifies that the research has been done a lot and cited a lot, in the picture it can be seen is Hamari J. who is the author with the most contribution in this research topic. While the light color explains the topic that is still rarely researched but related to the main source. It can also be explained that the more recent the year the lighter the color. In relation to the topic given, it references previous researchers by adding something new. So that the number of publications and citations is not yet large.

Research Trend Analysis of Pedagogical Education Innovation through Gamification

In seeing research trends in this field, researchers will discuss the results of data processing through the VOS Viewer application. The data processed in seeing trends includes keywords obtained from data that has been obtained through the Scopus database. The development of research on pedagogical education innovation through gamification can be seen in the 2018-2023 research year through the graph below:

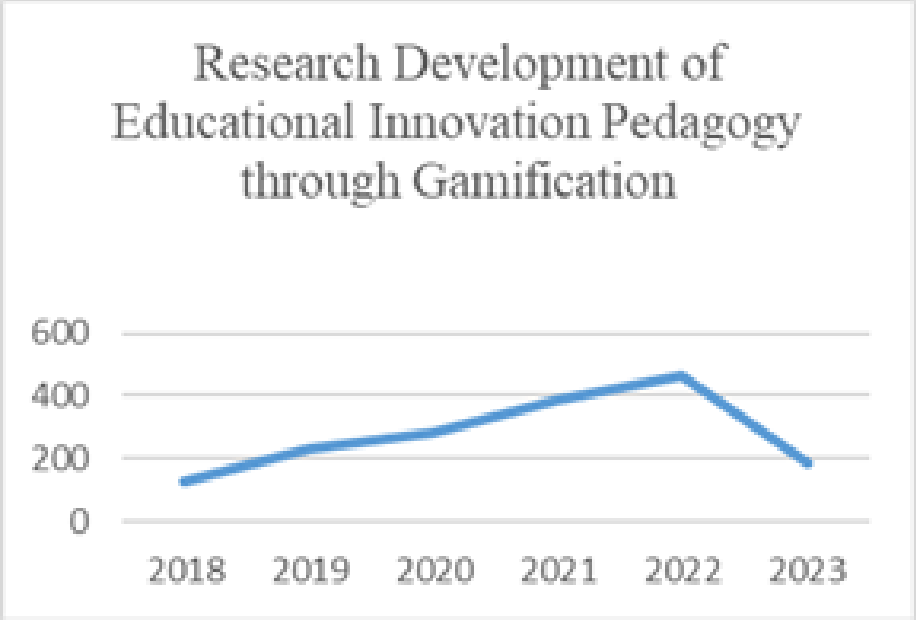

Fig. 3 - Research Development on Pedagogical Education Innovation through Gamification

In the figure above it can be seen that the research trend from 2018-2022 has always increased, in 2023 where this research took place until data collection in May 2023 there were already 186 studies. Mid-year has reached 186, this can indicate that an increase in publications can also occur until the end of 2023. So we can see that indeed the trend of research on this topic always increases every year along with the development of knowledge about this field of study.

The next analysis conducted is by looking at keyword distribution. This approach is usually used to determine the relevance of publications based on the relationship between citations or between words in publications. Based on the results of VOS Viewer from 1,680 data by searching through related keywords, there are 73 keyword items that match the research topic and form 13 clusters. Here are the details of the clusters that have been formed:

Table 2. Keyword Cluster

Cluster 1 - Red (11 items)- Flipped Classroom	Collaboration, flipped classroom, innovation, learning analytics, learning performance, online learning, problem-based learning, project-based learning, students, teamwork, university
Cluster 2 -Green (11 items) - Gamification	Collaborative learning, distance learning, educational technology, environmental technology, environmental education, feedback, gamification, ICT, mobile learning, primary education, technology-enhanced learning
Cluster 3 - Dark blue (9 items) - Motivation	Academic performance, distance education, games, kahoot!, learning, machine learning, motivation, systematic literature review, university students
Cluster 4 - Yellow (8 items) - higher education	Engineering education, experiential learning, game-based learning, gamified learning, higher education, learning outcomes, LMS, stem education

Cluster 5 - Purple (7 items) - e-learning	Computer science, cooperative learning, e-learning, learning motivation, m-learning, teachers, teaching
Cluster 6 - Light blue (6 items)- student motivation	Educational game, pedagogy, STEM, student engagement, student motivation, undergraduate
Cluster 7 - Orange (4 items)- Covid-19	Blended learning, covid-19, industry 4.0, social media
Cluster 8 - Chocolate (4 items) - Education	Covid-19 pandemic, education, gamification in education, teaching innovation
Cluster 9 - Light Purple (4 items) - educational innovation	Educational innovation, flipped learning, physical education, secondary education
Cluster 10 - Pink (3 items) - Engagement	Engagement, evaluation, quizizz
Cluster 11 - Light Green (3 items) - Learning management system	Gamified, learning management system, self-regulated learning
Cluster 12 - Pastel blue (3 items) - educational games	Active learning, educational games, pharmacy education
Cluster 13- Light yellow (1 item)- Gameful Design	Gameful Design

The 73 keyword items form a group with similar research tendencies. Each cluster is formed in the connection between keywords. For example, in the green cluster, the main point of discussion in the cluster is gamification. Related articles that use the gamification keyword tend to use other keywords in the cluster, namely Collaborative learning, distance learning, educational technology, environmental technology, environmental education, environmental education, feedback, ICT, mobile learning, primary education, technology-enhanced learning. So that when the next author also wants to conduct research related to this field, it can easily find variable links to be studied. For more details, the following are the results of the description of the VOS Viewer regarding the relationship between keywords through the existing colors:

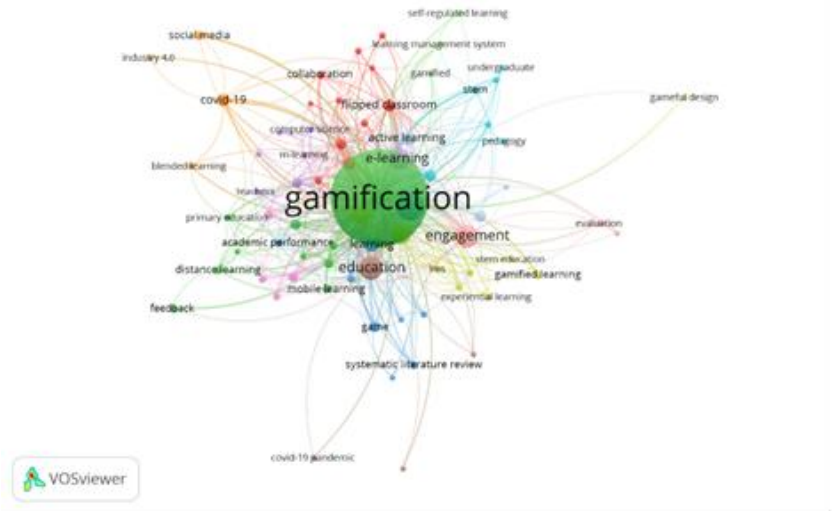

Fig. 4 - Network Visualization Keyword

In the picture above, we can see the keywords that are connected to each other through a point. The line connecting the points will form a pattern or group called a cluster. These points are keywords from articles processed in VOS Viewer and sampled in this research. The connection between one point and another point occurs when there is a similarity of publications involving keywords included in the cluster. Various connections have been made through calculations in the VOS Viewer application. So that this can be used as a research idea. Where when we want to do research about this field, we can choose some of these clusters to be used as research ideas. Furthermore, to see the many or few publications that have been done with these keywords can be seen through the following overlay visualization image:

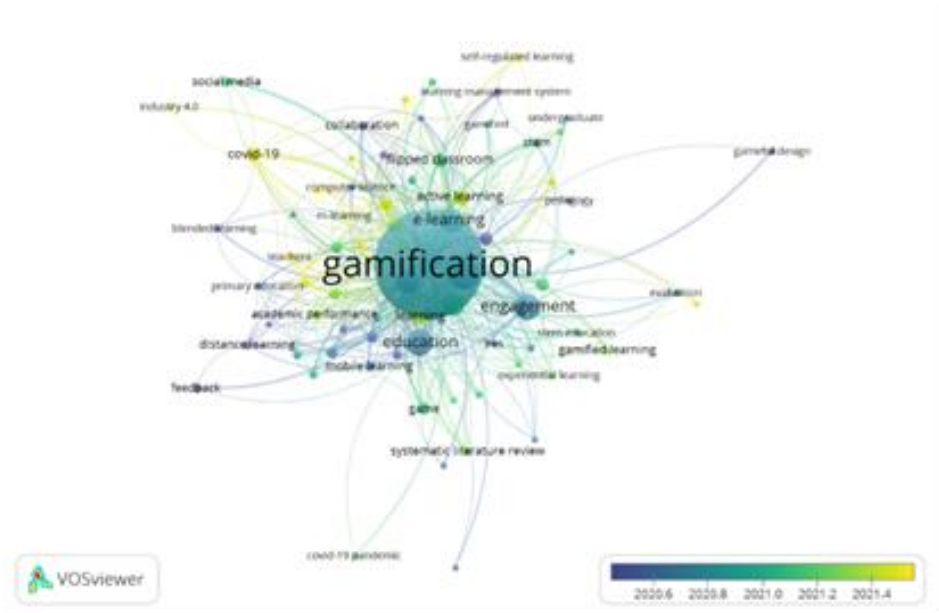

Fig.5 - Keyword Trend Visualization Overlay

Overlay Visualization is an overview of the renewal of publications that have been carried out identified through keywords and characterized by color differences. The color indicates the average number of publications per year. Blue dots identify keywords that are widely used. Meanwhile, yellow dots indicate keywords that have appeared recently or the latest trends in these keywords (Bahri et al., 2022). It can be clarified that the darker the color indicates that the keyword is the older the publication year and the lighter it indicates the more recent the research. Next is to see how many or few publications have been made, it can be explained by the density image in the VOS Viewer results as follows:

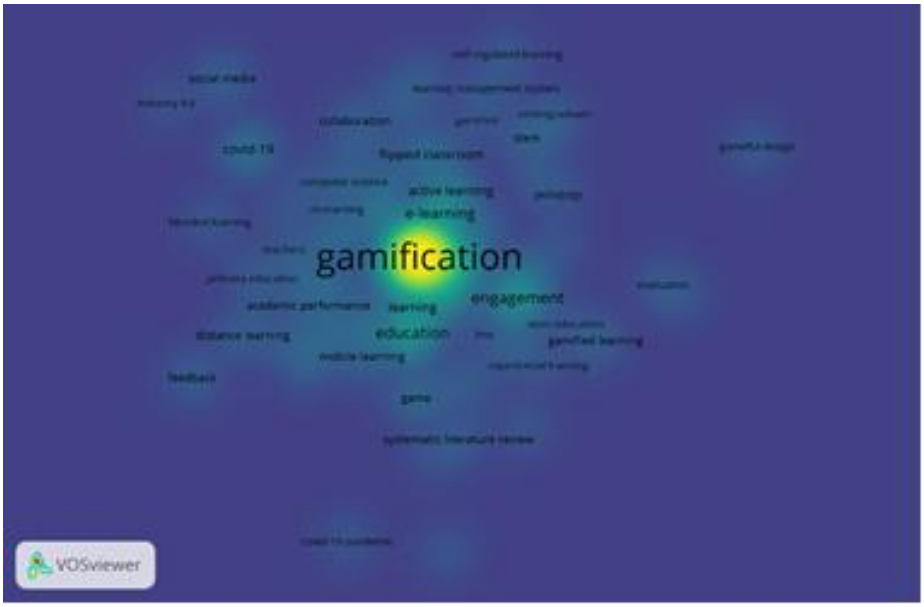

Fig.6 - Density Visualization

Based on the figure above, it can be explained that keywords with dark color keywords (blue) indicate that there have been many studies with these keywords. As for keywords with light colors (yellow), it states that these keywords have not been widely researched.

DISCUSSION

Based on the results of this study, we can see that this study is an interesting research topic to study. This is evidenced by the increasing number of publications related to this topic every year. Several studies related to gamification using bibliometric analysis such as study [5]. Ccompared to studies that sought to identify patterns in gamification research [6] (Trinidad et al., 2021), which examined the usage of gamification-based applications at higher education.

The database employed in data searches, the objectives of the research, and the data filtering that is conducted are all examples of the distinctions that exist in research. Research on gamification as a pedagogical innovation is in high demand due to its novelty and potential benefits. Certainly, the public's perspective on games is evident; there is a negative perspective.

Nonetheless, numerous research about gamification have transformed this negative perception into a positive one, revitalizing the educational landscape. Research conducted by [16] indicates that 78% of elementary school children lack comprehension and exhibit disinterest in thematic system learning. The creation of an educational game can be employed to address these issues. Game design can enhance students' focus in learning, including for children with special needs. The present user demographic, comprising digitally literate individuals from Generation Z and Generation Alpha, necessitates the implementation of learning innovations. According to pedagogical principles, a teacher functions as a facilitator who addresses the diverse needs of students [1]. It is imperative for educators to implement a multidisciplinary approach to learning design tailored to student needs in order to attain educational objectives. Enhancing research in gamification as a pedagogical innovation can yield novel concepts for implementation in educational activities.

CONCLUSION

This research was conducted by taking data from the Scopus database with the number of articles sampled, namely 1,680 articles. The bibliometric analysis used in this study aims to see publication trends regarding Pedagogical Education Innovation through Gamification. Based on the results of data processing, it is concluded as follows: from 2018 to 2022 there is an increase in research in this field, for 2023 the trend cannot be seen because it has not yet reached the end of the year. The researcher with the largest contribution to this field including the articles produced and the highest number of citations is Hamari J. The trend of research studies on this topic resulted in 13 research clusters with 73 keyword items. The increase in publications each year in this study identifies that this topic is a popular and needed topic in the field of pedagogics. Learning innovation through gamification is the answer to the saturation of the traditional learning process and brings fresh air to the world of education. The limitation in this research is that it still uses one database, namely Scopus, in data search. For further research, it can be suggested to be able to use other databases such as WoS, EBSCO and so on.

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