


# Gamification and game-based learning in primary education: A bibliometric analysis

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## ABSTRACT

Play's role in children's learning is crucial, necessitating effective teaching methods that boost engagement. This study maps the Scopus-indexed literature from 2013-2023, focusing on gamification and game-based learning's impact on learning outcomes and engagement in primary education. Initially, 233 articles were identified from the Scopus, with 36 relevant ones selected after manual review. Findings show a considerable research volume on gamification and game-based learning, but limited focus on primary education, with Spain leading in publications. Co-authorship analysis reveals few connections, indicating limited collaboration among researchers. The study indicates that gamification and game-based learning positively influence learning outcomes by enhancing engagement and participation among students. However, it acknowledges limitations due to using only open-access documents from the Scopus, suggesting future research should explore other databases for more comprehensive insights.

**Keywords:** bibliometric analysis, gamification, game-based, primary education, learning

## INTRODUCTION

Play is an important part of children's learning. With the improvement of technology, new concepts and strategies emerge such as integrating play and learning in order to improve the learning process of the students. In the past decade, gamification has earned recognition. Gamification is the process of applying game elements to non-gaming elements. It is primarily used to increase user engagement and motivation (Takbiri et al., 2023). Gamification's application has expanded in commerce, health, and education (Inocencio, 2018), and within the field of education, gamification has attracted the attention of researchers due to its potential to enhance student performance by transforming traditional lessons into enriched learning experiences (Inocencio, 2018).

Simultaneously, game-based learning has emerged as a distinct approach that develops interactive games specifically designed for educational purposes. It aims to impart targeted knowledge, skills, or objectives to learners (Inocencio, 2018). The popularity of both gamification and game-based learning can be attributed to their ability to motivate and engage students, leading to improved learning outcomes of primary education students. The younger generation has been heavily influenced by technology and instant access to information, and often exhibits a lack of motivation and interest in traditional classroom learning (Fiuza-Fernández et al., 2022). This necessitates the exploration of alternative educational approaches that can inspire student engagement and cultivate a genuine thirst for knowledge (Fiuza-Fernández et al., 2022). Gamification and game-based learning have emerged as strategies to address these challenges, offering benefits such as increased motivation, engagement, competition, collaboration, and self-directed learning (Fiuza-Fernández et al., 2022).

Gamification is used in different subject areas in order to promote improvement in motivation and engagement. Based on research focused on science lessons, gamified online learning programs have a positive impact on learners' motivation, self-efficacy, self-determination, career motivation, and grade motivation of learners. It also has a positive impact on the learner's understanding of educational content as it delivers difficult content in an enjoyable and easier way (Park & Kim, 2021). One study also used gamification to investigate the effect of gamification on students in physical education, and it resulted in an increased motivation of the learners toward the lesson (Sotos-Martinez et al., 2023).

Similar to gamification, game-based learning is a teaching method considered by many researchers that encourages children to participate in active learning (Avdiu, 2019). Game-based learning means including educational content in games (Avdiu, 2019).

The rationality of gamifying the learning process by incorporating game elements and mechanics stems from the belief that such an approach can effectively engage learners and shape their behavior in a desirable manner (Dichev & Dicheva, 2017). Gamification and game-based learning offer avenues for enhancing student motivation, engagement, and learning outcomes because the integration of game elements in lessons has the potential to transform traditional teaching methods and can cater to the evolving needs and preferences of the younger generation.

This study is a bibliometric analysis of the impact of gamification and game-based learning on learning outcomes and engagement in primary education. By definition, bibliometrics is defined as the science that studies the nature and course of a discipline through its publication (Hincapie et al., 2021). The bibliometric analysis of this study is to show how the area of investigation has evolved over time (Trinidad et al., 2021).

### **Purpose**

The purpose of this bibliometric analysis is to provide a scientific mapping of the impact of gamification and game-based learning on learning outcomes and engagement in primary education. This analysis is only limited to journal articles published between 2013 and 2023. Moreover, this analysis specifically aims to analyze the distribution of publications on gamification and game-based learning over the years, to illuminate countries and authors who contributed the most research on the area of investigation, to figure out the citation count distribution among the research titles on gamification and game-based learning, and to map out co-occurrence patterns of keywords and interconnection of gamification and game-based learning in primary education using the co-citation analysis. While previous systematic reviews have focused on reviewing the literature involving gamification or game-based learning for the non-specific type of learners such as Dichev and Dicheva (2017), this review will solely concentrate on analyzing journal articles at the primary level using the web database, the Scopus.

### **Research Question**

This bibliometric analysis presents 36 journal articles from the Scopus, a database website that cites journal articles, conference papers, book chapters, and others. This bibliometric study aims to document and synthesize patterns in knowledge production in gamification and game-based learning and to address the following research questions:

1. What is the distribution of publications on the impact of gamification and game-based learning on learning outcomes and engagement in primary education varied across different years?
2. Which countries have contributed the most to research on the impact of gamification and game-based learning on learning outcomes and engagement in primary education learning in primary education?
3. What is the citation count distribution among the top 10 most cited research articles on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?
4. Which authors collaborated and contributed the most to the research and what is the extent of their collaboration on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?
5. What are the co-occurrence patterns of keywords or topics in the research articles on gamification and game-based learning in primary education on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?
6. How are research articles on the impact of gamification and game-based learning on learning outcomes and engagement in primary education interconnected through co-citation analysis?

### **Conceptual Framework**

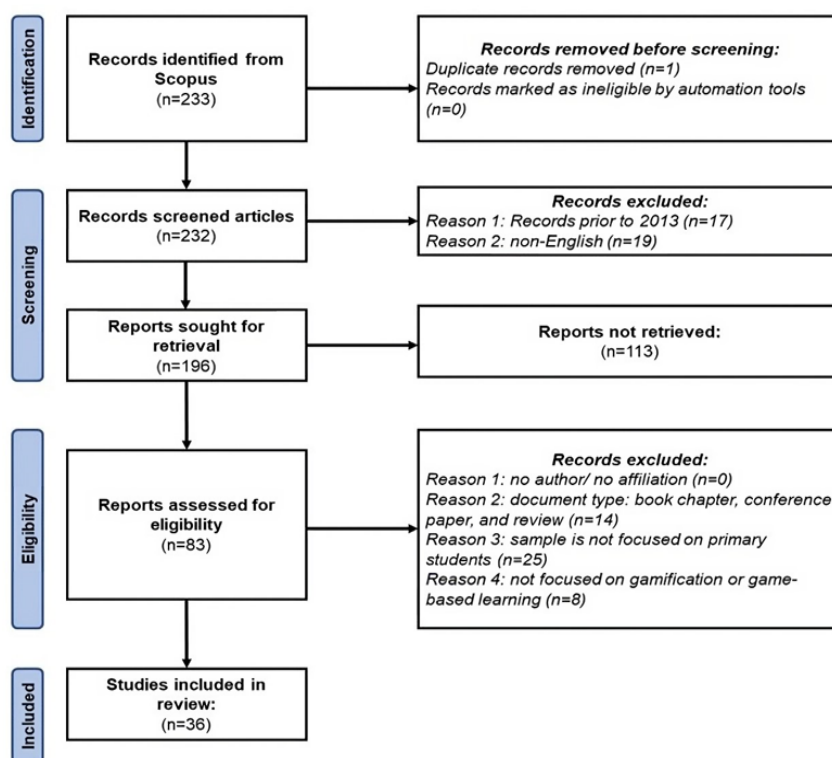
A bibliometric study serves the purpose of creating a scientific map that allows for the identification and classification of intellectual structures within a specific field of study over a defined period (Hallinger & Kovačević, 2019). In this context, citation serves as a metric to gauge research productivity and quality, indicating that articles with a higher number of citations are deemed to have greater influence or contribute higher quality insights to the existing body of knowledge (Geisler, 2000). Moreover, this study follows the four dimensions of conceptual models, these included size, time, and space. First, size in this study refers to the research productivity through the analysis of co-authorship, co-occurrences, and co-citation. Second, the time pertains to the period of time in which the included articles were published. This is from 2013 to 2023. Third, space refers to the geographic distribution of the publications being considered in the study.

### **Contributions**

The overview of the reviewed researchers about the impact of gamification and game-based learning on primary students' learning outcomes and engagement is one of the contributions of this study. Furthermore, this review can serve as a valuable resource for future researchers and education stakeholders, providing them with guidance to enhance their understanding and perspective on the impact of gamification and game-based learning in primary education

## **METHODOLOGY**

In this part of the study, the author discusses the steps for gathering the data in this bibliometric paper. From identifying the keyword terms to eliminating articles and including articles based on the exclusion and inclusion criteria that were utilized in the preferred reporting items for systematic reviews and meta-analysis (PRISMA) procedure. Additionally, the process of creating networks on VOSviewer was also discussed in this part of the study.



**Figure 1.** Inclusion & exclusion criteria (Adapted from Moher, 2013)

### Selection of Articles & Identification of Sources

The author selected the Scopus database as the primary source of relevant articles for this review. The choice of the Scopus database was based on its consistent standard for document selection in its index. Furthermore, the Scopus was preferred due to its advanced features for exporting bibliographic data (Hallinger & Nguyen, 2020).

The topical focus of this review is delimited to gamification, game-based learning, primary education or elementary education, and learning. The following keyword terms were used in the Scopus search:

TITLE-ABS-KEY ((gamification OR gamified OR “game-based” OR gamify) AND (“primary education” OR “elementary education”) AND learning)

After the identification of the keyword terms on the Scopus search, the author adopted PRISMA procedure for the guidelines for document search (Moher, 2013). These four stages were followed: identification, screening, eligibility, and included. **Figure 1** presents the compilation of publication data, obtained using PRISMA procedure (Moher, 2013) while ensuring the inclusion of relevant values for *n*.

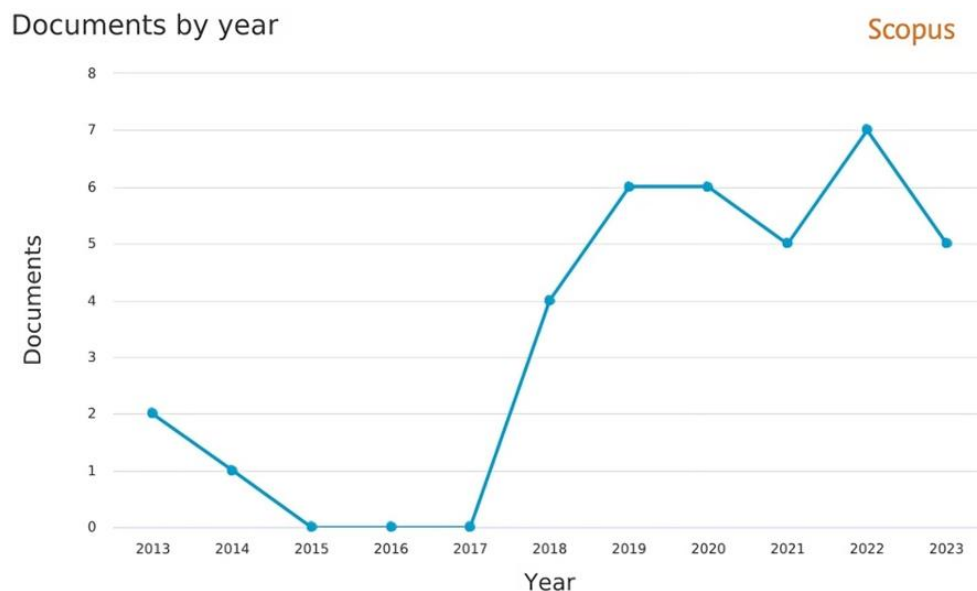
In the identification phase conducted in May 2023, a total of 233 documents were initially obtained from the database. Upon closer examination, one document was identified as a duplicate and subsequently eliminated. Moving forward, during the screening of the remaining 232 documents, 17 were excluded as they predated the year 2013. Additionally, 19 documents were removed from the original pool of 233 due to either being non-English or lacking available translations into English. Subsequently, 113 documents were rendered inaccessible and inactive, resulting in 83 documents qualifying for the next stage.

During the eligibility stage, a review process was conducted, leading to the exclusion of 14 documents categorized as reviews, book chapters, or conference papers. This left a selection comprised solely of articles sourced from journal publications. Further refinement resulted in removing additional 25 articles that did not focus on primary education. Finally, eight articles were eliminated as they did not pertain to gamification or game-based learning subjects. Ultimately, the paper included a total of 36 articles meeting the defined criteria.

### Data Analysis

In this part of the study, bibliometric analyses were conducted to interpret and understand the data collected from the Scopus database. These analyses were also utilized to address the research questions mentioned at the beginning of the study.

The 36 articles from the Scopus database were analyzed during the review process. To understand the geographical and chronological distribution of the impact of gamification and game-based learning on learning outcomes and engagements in primary education, Excel graphs of distribution by country and year from the database were exported. In addition, the chart for the citation overview of the articles was also exported in order to examine the citation patterns and trends received by the collected articles. However, the citation overview only included the top 10 cited articles from 2013 to 2023.



**Figure 2.** Distribution of publications of literature included in bibliometric analysis that is varied across different years (Generated from: Scopus Database based on open access journal articles)

Furthermore, the 36 articles from the Scopus database were exported as comma-separated values and uploaded into VOSviewer, a software program for creating bibliometric networks. Utilizing VOSviewer, the author conducted bibliometric analyses to map networks for co-authorship, co-occurrence, and co-citation. This allowed for a comprehensive exploration of the relationships and patterns among the articles in the dataset.

## RESULTS

This part of the study discusses the results acquired from the exported graphs from the Scopus database and the networks formed using the VOSviewer based on the 36 relevant articles included in this review in order to answer the research questions mentioned at the beginning of the study.

### 1. What is the distribution of publications on the impact of gamification and game-based learning on learning outcomes and engagement in primary education varied across different years?

Based on the graph in **Figure 2**, in 2013 and 2014, there were relatively fewer publications on impact of gamification and game-based learning on learning outcomes and engagement in primary education, with only two and one publication/s, respectively. The publications of articles gradually increased as there were four publications in 2018 that increased to six in both 2019 and 2020, meaning there was a slight increase in interest and research in the years that were mentioned. However, in 2021, the number of publications slightly decreased as there were only five publications. In 2022, there were seven publications suggesting a potential increase of interest in the area, and finally, in 2023, there were five publications.

Overall, the data suggests that the distribution of publications on gamification and game-based learning in primary education has varied across different years. This also suggests that few publications were done in this domain.

### 2. Which countries have contributed the most to research on the impact of gamification and game-based learning on learning outcomes and engagement in primary education learning in primary education?

**Figure 3** shows that Spain has the highest number of research contributions with 16 publications. It shows that there was a significant level of interest and research activity on the impact of gamification and game-based learning on learning outcomes and engagement in primary education in Spain. Following Spain, the United Kingdom, and the United States of America have three research publications each. China, Colombia, Finland, Italy, and Serbia have two research publications each. Moreover, the countries Australia, Belgium, Germany, Hong Kong, Indonesia, Iran, Kazakhstan, Malaysia, Mexico, Morocco, the Netherlands, South Korea, and Taiwan have one research publication each on gamification and game-based learning in primary education.

The data also shows that the publications of research on the field of investigation are more present in European countries compared to Asian countries and other parts of the world.

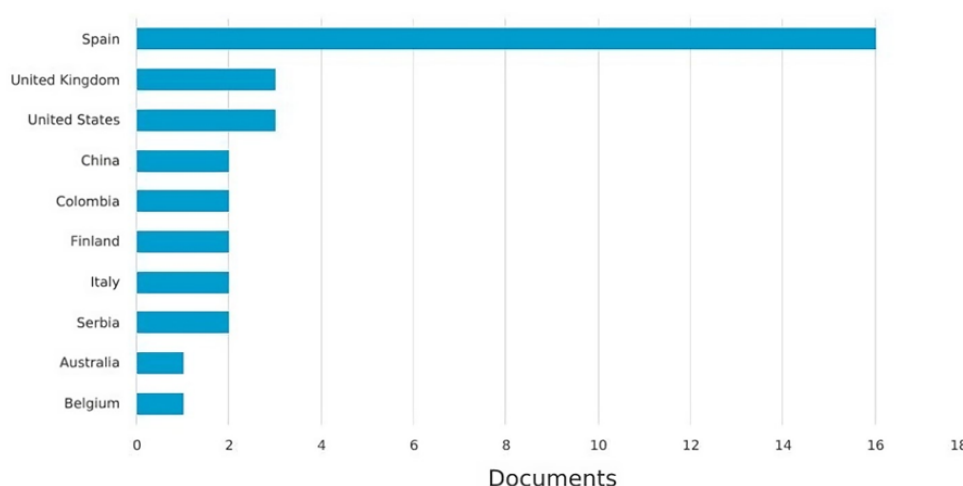
### 3. What is the citation count distribution among the top-10 most cited research articles on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?

**Table 1** shows the authors' contributions to the impact of gamification and game-based learning on learning outcomes and engagement in primary education based on the total citations of their articles from the Scopus database. The research article that has the highest citation count is entitled, "Evaluation of learning outcomes using an educational iPhone game vs. traditional game" published in 2013, with a total citation count of 123. The second-highest citation count belongs to the article "Evaluating the effectiveness of a game-based rational number training-In-game metrics as learning indicators," published in 2018, with a

## Documents by country or territory

Compare the document counts for up to 15 countries/territories.

Scopus



**Figure 3.** Distribution of publications of literature included in bibliometric analysis arranged by country (Generated from: Scopus Database based on open access journal articles)

**Table 1.** Rank order of 10 most cited documents from 36 articles included in bibliometric analysis

Rank	Title	Reference	TC
1	Evaluation of learning outcomes using an educational iPhone game vs. traditional game	Furió et al. (2013)	123
2	Evaluating the effectiveness of a game-based rational number training–In-game metrics as learning indicators	Kiili et al. (2018)	71
3	Investigating elementary school students' technology acceptance by applying digital game-based learning to environmental education	Cheng et al. (2013)	62
4	The effects of two digital educational games on cognitive and non-cognitive math and reading outcomes	Vanbecelaere et al. (2020)	47
5	Evaluating a tactile and a tangible multi-tablet gamified quiz system for collaborative learning in primary education	Garcia-Sanjuan et al. (2018)	37
6	Game-based learning: Increasing the logical-mathematical, naturalistic, and linguistic learning levels of primary school students	Del Moral Pérez et al. (2018)	29
7	Primary school students' perceptions of scaffolding in digital game-based learning in mathematics	Sun et al. (2021)	24
8	Serious gaming at school: Reflections on students' performance, engagement and motivation	Bottino et al. (2014)	21
9	Effect of the flipped classroom and gamification methods in the development of a didactic unit on healthy habits and diet in primary education	Gómez-García et al. (2020)	20
10	Gamification of assessments in the natural sciences subject in primary education	Sánchez- Rivas et al. (2018)	14

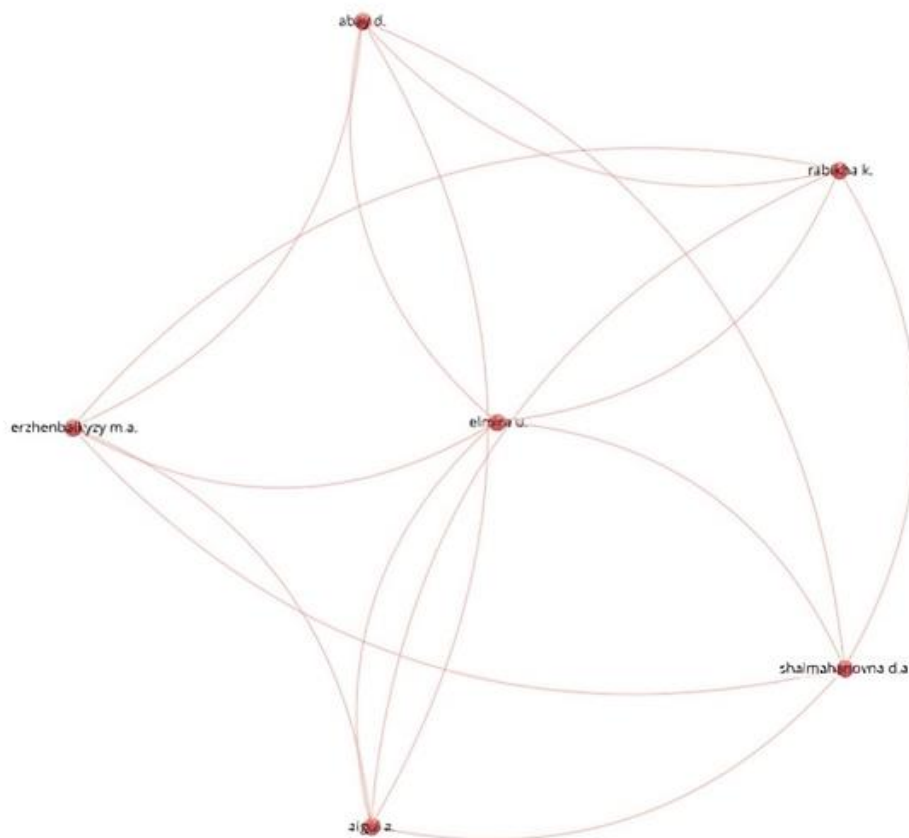
Note. TC: Total number of citations

total citation count of 71. There are multiple research articles with citation counts ranging from 62 to 37, indicating a moderate level of citations for these articles. Following these, there are several articles with lower citation counts, ranging from 29 to 14. The research articles with the lowest citation counts are “Primary school students' perceptions of scaffolding in digital game-based learning in mathematics” (24 citations), “Serious gaming at school: Reflections on students' performance, engagement and motivation” (21 citations), and “Effect of the flipped classroom and gamification methods in the development of a didactic unit on healthy habits and diet in primary education” (20 citations).

The magnitude of the citation count from the Scopus database is relatively low, this suggests that the literature on this area needs to gain a wider impact. It is also notable to see that the authors from the country Spain are included in this list, suggesting that Spain has many research activities regarding the impact of gamification and game-based learning on learning outcomes and engagement in primary education.

#### 4. Which authors collaborated and contributed the most to the research and what is the extent of their collaboration on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?

The co-authorship map in **Figure 4** shows few interconnections between the authors. The minimum number of documents of an author is one, and out of the 118 authors from the 36 articles, 118 met the thresholds. Upon verifying the author in the VOSviewer. Some of the 118 items in the network are not connected to each other. In addition, only six items consisted of the largest set of connected items, these authors are Abay, D., Erzhembalkyzy, M. A., Aigua, A., Shalmanovna, D. A., and Rabikha, K., lastly all of them are connected to Elmira U. This shows that few authors collaborate within the 36 relevant papers from the Scopus database regarding the impact of gamification and game-based learning on learning outcomes and engagement in primary education.



**Figure 4.** Co-authorship map showing key authors who collaborated & contributed to literature (Source: Author's own elaboration, using VOSviewer software)

In addition, the map denotes that there were only a few collaborations were made by the researchers. This suggests that the authors have limited engagement with each other as the interconnectedness of the authors with each other is limited.

##### **5. What are the co-occurrence patterns of keywords or topics in the research articles on gamification and game-based learning in primary education on the impact of gamification and game-based learning on learning outcomes and engagement in primary education?**

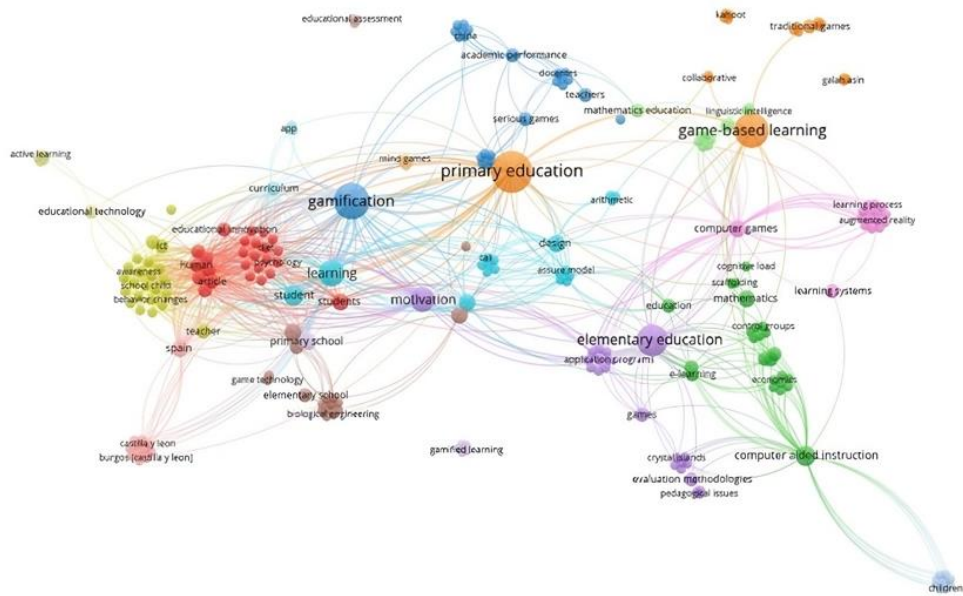
The co-occurrence map shows varied keywords from the 36 articles included in the literature. 244 keywords were cited from the literature and the keywords primary education, gamification, learning, and motivation have the highest total link strength in the calculated measured 189, 174, 122, and 108, respectively.

Based on the map, the keywords with the highest link were all connected with each other gamification in primary education promotes motivation and learning. Other keywords such as awareness and behavior change are included as there were studies on gamification and game-based learning that have an impact on the behaviors of children. According to Parsons et al. (2019), incorporating digital prosocial games into educational settings has a positive impact as it promotes prosocial skills among young children. Also, the map shows mathematics education, as most of the included articles in this paper utilized the subject area of mathematics to show the impact of gamification and game-based learning on learning outcomes and engagement in primary education. **Figure 5** shows co-occurrence map showing occurrences of all keywords in article included in the bibliometric analysis.

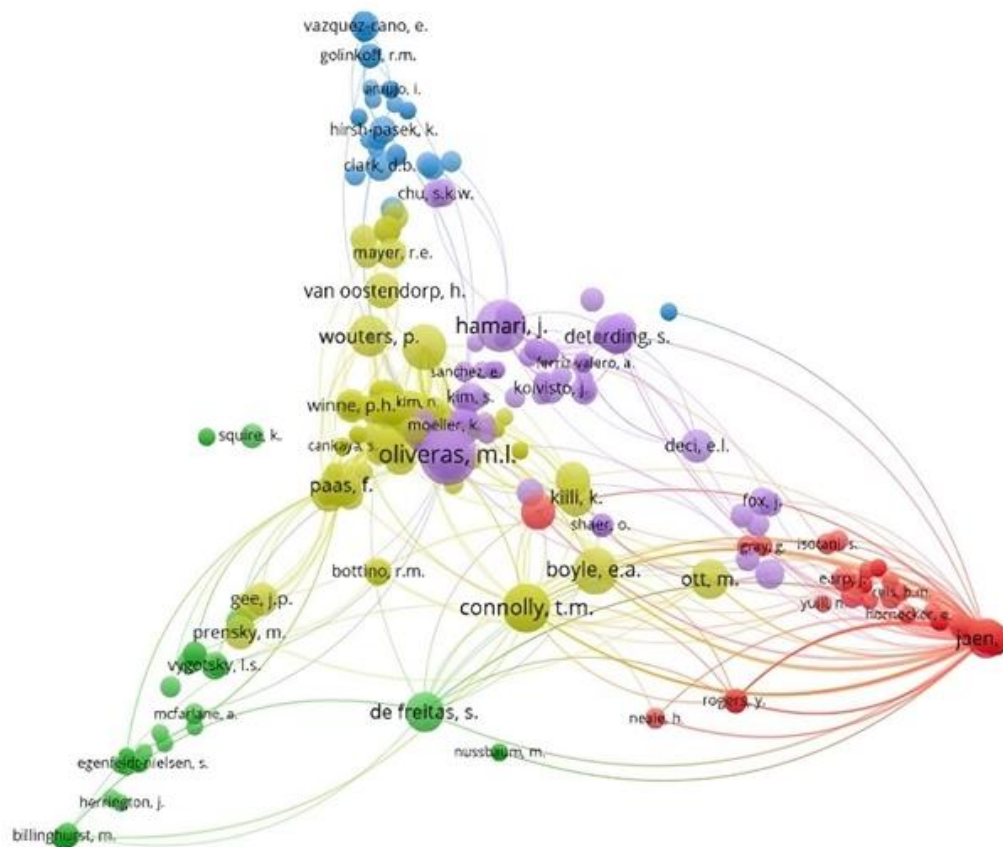
##### **6. How are research articles on the impact of gamification and game-based learning on learning outcomes and engagement in primary education interconnected through co-citation analysis?**

The author co-citation map shows the interconnections of the authors who cited each other from the articles included in the literature review. From the 3,774, 1,000 were selected in order to show the networks in the co-citation. The map shows that there are 4 distinct interconnections between the author co-citation. In addition, Oliveras, M. L., Hamari, J., Conolly, T. M., Hayney, T., and Boyle, E. A. are the authors that have the highest citations, their citations are 22, 17, 15, 15, and 14, respectively (**Figure 6**).

In bibliometrics, co-citation analysis is a method for exploring the cognitive framework of science. It entails the tracking of paper pairs that are collectively cited within the source articles (Kademani et al., 2011). Based on the map of co-citation of authors, the clusters that have the same color share a common theme as they have cited each other. Most of the blue clusters discuss using gamification in e-learning. From the study of Li et al. (2022), it has been revealed that the use of gamification in e-learning helps the primary students to gain self-regulated learning interests. On the other hand, the yellow clusters are about the game-based approaches in enhancing educational outcomes and engagement in mathematics education. The purple clusters are on exploring the integration of gamification in diverse learning environments. The red clusters of authors discuss the use of gamification and



**Figure 5.** Co-occurrence map showing occurrences of all keywords in article included in bibliometric analysis (Source: Author's own elaboration, using VOSviewer software)



**Figure 6.** Co-citation map showing the authors in the bibliometric analysis (Source: Author's own elaboration, using VOSviewer software)

game-based learning in collaborative learning in primary education. Finally, the green clusters share the common theme of the efficacy of game-based learning in enhancing learning outcomes and engagement across various educational contexts.

## DISCUSSION

This part of the study discusses the results and findings from reviewing the body of knowledge from the 36 articles from the Scopus database.

The body of knowledge on the impact of gamification and game-based learning on learning outcomes and engagement in primary education from the 36 articles from the Scopus database highlights the trends in the distribution of publications by year, country, and the 10 most cited articles in the review. The trend in the distribution of publications from 2013 to 2023 shows fluctuations in the interest in gamification and game-based learning. Years 2018, 2019, and 2020 show the highest number of publications indicating this time period has a heightened interest and research activity in the area.

On the other hand, the trend in the distribution of publications based on country/ territory shows that Spain has the highest number of research publications. Spain has a strong focus on gamification and game-based learning in primary education. Other European countries such as the United Kingdom, Finland, and Italy also show a notable presence in terms of research publications. Authors from Spain have articles that are the most cited within the included articles in the study. These highest-cited research articles provide valuable insights and findings in the area of gamification and game-based learning, demonstrating their importance and influence within the field.

In addition, based on the VOSviewer map on co-author analysis, it showed that there was a lack of significant interconnections between authors suggesting a relatively low level of collaboration within the research community focused on gamification and game-based learning in primary education. Only 6 authors formed the largest set of connected items indicating that more efforts are needed to foster collaboration among researchers in order to have more comprehensive and impactful research outcomes. On the other hand, based on the co-occurrence map from the VOSviewer, the keywords primary education, gamification, learning, and motivation were highly linked words signifying their importance in the context of gamification and game-based learning. These words provided insights into the interconnectedness of different research themes and areas within the field. Finally, based on the co-citation map, it showed to identify the patterns of collaboration and influence among authors in the area of investigation. Moreover, the presence of distinct interconnections or clusters of authors suggested the existence of different research groups that have common research interests or collaborations. The author co-citation pattern could help researchers to identify key figures and research communities in the field, fostering potential collaborations and promoting further knowledge exchange.

## CONCLUSIONS & RECOMMENDATIONS

In conclusion, this bibliometric analysis explores the impact of gamification and game-based learning on learning outcomes and engagement in primary education by mapping trends in publications using the Scopus and PRISMA framework by Moher (2013) to identify relevant literature.

Based on the conceptual framework of Hallinger and Kovačević (2019), the findings reveal limited research activities from 2013 to 2023. Spain emerges as the leading country in publications, with European countries contributing more than others globally. Collaboration among authors is minimal, resulting in few connections.

However, this study has acknowledged limitations. Firstly, its reliance on the Scopus database creates bias. Including other web databases like Web of Science, ERIC, IEEE Xplore, ScienceDirect, and others may yield different publication trends. Secondly, the focus on learning outcomes and engagement in primary education may overlook other effects of gamification and game-based learning.

Future research should address these limitations to offer a more comprehensive understanding of the topic's trends and contribute to a broader body of knowledge in this area.

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**Ethical statement:** The author stated that the study did not require approval from an institutional review committee. It is based on existing literature and did not involve direct interaction with human subjects. The author further stated that the bibliometric data utilized in this study were sourced from open access materials available in the SCOPUS database, and additional relevant data were obtained from publicly accessible sources. As bibliometric analyses involve the use of aggregated publication data without personally identifiable information, the use of inform consent forms was not applicable.

**Declaration of interest:** No conflict of interest is declared by the author.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from the author.

## REFERENCES

- Avdiu, E. (2019). Game-based learning practices in Austrian elementary schools. *Educational Process: International Journal*, 8(3), 196-206. <https://doi.org/10.22521/edupij.2019.83.4>
- Bottino, R. M., delle Ricerche, C. N., Ott, M., & Tavella, M. (2014). Serious gaming at school: Reflections on students' performance, engagement and motivation. *International Journal of Game-Based Learning*, 4(1), 21-36. <https://doi.org/10.4018/IJGBL.2014010102>
- Cheng, Y.-M., Lou, S.-J., Kuo, S.-H., & Shih, R.-C. (2013). Investigating elementary school students' technology acceptance by applying digital game-based learning to environmental education. *Australasian Journal of Educational Technology*, 29(1), 96-110. <https://doi.org/10.14742/ajet.65>
- Del Moral Pérez, M. E., Duque, A. P. M., & García, L. C. F. (2018). Game-based learning: Increasing the logical-mathematical, naturalistic, and linguistic learning levels of primary school students. *Journal of New Approaches in Educational Research*, 7(1), 31-39. <https://doi.org/10.7821/naer.2018.1.248>



- Dichev, C., & Dicheva, D. (2017). Gamifying education: What is known, what is believed and what remains uncertain: A critical review. *International Journal of Educational Technology in Higher Education*, 14, 9. <https://doi.org/10.1186/s41239-017-0042-5>
- Fiuza-Fernández, A., Lomba-Portela, L., Soto-Carballo, J., & Pino-Juste, M. R. (2022). Study of the knowledge about gamification of degree in primary education students. *PLoS ONE*, 17(3), e0263107. <https://doi.org/10.1371/journal.pone.0263107>
- Furió, D., González-Gancedo, S., Juan, M.-C., Seguí, I., & Rando, N. (2013). Evaluation of learning outcomes using an educational iPhone game vs. traditional game. *Computers & Education*, 64, 1-23. <https://doi.org/10.1016/j.compedu.2012.12.001>
- Garcia-Sanjuan, F., Jurdi, S., Jaen, J., & Nacher, V. (2018). Evaluating a tactile and a tangible multi-tablet gamified quiz system for collaborative learning in primary education. *Computers & Education*, 122, 65-84. <https://doi.org/10.1016/j.compedu.2018.04.011>
- Geisler, E. (2000). *The metrics of science and technology*. Bloomsbury Publishing.
- Gómez-García, G., Marin-Marin, J. A., Romero-Rodríguez, J.-M., Navas-Parejo, M. R., & Jimenez, C. R. (2020). Effect of the flipped classroom and gamification methods in the development of a didactic unit on healthy habits and diet in primary education. *Nutrients*, 12(8), 2210. <https://doi.org/10.3390/nu12082210>
- Hallinger, P., & Kovačević, J. (2019). A bibliometric review of research on educational administration: Science mapping the literature, 1960 to 2018. *Review of Educational Research*, 89(3), 335-369. <https://doi.org/10.3102/0034654319830380>
- Hallinger, P., & Nguyen, V.-T. (2020). Mapping the landscape and structure of research on education for sustainable development: A bibliometric review. *Sustainability*, 12(5), 1947. <https://doi.org/10.3390/su12051947>
- Hincapie, M., Diaz, C., Valencia, A., Contero, M., & Güemes-Castorena, D. (2021). Educational applications of augmented reality: A bibliometric study. *Computers & Electrical Engineering*, 93, 107289. <https://doi.org/10.1016/j.compeleceng.2021.107289>
- Inocencio, F. (2018). Using gamification in education: A systematic literature review. *ICIS 2018 Proceedings*. <https://aisel.aisnet.org/icis2018/behavior/Presentations/3>
- Kademani, B. S., India, & India. (2011). *Beyond librarianship: Creativity, innovation, and discovery*. B. R. Pub. Corp.
- Kiili, K., Moeller, K., & Ninaus, M. (2018). Evaluating the effectiveness of a game-based rational number training—In-game metrics as learning indicators. *Computers & Education*, 120, 13-28. <https://doi.org/10.1016/j.compedu.2018.01.012>
- Li, X., Xia, Q., Chu, S. K. W., & Yang, Y. (2022). Using gamification to facilitate students' self-regulation in e-learning: A case study on students' L2 English learning. *Sustainability*, 14(12), 7008. <https://doi.org/10.3390/su14127008>
- Moher, D. (2013). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, 151(4), 264. <https://doi.org/10.7326/0003-4819-151-4-200908180-00135>
- Park, S., & Kim, S. (2021). Is sustainable online learning possible with gamification?—The effect of gamified online learning on student learning. *Sustainability*, 13(8), 4267. <https://doi.org/10.3390/su13084267>
- Parsons, S., Karakosta, E., Boniface, M., & Crowle, S. (2019). Prosocial games for inclusion: Interaction patterns and game outcomes for elementary-aged children. *International Journal of Child-Computer Interaction*, 22, 100142. <https://doi.org/10.1016/j.ijcci.2019.100142>
- Sánchez-Rivas, E., Ruiz-Palmero, J., & Sánchez-Rodríguez, J. (2018). Gamification of assessments in the natural sciences subject in primary education. *Educational Sciences: Theory & Practice*, 19(1), 95-111. <https://doi.org/10.12738/estp.2019.1.0296>
- Sotos-Martínez, V. J., Tortosa-Martínez, J., Baena-Morales, S., & Ferriz-Valero, A. (2023). Boosting student's motivation through gamification in physical education. *Behavioral Sciences*, 13(2), 165. <https://doi.org/10.3390/bs13020165>
- Sun, L., Ruokamo, H., Siklander, P., Li, B., & Devlin, K. (2021). Primary school students' perceptions of scaffolding in digital game-based learning in mathematics. *Learning, Culture and Social Interaction*, 28, 00457. <https://doi.org/10.1016/j.lcsi.2020.100457>
- Takbiri, Y., Bastanfard, A., & Amini, A. (2023). A gamified approach for improving the learning performance of K-6 students using Easter eggs. *Multimedia Tools and Applications*, 82, 20683-20701. <https://doi.org/10.1007/s11042-023-14356-7>
- Trinidad, M., Ruiz, M., & Calderon, A. (2021). A bibliometric analysis of gamification research. *IEEE Access*, 9, 46505-46544. <https://doi.org/10.1109/access.2021.3063986>
- Vanbecelaere, S., Van den Berghe, K., Cornillie, F., Sasanguie, D., Reynvoet, B., & Depaepe, F. (2020). The effects of two digital educational games on cognitive and non-cognitive math and reading outcomes. *Computers & Education*, 143, 103680. <https://doi.org/10.1016/j.compedu.2019.103680>