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The Use of Games for Learning in Primary Schools: A Bibliometrics Analysis of the Scopus Database

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Abstrak

Pembelajaran sekolah dasar yang terintegrasi dengan game dapat meningkatkan motivasi siswa dalam belajar sehingga dapat berdampak positif pada hasil belajar. Bibliometric review digunakan dalam riset ini, bertujuan untuk menganalisis artikel yang membahas pemanfaatan game pada jenjang sekolah dasar yang diterbitkan pada jurnal terindeks database Scopus periode tahun 2013-2022. Artikel sejumlah 122 yang membahas pengintegrasian game pada pembelajaran jenjang sekolah dasar dianalisis. Temuan review menunjukkan bahwa terjadi peningkatan jumlah publikasi secara signifikan tahun 2016-2021, sekitar 77,87% artikel diterbitkan pada periode tersebut. Spain dan Indonesia mendominasi jumlah publikasi. Empat authors dengan masing-masing 3 publikasi merupakan author yang berpengaruh. Visualisasi data menunjukkan bahwa topik riset ini dapat dikelompokkan berdasarkan jenis game, macam game, subjek studi, pendekatan pembelajaran, jenis pembelajaran, subjek yang terlibat dalam penelitian, dan sejumlah topik yang berpotensi untuk integrasikan dengan topik lain agar didapatkan novelty. Temuan penelitian ini dapat membantu peneliti yang relevan untuk mengenali tren penelitian dalam penggunaan game untuk pembelajaran sekolah dasar secara global dan merekomendasikan arah untuk penelitian lebih lanjut.
Kata Kunci: permainan, sekolah dasar, analisis bibliometrik.

Abstract

Elementary school learning that is integrated with games can increase student motivation in learning so that it can have a positive impact on learning outcomes. The bibliometric review used in this research aims to analyze articles that discuss the use of games at the elementary school level published in the Scopus database indexed journal for the period 2013-2022. A total of 122 articles discussing the integration of games in primary school level learning were analyzed. The review findings show that there was a significant increase in the number of publications in 2016-2021, around 77.87% of articles were published in that period. Spain and Indonesia dominate the number of publications. Four authors with 3 publications each are influential. Data visualization shows that this research topic can be grouped based on the type of game, type of game, subject of study, learning approach, type of learning, the subject involved in research, and a number of topics that have the potential to be integrated with other topics to obtain novelty. The findings of this study can help relevant researchers to recognize research trends in the use of games for primary school learning globally and recommend directions for further research.
Keywords: *game, elementary school, bibliometric analysis.*

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INTRODUCTION

The use of games in learning is an important element in the teaching and learning process in elementary schools. Game-based learning has been widely used in elementary schools (S A Zabala-Vargas et al., 2022). The use of digital games can stimulate children cognitively in a fun way (Moron et al., 2022). Games can relax children's brains (Dewi & Verawati, 2022). The use of games can turn a boring learning environment into a smarter one (Kamalodeen, Ramsawak-Jodha, Figaro-Henry, Jaggernauth, & Dedovets, 2021). Collaborative learning activities can be done through team games (Sumtsova et al., 2018) so as to improve interpersonal relationships among students (Fernández-Gavira, Espada-Goya, Alcaraz-Rodríguez, & Moscoso-Sánchez, 2021).

Previous research has discussed a lot about the use of games for learning at the basic education level which has an impact on a number of aspects that students have, but there is very limited information regarding the results of the analysis and summaries of a number of state-of-the-art research. Research on the impact of video games has been carried out in Ireland which has shown that statistically, it can improve math performance and student engagement in learning. However, there are also other results in the form of math anxiety experienced by female students after playing games (Rocha & Dondio, 2021). In China, experiments have also been carried out regarding the integration of educational games in language learning that can increase vocabulary acquisition (Chen, Yang, & Mei, 2021). In Indonesia, non-digital games are used in physical education to develop social skills (Hartanto, Kusmaedi, Ma'mun, & Abduljabar, 2021) and locomotor skills (Sahudi, Priyono, & Saputra, 2021).

The summary of relevant previous research can be done using bibliometric analysis. This methodology was initiated by Eugene Garfield in the mid-20th century (Cronin, 2001). Bibliometrics implements a series of mathematical and statistical methods in various scientific literature for analysis (González-Zamar & Abad-Segura, 2021). Bibliometric analysis is used to review various aspects such as countries, institutions, authors, and journals and can also be used to analyze patterns of collaboration among various actors such as countries, institutions, and authors (Cardella, Hernández-Sánchez, Monteiro, & Sánchez-García, 2021).

Using the Scopus database from 2013 to 2022, this study intends to examine a variety of studies on the use of games in primary school education. Six research questions were posed to investigate the current trends and patterns in the use of games in primary school:

1. How did the publication output profile of game usage in elementary school learning change from 2013 to 2022?
2. How did the publishing of game usage in elementary school learning spread across the world's nations and institutions?
3. Who were the world's leading researchers on the use of games in elementary school learning?
4. How did publishing trends on the use of games in primary school learning change between 2013 and 2022?
5. How did the presentation of study findings on the usage of games in primary school learning reveal a trend?
6. How significant was the 2013-2022 contribution of Indonesian scholars to the study of the use of games in primary school learning?

This review provides a useful summary of how to utilize games in elementary school education. The structure of our article is as follows. In the next section, we describe the datasets and methods used for this investigation. The Results Part gives responses to our study questions in the third section. The limits and ramifications of our study are then discussed before we deliver our results.

METHOD

Research Design and Database

The study followed the guidance of a bibliometric study. Bibliometric review is very powerful in examining and evaluating a number of works of literature in a particular field of study (McNicholas, Floyd, Fennimore, & Fitzpatrick, 2022). This study supports several Scopus database articles. Since this collection contains journals and conference proceedings that are regarded as more authoritative by the scientific community, as well as for their consistency and regularity, it is a valuable resource. The investigation began by doing an online search on February 15, 2022.

Article Search Strategy

To get some relevant articles, keywords are entered into the search engines. The keywords are “game” and “primary education”. To broaden the search, the equivalent words used in "primary education" are: "primary school", "elementary education", "elementary school", "basic school", and "basic education". From the results of entering these keywords, it was recorded that there were 3,266 documents.

For a more precise search, several inclusion criteria were applied, including 1) the type of open access is limited to the Gold type so that all articles to be analyzed are easy to obtain; 2) the analyzed articles were published in the last 10 years (2013-2022) to have high relevance to the development of this topic, 3) this review is limited to the field of Social Science; 4) the language of the article to be reviewed is English to make it easier to read the article; and 5) this review only focuses on articles published by the Journal, not from the results of the Proceedings.

Using the following search query, the main database was extracted from Scopus:

TITLE-ABS-KEY(game* AND "primary school" OR "elementary education" OR "elementary school" OR "primary education" OR "basic school" OR "basic education") AND (LIMIT-TO (OA,"publisherfullgold")) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"SOCI")) AND (LIMIT-TO (LANGUAGE,"English")) AND (LIMIT-TO (SRCTYPE,"j"))

In the end, 122 documents were collected for examination. In the final data, the following fields were captured for each document: article identifying number, topic indicates, publisher journal, cited connection, authors, institution, nation, document link, and publication year.

Data analysis

Scopus Analyzer and VOSviewer were used to process these data for bibliometric and networking analysis, respectively. The VoSViewer program was used to determine the study trend for any issue (Jiménez-García, Ruiz-Chico, Peña-Sánchez, & López-Sánchez, 2020; Shah, Lei, Ali, Doronin, & Hussain, 2020). The study was conducted to analyze research trends, such as characteristics of publication outputs, document publications, language source materials, distribution of countries and organizations, distribution of outputs within subject categories, leading authors, leading citations, and articles published trends from 2013 to 2022.

RESULT AND DISCUSSION

1. How did the publication output profile of game usage in elementary school learning change from 2013 to 2022?

This research aims to review 122 articles published in the period 2013-2022 that discuss the use of games in elementary school learning. All of these articles are spread across 57 sources in the form of research journals indexed in the Scopus database. The growth in the number of publications related to this topic is about 2.95 per

year. This topic also attracted 370 authors from various countries in the world. Other general information such as the average citation for each document per year, the number of references, and other information can be seen in Table 1.

Table 1
General Information related to Data 122 articles

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2013:2022
Sources (Journals, Books, etc)	57
Documents	122
Average years from publication	2.95
Average citations per documents	4.795
Average citations per year per doc	0.901
References	5052
DOCUMENT TYPES	
article	122
DOCUMENT CONTENTS	
Keywords Plus (ID)	186
Author's Keywords (DE)	435
AUTHORS	
Authors	370
Author Appearances	396
Authors of single-authored documents	17
Authors of multi-authored documents	353
AUTHORS COLLABORATION	
Single-authored documents	17
Documents per Author	0.33
Authors per Document	3.03
Co-Authors per Documents	3.25
Collaboration Index	3.36

In general, the growth in the number of documents from year to year has increased dramatically. Figure 1 shows the change in the number of documents every year from 2013 to 2022. In 2013 and 2014, the number of documents stagnated at 6 papers per year. A number of scientists were involved in publishing research in 2013 and 2014, namely de Queiroz et al. (2013), Nursyahidah et al. (2013), Cheng et al. (2013), Frizzo (2013), Razak & Connolly (2013), Jaelani et al. (2013), Otero Saborido et al. (2014), Okeke (2014), Hsiao et al. (2014), Astuti (2014), Halloluwa et al. (2014), and Gil-Madrona et al. (2014). 2016 was the year in which only 2 articles were published and this is the lowest number in the last 1 decade. However, after 2016, the number of documents issued increased significantly until it peaked in 2021 with 38 papers. By early 2022, 4 documents had been published (Nur, Kartono, Zaenuri, & Rochmad, 2022; Santurio & Fernández-Río, 2022; Sibgatullin et al., 2022; Xenofontos & Alkan, 2022).

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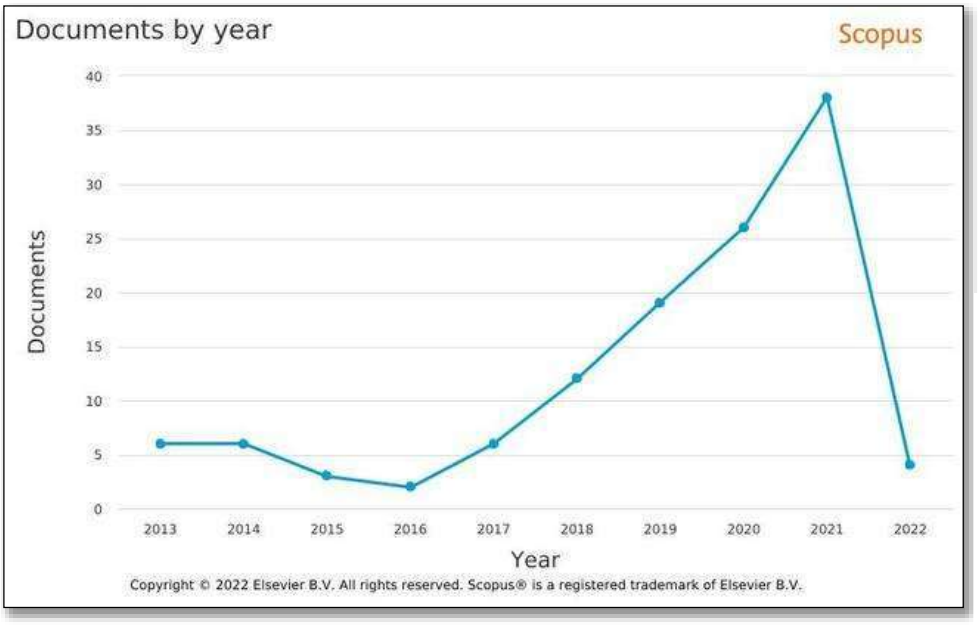
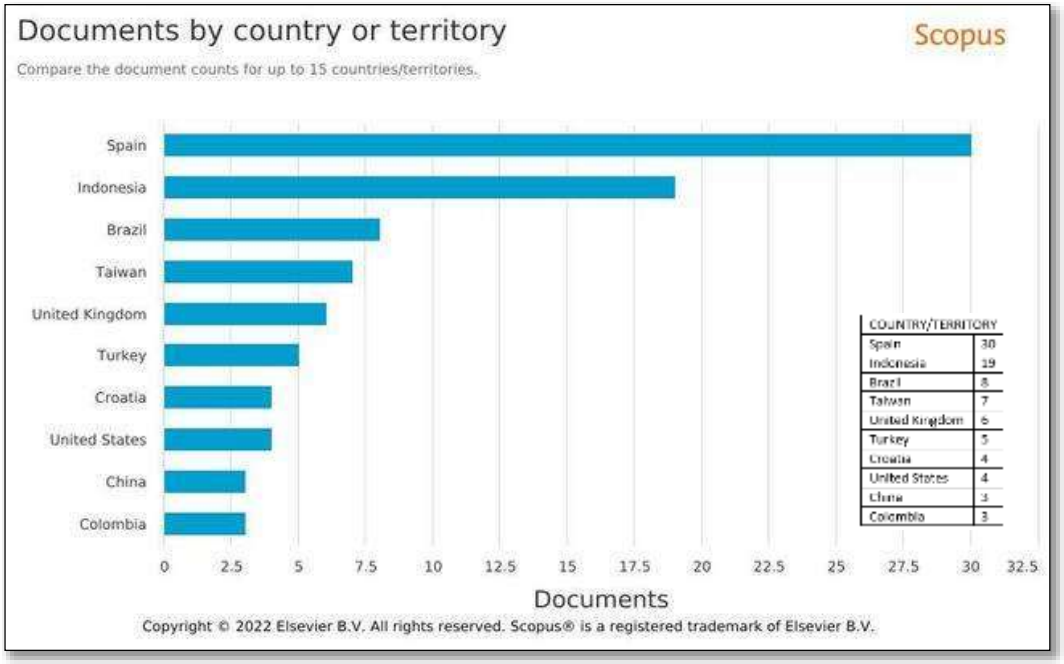


YEAR	
2022	4
2021	38
2020	26
2019	19
2018	12
2017	6
2016	2
2015	3
2014	6
2013	6

Figure 1. Growth of Number of Papers per Year

2. How did the publishing of game usage in elementary school learning spread across the world's nations and institutions?

The production of articles on the topic of using games in primary schools is spread across some countries (Figure 2). It is clear, sequentially, that Spain (30) and Indonesia (19) dominate the production of the number of articles. Brazil (8), Taiwan (7), the United Kingdom (6), and Turkey (5) came in next. Croatia and United States were able to produce the same number of papers, namely 4 works. China and Colombia managed to donate 3 publications each related to this topic.



COUNTRY/TERRITORY	
Spain	30
Indonesia	19
Brazil	8
Taiwan	7
United Kingdom	6
Turkey	5
Croatia	4
United States	4
China	3
Colombia	3

Figure 2. Documents Issued by Individual Countries

A number of papers related to the use of games in inter-affiliate elementary school learning can be seen in Table 2. Ten institutions contributed documents related to this topic. These institutions come from Spain, Indonesia, Taiwan, Russia, and South Africa. Institutions from Spain and Indonesia dominate this affiliate contribution.

Table 2
Institutional Contribution by Country

Affiliation	Documents	Country
Universidad de Oviedo	6	Spain
Universitas Negeri Jakarta	4	Indonesia
Universidad de Extremadura	3	Spain
National Taiwan Normal University	3	Taiwan
Universidad de Granada	3	Spain
Universitas Sriwijaya	3	Indonesia
Kazan Federal University	3	Russia
Universidad de Murcia	2	Spain
Universidad de Castilla-La Mancha	2	Spain
University of South Africa	2	South Africa

3. Who were the world's leading researchers on the use of games in elementary school learning?

In the context of the most prolific authors, Freu, Gamero, García-Ceberino, and Ibáñez were able to produce 3 articles each. For the rest, several authors can contribute 2 documents each (See Figure 3).

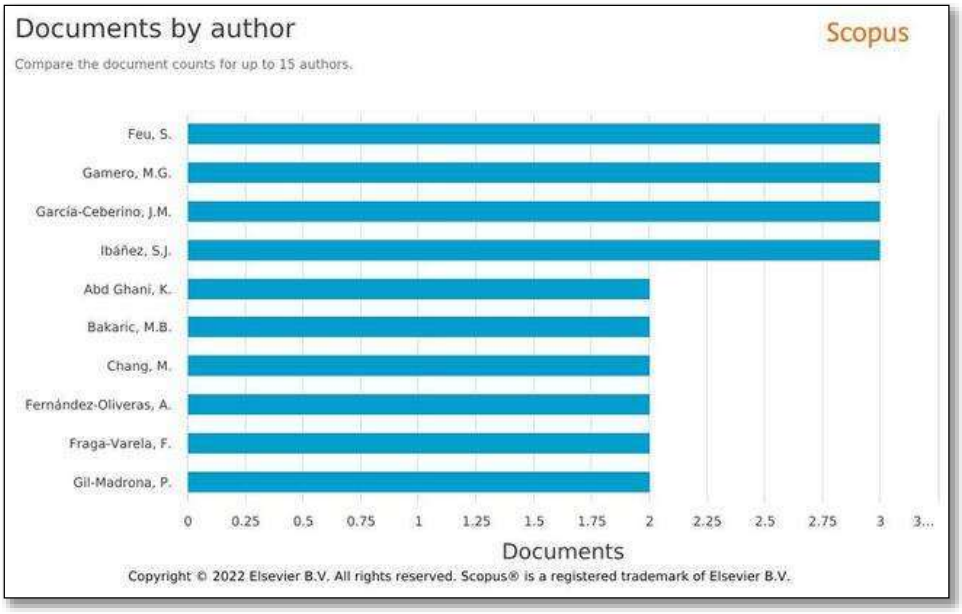


Figure 3. The Most productive author during 2013-2022

In general, total author citations and total document citations are directly proportional (See Figure 4 and Table 3). Authors who are members of one article have the same number of citations. Cózar-Gutiérrez and Sáez-López co-authored and received 63 citations. Fernández-Montalvo, Peñalva, and Irazabal were cited 52 times. Cheng along with Lou, Kuo, and Shih earned 50 citations. The authors cite Cañabate and colleagues 22 times.

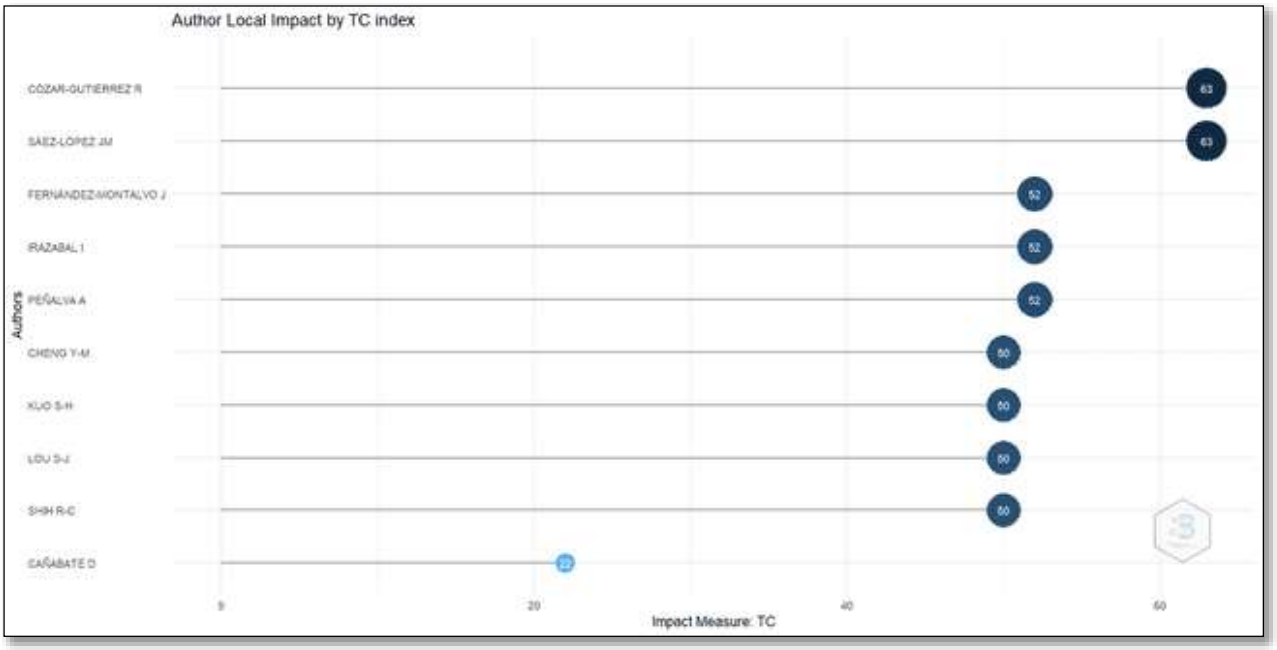


Figure 4. Total citations received by the Top Ten Authors

Table 3
Total Citation Top 10 Documents

Document	Author (s)	Total Citations
Game-based learning and gamification in initial teacher training in the social sciences: an experiment with MinecraftEdu	Cózar-Gutiérrez & Sáez-López (2016)	63
Internet Use Habits and Risk Behaviours in Preadolescence	Fernández-Montalvo et al. (2015)	53
Investigating elementary school students' technology acceptance by applying digital game-based learning to environmental education	Cheng et al. (2013)	50
Analyzing emotions and social skills in physical education	Cañabate et al. (2018)	22
Game-based learning: Increasing the logical-mathematical, naturalistic, and linguistic learning levels of primary school students	Pérez et al. (2018)	21
Effective home-school partnership: Some strategies to help strengthen parental involvement	Okeke (2014)	20
Also want girls to play: Participation of children in organized physical activity in the context no school	Gil-Madrona et al. (2014)	19
Application of the ubiquitous game with augmented reality in primary education	Sáez-López et al. (2019)	16
The influence of collaborative learning games within different devices on student's learning performance and behaviors	H. S. Hsiao et al. (H. S. Hsiao, Chang, Lin, Chang, & Chen, 2014)	16
Design and implementation of the anonymized social network-based mobile game system for learning mathematics	Juric et al. (2018)	14

4. How did publishing trends on the use of games in primary school learning change between 2013 and 2022?

Reviews of the use of games in learning at the elementary school level are filtered based on publications by research journals only (Table 4). The International Journal of Emerging Technologies in Learning leads with 14 papers. Meanwhile, the second position with 11 documents was occupied by Sustainability Switzerland. Education Sciences and the International Journal of Human Movement and Sports Sciences shared the same number of 8 articles and were followed by Communicar which was able to produce 4 documents. On the other hand, some journals contributed by publishing 3 documents, namely Apunts Educacion Physica Y Deportes, Eurasia Journal of Mathematics Science and Technology Education, Frontiers in Education, International Electronic Journal of Elementary Education, and Maringa Journal of Physical Education.

Table 4
Number of Documents by Journal

No	SOURCE TITLE	Number of documents
1	International Journal of Emerging Technologies in Learning	14
2	Sustainability Switzerland	11
3	Education Sciences	8
4	International Journal of Human Movement and Sports Sciences	8
5	Comunicar	4
6	Apunts Educacion Fisica Y Deportes	3
7	Eurasia Journal of Mathematics Science and Technology Education	3
8	Frontiers in Education	3
9	International Electronic Journal of Elementary Education	3
10	Journal Of Physical Education Maringa	3

5. How did the presentation of study findings on the usage of games in primary school learning reveal a trend?

Visualization of research trends on game integration in elementary school learning was obtained from 122 woks indexed by the Scopus database. In the data visualization (Figure 5), it can be seen that there are seven clusters with their respective colors (red, green, blue, yellow, purple, light blue, and orange). Cluster 1 (red) indicates the use of collaborative learning in primary education and higher education. Cluster 2 (green) relates to the use of games in physical education and mathematics education by considering gender. Students learn by using serious games, which is the theme of Cluster 3 (blue). Cluster 4 (yellow) illustrates e-learning in elementary schools that integrates digital educational games and educational technology. Cluster 5 (purple) discusses the discussion on the application of game-based learning to motivate student learning. Cluster 6 (light blue) is related to education for children using video games to promote academic performance. The last domain, Cluster 7 (orange) relates to the discussion of the use of augmented reality through mobile learning in inclusive education.

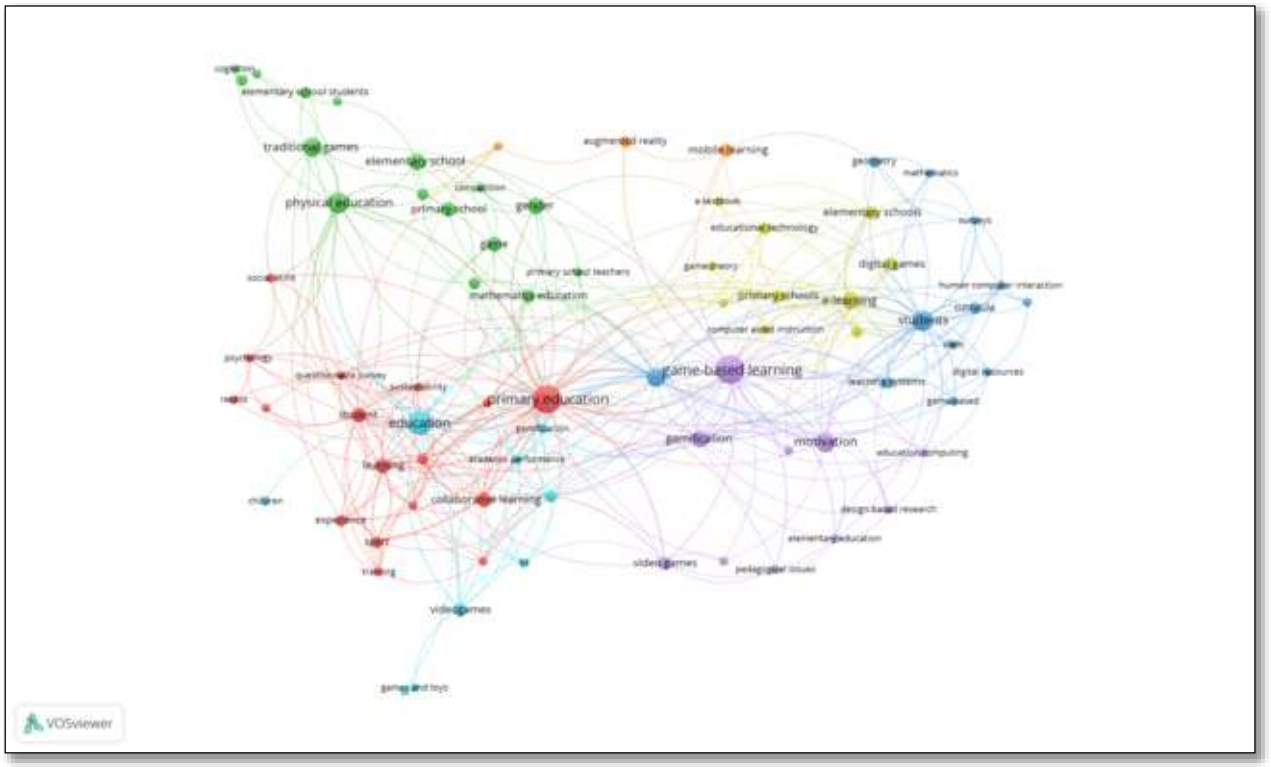


Figure 5. Overview of Research related to Game Utilization in Elementary Schools (2013-2022)

Some topics were not included in the previous clusters, namely special education, computational thinking, and PMRI (Indonesian Realistic Mathematics Approach). This means that the three topics can be combined with other topics so that they can provide novelty for future research (Figure 6).

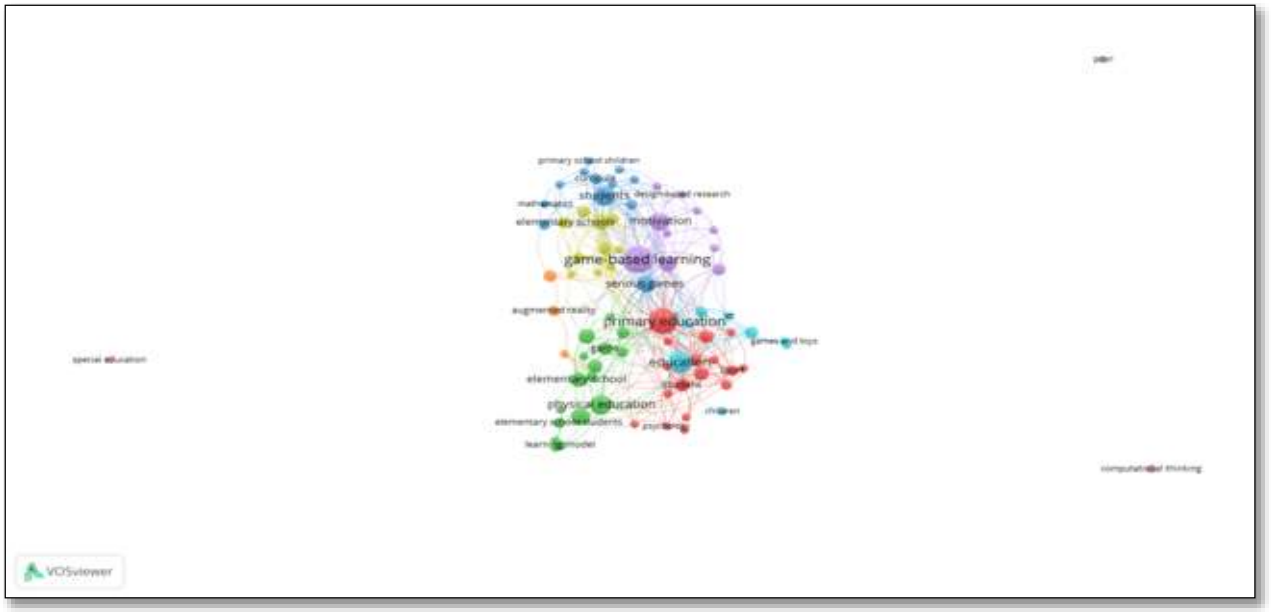


Figure 6. Next Research Opportunity

The relationship between variables can be found if a more in-depth analysis is carried out on each of these variables. Figure 7 shows what types of games are used in learning at the basic education level. The types of games include digital games, traditional games, serious games, and educational games.

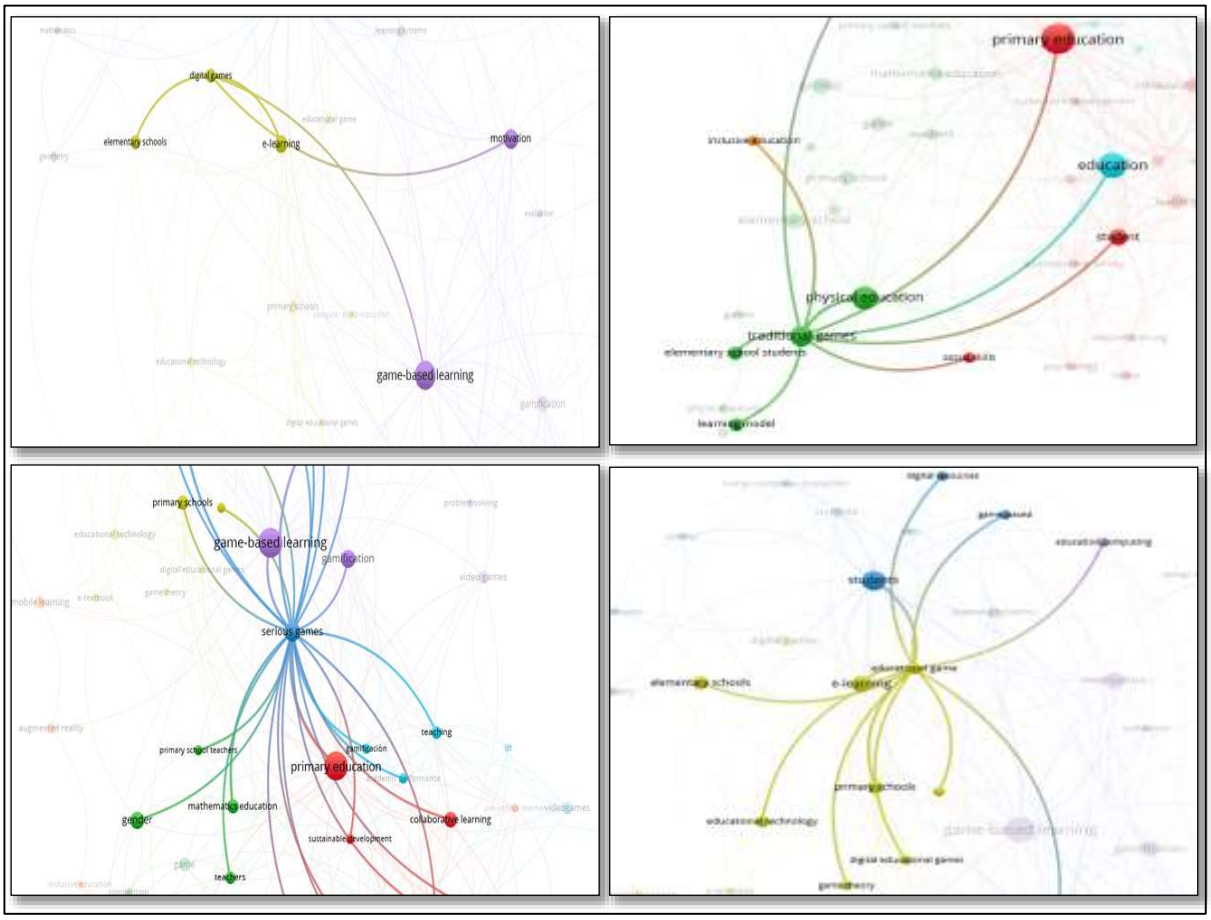


Figure 7. Types of Games Used in Learning in Elementary Schools

When viewed from the field of study, there are two main subject areas such as mathematics, and physical education, which utilize games in the implementation of Figure 8 learning.

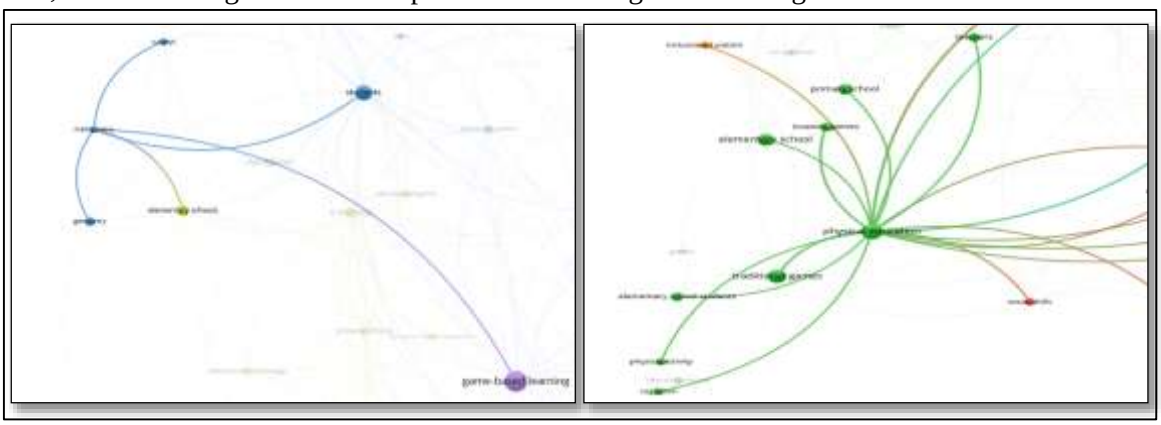


Figure 8. The main fields of study that use games in their learning

Another finding is related to the learning approach used in state-of-the-art articles. Game-based learning (e-learning), collaborative learning, problem-solving, gamification, STEM, and computer-aided instruction is learning approaches that are often used. The relationship between these variables can be seen in Figure 9.

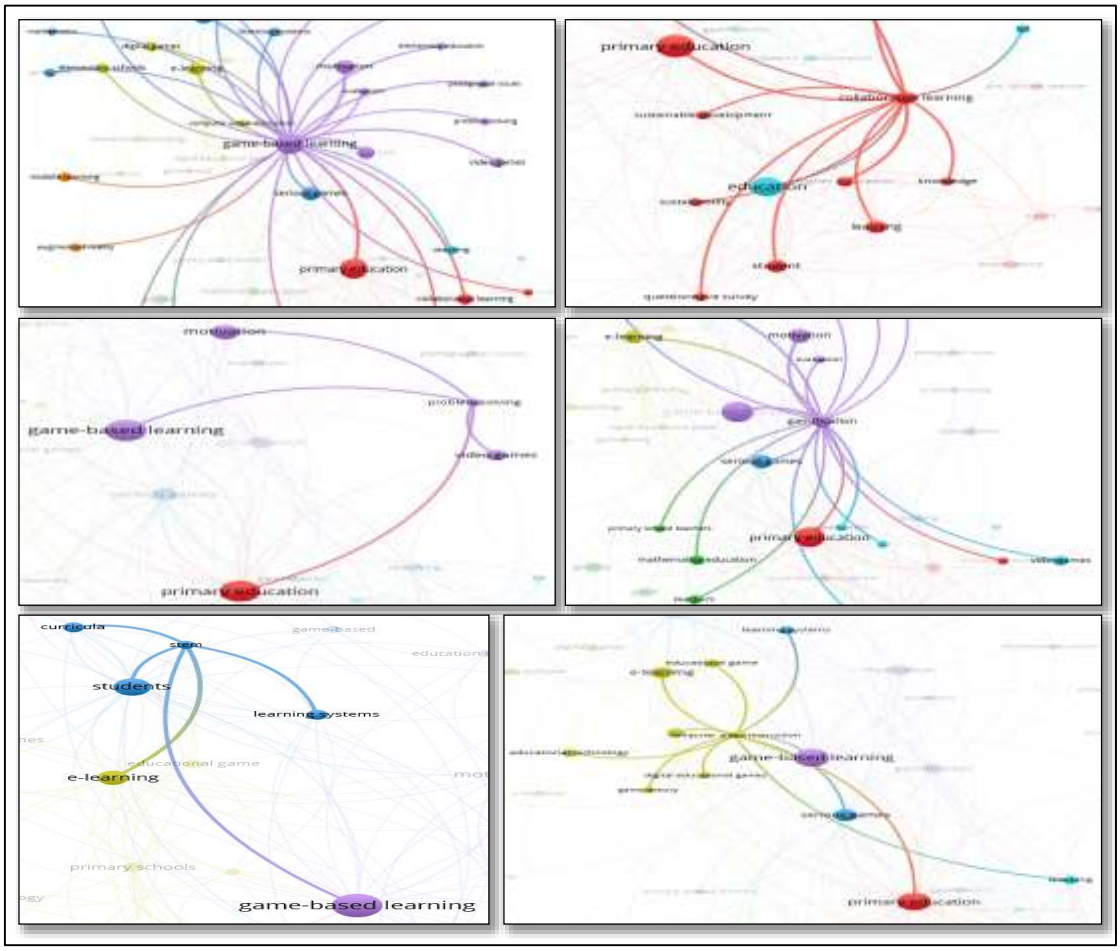


Figure 9. Frequently Used Learning Approach

Research on the topic of using games in elementary school learning involves a number of research subjects. The subjects frequently mentioned in these articles are pre-service elementary education teachers, primary school teachers, and primary school children (Figure 10).

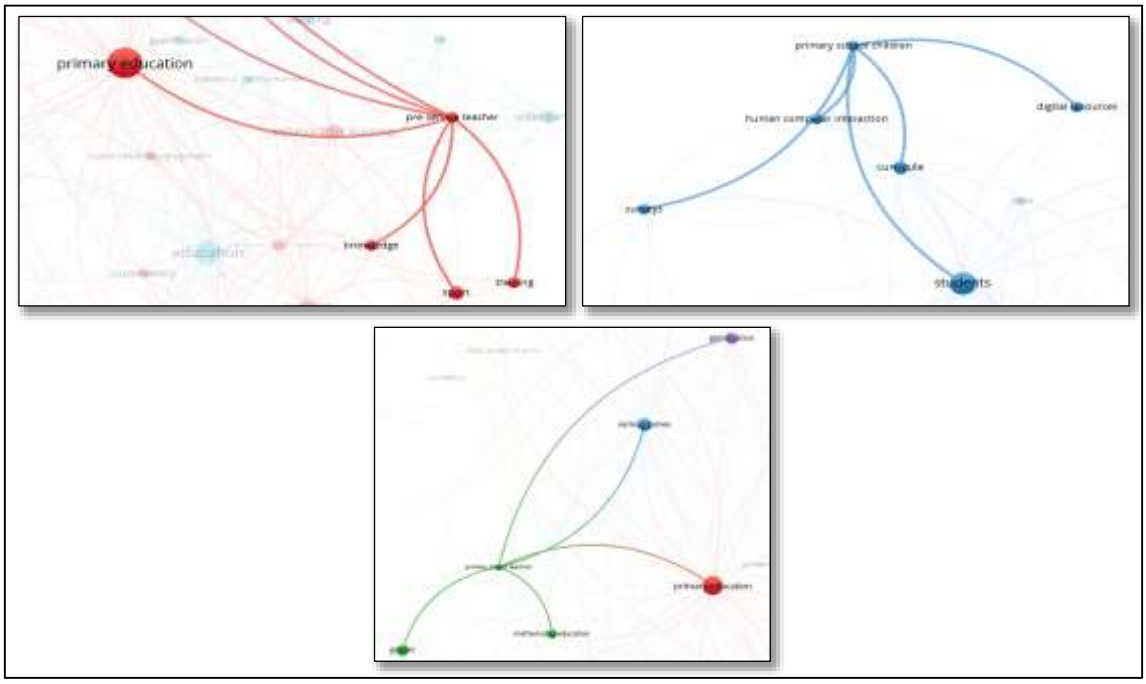


Figure 10. Research Subjects

6. How significant was the 2013-2022 contribution of Indonesian scholars to the study of the use of games in primary school learning?

Indonesia donated 19 documents related to the integration of games in primary school level learning. The papers were spread across some universities (Table 5). Jakarta State University and Indonesia Education University competed with each other being able to publish 4 articles. Sriwijaya University and Yogyakarta State University were next with the achievements of 3 and 2 articles respectively. For the rest, some universities were able to publish 1 article during that period.

Table 5
Number of Documents issued by Affiliates from Indonesia

No	Affiliation	Number of documents
1	Universitas Negeri Jakarta	4
2	Universitas Pendidikan Indonesia	4
3	Universitas Sriwijaya	3
4	Universitas Negeri Yogyakarta	2
5	Majalengka University	1
6	IKIP PGRI Pontianak	1
7	University of Nahdlatul Ulama Lampung	1
8	Universitas PGRI Palembang	1
9	University of Sriwijaya	1
10	STKIP PGRI Lubuklinggau	1

There are 8 journals idolized by writers from Indonesia during 2013-2022 (Table 6). The International Journal of Human Movement and Sports Sciences is a journal that frequently publishes articles by Indonesian authors. In second and third positions, respectively, are the International Journal of Emerging Technologies in Learning and the Journal on Mathematics Education. After that, there are Jurnal Cakrawala Pendidikan, European Journal of Educational Research, Participatory Educational Research, Teoria Ta Metodika Fizicnogo Vihovanna, dan Universal Journal of Educational Research.

Table 6
Favorite Journal of Indonesian Authors

No.	Source Title	Documents
1	International Journal of Human Movement and Sports Sciences	8
2	International Journal of Emerging Technologies in Learning	3
3	Journal On Mathematics Education	3
4	Cakrawala Pendidikan	1
5	European Journal of Educational Research	1
6	Participatory Educational Research	1
7	Teoria Ta Metodika Fizicnogo Vihovanna	1
8	Universal Journal of Educational Research	1

The growth of jobs that discuss the use of games in primary school learning has increased significantly over the past decade. Starting with 6 papers in 2013 and reaching a peak in 2021. Articles discussing this topic in 2022 have the potential to exceed the achievements in 2021. The rapid increase in the number of documents occurred when COVID-19 hit all countries from 2019 until now. Until this manuscript was compiled, there have been 4 authors who published their documents, namely Xenofontos & Alkan (2022), Sibgatullin et al. (2022), Santurio & Fernández-Río (2022), dan Nur et al. (2022).

Games take many forms. Based on the use of technology, games are grouped into digital games and traditional games. Digital games can attract and develop learning motivation (Tazouti, Boulaknadel, & Fakhri, 2019). Video games can be used by teachers to train students to solve problems (Mee Mee et al., 2021). Traditional games are more focused on the use of physical activity (Syaflin et al., 2021). Serious games are not used for entertainment but can increase the independence and motivation of elementary school students (Papanastasiou, Drigas, & Skianis, 2017). On the other hand, educational games can be used by teachers to assist students in improving language vocabulary at the elementary school level.

Various kinds of digital games are used in several fields of study in elementary schools. Video games and augmented reality through mobile learning are the types of digital games used. Mathematics and physical education were the main fields of study when the previous researchers conducted their research. A number of researchers apply games in mathematics learning in elementary schools (Fernández-Oliveras, Espigares-Gámez, & Oliveras, 2021; Fraga-Varela Dr., Vila-Couñago Dr., & Martínez-Piñeiro Dr., 2021; P Juric, Bakaric, & Matetic, 2021; Pires et al., 2019). Games in the form of invasion can be used in the field of physical education studies (Otero Saborido et al., 2014).

Variable learning approach used by research is very diverse. Vázquez-Vílchez et al. (2021) used game-based learning for research involving teachers as research subjects. On the other hand, collaborative learning is integrated with a number of forms of games to achieve this learning goal. These games include serious games (Saitua-Iribar, Corral-Lage, & Peña-Miguel, 2020) and video games (Martín-del-Pozo, García-Valcárcel Muñoz-Repiso, & Hernández Martín, 2019; Marta Martín del Pozo, Basilotta Gómez-Pablos, & García-Valcárcel Muñoz-Repiso, 2017). Juric et al. (2018) uses a problem solving approach along with social media to develop learning outcomes and socialization among class members. Another approach is gamification which is usually collaborated with games-based learning (Ramón Cózar-Gutiérrez & Sáez-López, 2016; Sergio A. Zabala-Vargas et al., 2021).

Three subjects are often involved in previous studies that have two types of learning. Research subjects frequently involved are pre-service elementary education teachers (García-Ceberino, Feu, Gamero, & Ibáñez, 2021; M Martín del Pozo, Basilotta Gómez-Pablos, & García-Valcárcel Muñoz-Repiso, 2017; Mee Mee et al., 2020; Perera & Hervás-Gómez, 2021), primary school teachers (Fraga-Varela, Vila-Couñago, & Rodríguez-Groba, 2021; Susman & Pavlin, 2020; Yaşar, Kıyıcı, & Karataş, 2020), and primary school children (Chiazzese, Fulantelli, Pipitone, & Taibi, 2018; Kayumova, Gainullina, Akhmadieva, Matvienko, & Kabakhidze, 2021). This learning is also related to mobile learning which is considered to be able to penetrate space and time (Jen-

Yi, Chuan-His, & Yi-Hsin, 2020), and e-learning which is promoted to increase student motivation, engagement, and learning (T. Alshammari, 2020).

CONCLUSION

Through bibliometric analysis, this research intends to review technical papers for the period 2013-2022 related to the use of games for learning at the elementary school level. The results of the review show a significant increase in terms of the number of papers published in the 2016-2021 period. Some countries, such as Spain and Indonesia, are very dominant in terms of the number of documents. Four authors are considered to have had more influence in this field. The data mapping display shows that relevant previous research can be classified based on the type of game, type of game, subject of study, learning approach, type of learning, the subject involved in research, and a number of topics that have the potential to be integrated with other topics to obtain novelty. The results of this review report can provide mapping and identify research trends, especially on the topic of game integration in teaching in elementary schools so that it can be used as an alternative reference for future research. This review is limited to the elementary school level and uses only the Scopus database. The next review paper should be made at other levels of education and use a combination of prestigious databases such as Scopus and Web of Science.

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