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BIBLIOMETRIC ANALYSIS: TRENDS IN GAME-BASED LEARNING ON STUDENT LEARNING OUTCOMES BASED ON GOOGLE SCHOLAR (2020 - 2024)

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Abstract

The development of educational technology is driving the increased use of Game-Based Learning (GBL) as a learning strategy considered effective in supporting student learning achievement. Although numerous studies have examined the effectiveness of GBL, bibliometric studies mapping research trends and focuses in this field are still limited. This study uses bibliometric analysis to identify publication trends, dominant keywords, and research linkage patterns regarding GBL and student learning outcomes. Data was collected through Publish or Perish from Google Scholar using the keywords "game-based learning" AND "learning outcomes" with a publication range of 2020–2024, resulting in 199 articles analyzed using VOSviewer through network, overlay, and density visualization. The research findings indicate a significant increase in publications related to GBL and learning outcomes in 2023–2024, with a total of 199 articles and 7,985 citations. VOSviewer analysis identified 58 keywords divided into seven clusters, with key terms such as game, student, and learning outcome, indicating a strong focus on the effectiveness of GBL on learning achievement. This finding provides a comprehensive overview of the development of GBL research on learning outcomes, while also serving as a foundation for researchers and educators to develop more effective.

Abstrak

Perkembangan teknologi pendidikan mendorong meningkatnya penggunaan Game-Based Learning (GBL) sebagai strategi pembelajaran yang dinilai efektif dalam mendukung capaian belajar siswa. Meskipun banyak penelitian mengkaji efektivitas GBL, kajian bibliometrik yang memetakan tren dan fokus penelitian dalam bidang ini masih terbatas. Penelitian ini menggunakan analisis bibliometrik untuk mengidentifikasi tren publikasi, kata kunci dominan, dan pola keterkaitan penelitian mengenai GBL dan hasil belajar siswa. Data dikumpulkan melalui Publish or Perish dari Google Scholar menggunakan kata kunci "game-based learning" AND "learning outcomes" dengan rentang publikasi 2020–2024, menghasilkan 199 artikel yang dianalisis menggunakan VOSviewer melalui visualisasi network, overlay, dan density. Hasil penelitian menunjukkan bahwa publikasi terkait GBL dan hasil belajar mengalami peningkatan signifikan pada 2023–2024, dengan total 199 artikel dan 7.985 sitasi. Analisis VOSviewer mengidentifikasi 58 kata kunci yang terbagi dalam tujuh kluster, dengan kata kunci utama seperti game, student, dan learning outcome, menandakan fokus kuat pada efektivitas GBL terhadap pencapaian belajar.Temuan ini memberikan gambaran komprehensif mengenai perkembangan penelitian GBL terhadap hasil belajar, sekaligus menjadi dasar bagi peneliti dan pendidik untuk mengembangkan strategi pembelajaran digital yang lebih efektif.

INTRODUCTION

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The paradigm shift in education in recent years has encouraged a shift towards more interactive, collaborative, and student-centered learning. (J. Gayathri, 2024). This shift has triggered the development of innovative approaches that emphasize active student participation in the learning process, one of which is Game-Based Learning. GBL has emerged as a pedagogical strategy that integrates game elements to increase student motivation and learning achievement (Yu et al., 2021). This approach has been proven to encourage active student engagement and optimize cognitive achievement through interactive and enjoyable learning experiences (Adipat et al., 2021). Along with advances in digital technology, the application of GBL has become increasingly widespread, covering various fields such as science, mathematics, and language, which has led to the creation of a more holistic learning process (Mao et al., 2022). In addition, a number of studies show that GBL contributes positively to students' intrinsic motivation and learning satisfaction (Irfan & Rahman, 2024). In the context of digital education transformation, the application of GBL is increasingly relevant because it offers an adaptive learning method that suits the characteristics of today's students (Wang et al., 2022; Mao et al., 2022).

Several studies confirm that GBL has a significant impact on improving learning outcomes and student engagement in various educational contexts (Yu et al., 2021; Adipat et al., 2021; Wang et al., 2022). The integration of game elements has been proven to not only increase interest in learning but also strengthen conceptual understanding, memory, concept retention, and critical thinking skills (Liu & Hwang, 2024; Mao et al., 2022). A meta-analysis by Wang et al., (2022) shows that GBL has a moderate to high effect on learning achievement compared to conventional methods. However, the effectiveness of GBL is highly dependent on the alignment between game design and learning objectives, including the balance between entertainment and teaching material substance (Pratiwi et al., 2023). The consistency of these findings confirms that GBL is a growing research topic and has a strategic position in learning innovation.

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Although various studies have examined the effectiveness of GBL on learning outcomes, most of them still focus on implementation aspects and have not provided a comprehensive bibliometric mapping of research trends in the field of GBL and learning outcomes. To date, there have been few studies that systematically analyze the dynamics of GBL publications and their relationship with learning outcome variables based on open databases such as Google Scholar. Bibliometric analysis is necessary to identify patterns, trends, and impacts in scientific literature (Passas, 2024). Based on this gap, this study aims to analyze publication trends and patterns of Game-Based Learning research related to student learning outcomes during the period 2020–2024 using data from Google Scholar and analyzed using VOSviewer software. This study is limited to scientific articles indexed in Google Scholar during that period, so it is expected that the results can provide empirical contributions to understanding GBL research patterns and serve as a reference for the development of future digital education research and policies.

METHODE

This research method uses bibliometric analysis to map the development and trends of research related to Game-Based Learning (GBL) on student learning outcomes. The research data were obtained from scientific articles indexed in Google Scholar, because this database is open and easily accessible compared to paid databases such as Scopus or Web of Science.

The data collection process was carried out using Publish or Perish (PoP) software, which functions to retrieve publication metadata from Google Scholar while also assisting with reference management. The search was conducted using the keywords "game-based learning" AND "learning outcomes" within the publication period of 2020–2024. The maximum results feature in PoP was set to 200 results so that the data obtained remained relevant and did not cause duplication or excessive visualization in the next stage of analysis. Based on these

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parameters, 200 scientific articles were collected that were relevant to the research focus.

Each publication obtained includes metadata elements such as title, author, year of publication, number of citations, and journal source. All data is exported in (.ris) format for subsequent analysis using VOSviewer software. This application is used to perform computational bibliometric mapping, which aims to identify trends, dominant topics, and patterns of interrelationships between keywords in the field of GBL and learning outcomes.

The analysis is carried out through several forms of visualization, namely *network visualization, density visualization,* and *overlay visualization*, with a primary focus on co-occurrence analysis (keywords). Before mapping, the researchers first filtered and removed irrelevant or duplicative keywords to ensure more accurate and representative visualization results. The results of this mapping form the basis for identifying research development directions, prominent topics, and the dynamics of Game-Based Learning studies on student learning outcomes during the 2020–2024 period.

HASIL DAN PEMBAHASAN

A. Hasil dan Pencarian Data Publikasi

Based on the results of data searches using the Publish or Perish (PoP) application, which took sources from Google Scholar in November 2025, 200 scientific articles relevant to the topic of Game-Based Learning (GBL) and student learning outcomes in the 2020–2024 period were obtained. After verification, one article was eliminated because it did not have valid publication year information and was known to have been published in 2025, thus not meeting the inclusion criteria. Therefore, a total of 199 publications were used in the analysis.

Overall, these articles generated 7,985 citations, with an average of 1,597 citations per year and 39.93 citations per article. This figure shows that research on Game-Based Learning and learning outcomes has received a high level of attention among academics over the past five years. In addition, the average h-

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index value of 47 and g-index of 83 indicate that there are a number of publications that are not only frequently cited but also have a significant influence on the development of studies in this field. The average number of authors per article, which is 2.87 people, shows a collaborative trend in GBL-related research.

To see the publications that have contributed most to this field, Table 1 shows the ten articles with the highest number of citations during the 2020–2024 period.

Table 1. 10 Articles with the Highest Number of Citations

No.	Author	Title	Year	Number of Citations
1	Yu et al.	The Effect of Educational Games on Learning Outcomes, Student Motivation, Engagement, and Satisfaction	2021	538
2	Adipat et al.	Engaging Students in the Learning Process with Game-Based Learning: The Fundamental Concepts	2021	430
3	Wang et al.	Effects of digital game-based STEM education on students' learning achievement: a meta-analysis	2022	419
4	Liu et al.	Using the Concept of *Game-Based Learning* in Education	2020	280
5	Mao et al.	Effects of *Game-Based Learning* on Students' Critical Thinking: A Meta-Analysis	2022	210
6	Deng et al.	Digital *Game-Based Learning* in a Shanghai primary-school mathematics class: A case study	2020	189
7	Emerson et al.	Multimodal learning analytics for game-based learning	2020	185
8	Greipl et al.	Potential and limits of game-based learning	2020	171
9	Breien & Wasson	Narrative categorization in digital game-based learning: Engagement, motivation & learning	2021	165

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10	Tsai & Tsai	A meta-analysis of research on digital game-based science learning	2020	158

Table 1 shows that several articles have had a significant influence on the development of research in the field of Game-Based Learning (GBL). The article by Yu et al. (2021) ranks first with 538 citations, emphasizing how the use of educational games can increase student motivation, engagement, and learning outcomes. Meanwhile, other articles focus on topics such as digital game-based STEM education, critical thinking skills development, and the application of multimodal learning analytics. This variety of themes reflects the diversity of approaches and scientific interest that has grown rapidly in GBL research throughout the 2020–2024 period.

B. Trends in *Game-Based Learning* and Learning Outcomes

Over the past five years, research related to Game-Based Learning and learning outcomes has shown a consistent upward trend. To illustrate this growth pattern in more detail, Table 2 presents data on the number of publications each year.

Table 2. Trends in Publications on Game-Based Learning and Learning Outcomes

Year	Number of Publications
2020	26
2021	30
2022	22
2023	57
2024	64
Total	199
Rata-rata	39,8

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Based on Table 2, it is known that the number of publications on Game-Based Learning and learning outcomes fluctuated at the beginning of the period but increased sharply since 2023. In 2020, there were 26 publications discussing the application of GBL on student learning outcomes. This number increased slightly in 2021 to 30 publications, but declined again in 2022 to only 22 publications. Despite this decline, the publication trend rose significantly again in 2023 with 57 publications and peaked in 2024 with 64 publications. Overall, the total number of publications over the past five years was 199 articles, with an average of 39.8 publications per year. These trends are more clearly visible in Figure 1 below.

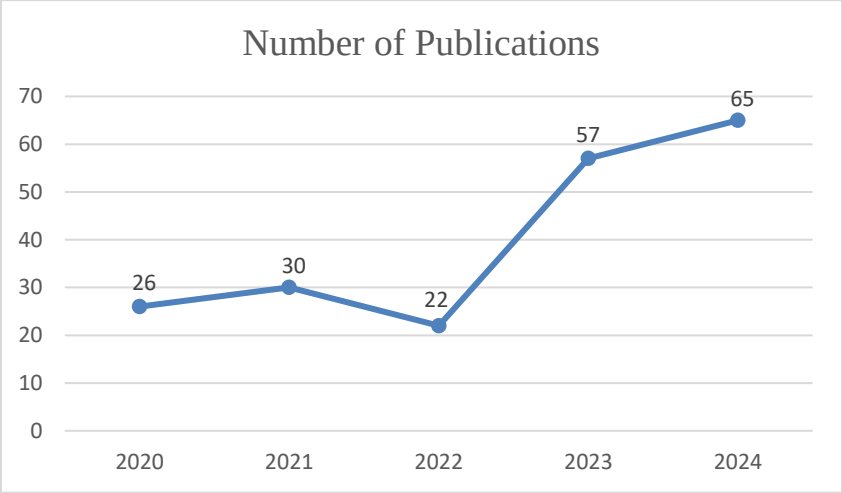

Figure 1. Trends in Game-Based Learning Research and Learning Outcomes

C. Research Trends in Game-Based Learning on Learning Outcomes Using VOSviewer

Over the past five years, research related to Game-Based Learning and learning outcomes has shown a consistent upward trend. To illustrate this growth pattern in more detail, Table 2 presents data on the number of publications each year.

Based on the results of data processing using VOSviewer, 58 keywords (items) were classified into 7 main clusters. Each cluster describes the thematic

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relationship between studies on Game-Based Learning (GBL) and student learning outcomes in the 2020–2024 period.

(i) Cluster 1 consists of 12 items marked in red. This cluster represents themes related to learning achievement, gamification, motivation, and student engagement. The twelve items in this cluster are *achievement, education, educational game, effect, gamification, impact, meta analysis, motivation, serious game, student engagement, study,* and *tool.*

(ii) Cluster 2 consists of 10 items marked in green. This cluster represents themes related to the application of Game-Based Learning in mathematics and science learning, including the learning approaches or models used and their impact on learning outcomes. The ten items included in this cluster are as follows *application, approach, game, gbl, influence, mathematics, mathematics education, model, outcome,* and *science.*

(iii) Cluster 3 consists of 9 items marked in dark blue. This cluster represents themes related to the development of learning media, literature analysis, and the use of board games associated with student motivation and engagement. The nine items in this cluster include *analysis, board game, development, learner, learning outcome, literature review, medium, student motivation,* and *use.*

(iv) Cluster 4 consists of 9 items marked in yellow. This cluster represents themes related to learning activities, strategies, effectiveness, and systematic studies in the context of learning. The nine items in this cluster include *activity, concept, effectiveness, learning, review, strategy, student, systematic review,* and *teaching.*

(v) Cluster 5 consists of 7 items marked in purple. This cluster represents themes related to digital game-based learning, emotions, and student performance. The seven items in this cluster include *analytic, dgbl, difference, digital game, emotion, performance,* and *research.*

(vi) Cluster 6 consists of 6 items marked in sky blue. This cluster represents themes related to classroom learning, student engagement, the use of game

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platforms such as Kahoot, and the educational context during COVID-19. The six items in this cluster are *classroom, covid, engagement, game-based learning, higher education,* and *Kahoot.*

(vii) Cluster 7 consists of 5 items marked in orange. This cluster represents themes related to learning autonomy, self-efficacy, learning environment, and student learning outcomes. The five items included in this cluster are *autonomy, efficacy, environment, student learning outcome,* and *type.*

From the cluster mapping, the relationships between keywords were visualized through network visualization on VOSviewer. The network visualization display is shown in Figure 2.

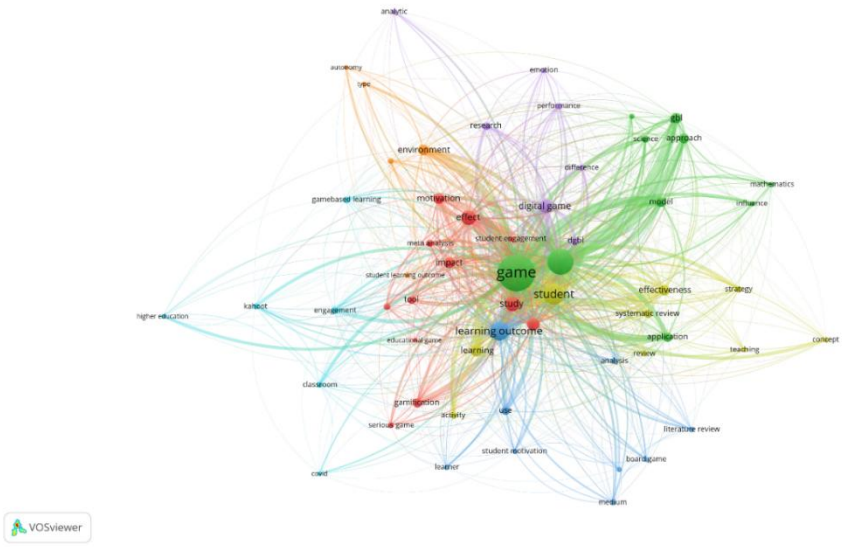

Figure 2. *Network Visualization*

Visualisasi jaringan pada Gambar 2 menampilkan hubungan keseluruhan antar-kata kunci yang muncul dalam publikasi terkait *Game-Based Learning* dan hasil belajar siswa pada periode 2020–2024. Titik dengan ukuran lebih besar seperti game, student, dan learning outcome menandai kata kunci dengan frekuensi kemunculan serta keterhubungan tertinggi. Jaringan terlihat padat dan saling terhubung, menunjukkan bahwa penelitian dalam bidang ini berkembang secara multidisipliner. Setiap kluster memiliki fokus tema yang berbeda, tetapi tetap saling beririsan melalui konsep inti seperti hasil belajar, keterlibatan siswa, dan penggunaan permainan edukatif. Struktur jaringan ini memperlihatkan

bahwa *Game-Based Learning* tidak berdiri sendiri, melainkan terintegrasi ke dalam berbagai konteks pendidikan dan pendekatan pedagogis. Untuk melihat perkembangan tema penelitian dari waktu ke waktu, digunakan overlay visualization yang ditampilkan pada Gambar 3.

The network visualization in Figure 2 shows the overall relationships between keywords that appear in publications related to *Game-Based Learning* and student learning outcomes in the period 2020–2024. Larger dots such as game, student, and learning outcome, indicate keywords with the highest frequency of occurrence and connectivity. The network appears dense and interconnected, indicating that research in this field is developing in a multidisciplinary manner. Each cluster has a different thematic focus, but they still intersect through core concepts such as learning outcomes, student engagement, and the use of educational games. This network structure shows that *Game-Based Learning* does not stand alone, but is integrated into various educational contexts and pedagogical approaches. To see the development of research themes over time, an overlay visualization is used, as shown in Figure 3.

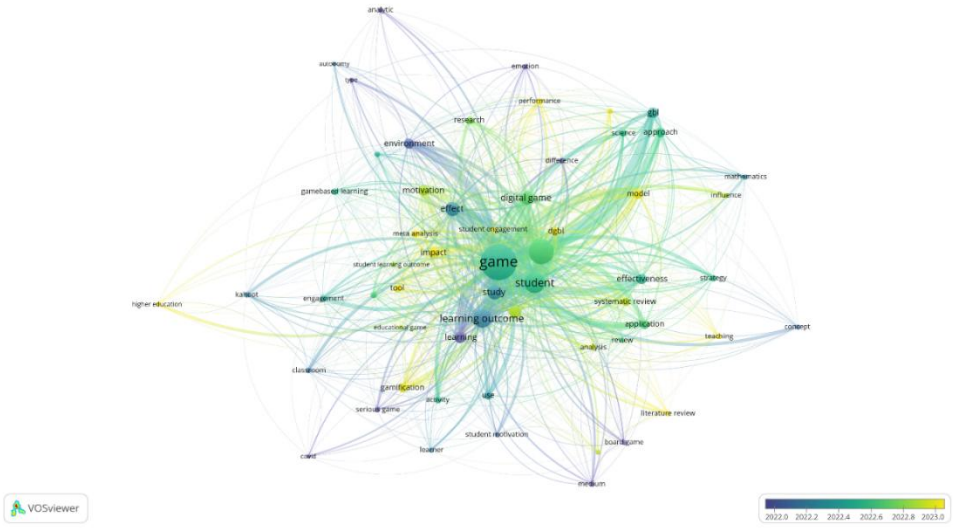

Figure 1. *Overlay Visualization*

Overlay Visualization shows the temporal distribution of keywords based on year of publication. Keywords that appear in yellow, such as model, impact, tool, student engagement, DGBL (digital game-based learning), teaching,

performance, and gamification, indicate that these topics are the focus of more recent research in the 2020–2024 period. The presence of these keywords indicates that recent research increasingly highlights the use of Game-Based Learning as a pedagogical model, its impact on learning performance, and the use of tools and strategies to increase student engagement. Furthermore, the strength of the relationship and density between items is visualized through density visualization, as shown in Figure 4.

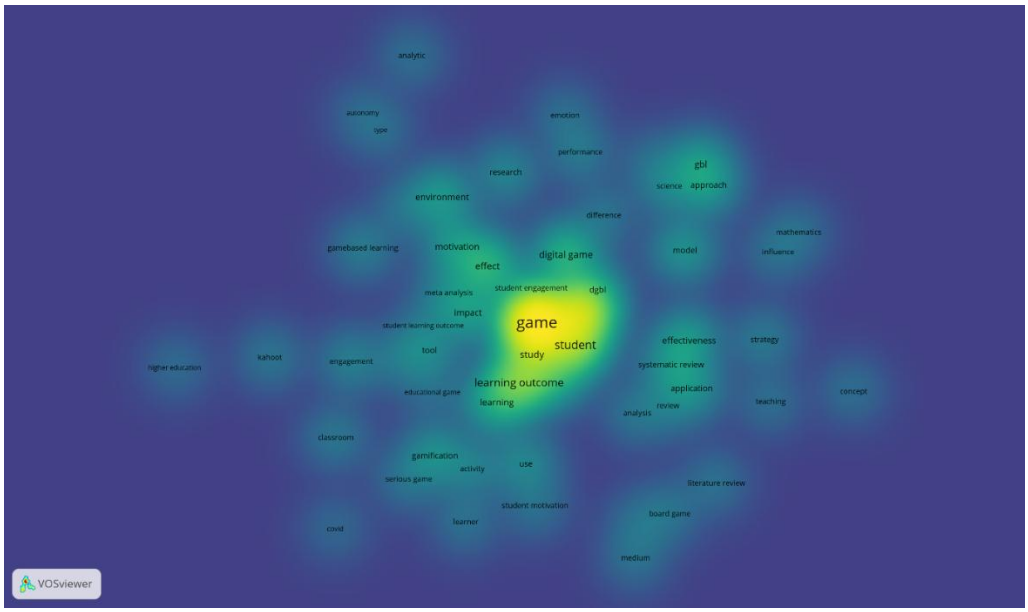

Figure 4. *Density Visualization*

Density Visualization in Figure 4 highlights areas with the highest research intensity. Bright yellow marks keywords with the highest frequency and connectivity. Keywords such as game, student, study, and learning outcome appear as centers of density, confirming that these themes are the main foundations of Game-Based Learning research and learning outcomes in 2020–2024. Conversely, keywords in the dark blue area have lower density levels, indicating that these topics are still being developed to a limited extent.

CONCLUSION

This study shows that during the period 2020–2024, there were 199 publications discussing Game-Based Learning (GBL) and student learning

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outcomes. The publication trend fluctuated at the beginning of the period and increased sharply in 2023–2024, with the peak number of publications occurring in 2024 with 64 articles. In addition, these articles generated a total of 7.985 citations, with an average of 39,93 citations per article. The h-index value of 47 and g-index of 83 indicate that this field of study has a strong academic impact and is developing consistently.

The VOSviewer mapping results identified 58 keywords divided into seven thematic clusters. These clusters reflect the research focus on learning achievement, gamification, science and mathematics learning, media development, the effectiveness of learning approaches, digital learning, and affective and learning environment aspects. The network visualization shows strong connections between keywords, with games, students, and learning outcomes at the center of the density. The overlay visualization shows that topics such as performance, gamification, student engagement, and digital game-based learning have been the focus of more recent research during the observation period.

Overall, the results of the bibliometric analysis show that research on Game-Based Learning and learning outcomes has undergone significant development, both in terms of the number of publications and the variety of topics studied. The density of keywords on the core theme shows that GBL is consistently studied as a pedagogical approach directly related to improving learning outcomes. These findings provide an overview of the direction of GBL research development and can serve as a basis for further research in the field of educational technology.

DAFTAR PUSTAKA REFERENCES

Adipat, S., Laksana, K., Busayanon, K., Asawasowan, A., & Adipat, B. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. *International Journal of Technology in Education*. https://eric.ed.gov/?id=EJ1311472

Breien, F. S., & Wasson, B. (2021). Narrative categorization in digital game-based learning: Engagement, motivation &learning. *British Journal of Educational Technology*, *15*, 91–11. https://doi.org/10.1111/bjet.13004

Deng, L., Wu, S., Chen, Y., & Peng, Z. (2020). Digital game-based learning in a Shanghai primary-school mathematics class: A case study. *Journal of Computer Assisted Learning*, *36*(5), 709–717. https://doi.org/10.1111/jcal.12438

Emerson, A., Cloude, E. B., Azevedo, R., & Lester, J. (2020). Multimodal learning analytics for game-based learning. *British Journal of Educational Technology*, *51*(5), 1505–1526. https://doi.org/10.1111/bjet.12992

Greipl, S., Moeller, K., & Ninaus, M. (2020). Potential and Limits of Game-based Learning. *International Journal of Technology Enhanced Learning*, *12 No.4*, 363–389. https://doi.org/10.1504/IJTEL.2020.110047

Irfan, M., & Rahman, S. R. (2024). Effect of Game-Based Learning on Grade 11 Senior High School Science Students' Learning Interest. *Indonesian Journal of Educational Science (IJES)*, *7 (1)*. https://ojs.unsulbar.ac.id/index.php/ijes/article/view/4248

J. Gayathri. (2024). Paradigm Shift in Teaching. *Indian Journal of Computer Science*. https://doi.org/https://doi.org/10.17010/ijcs/2024/v9/i1/173696

Liu, L. A., & Hwang, G. J. (2024). Effects of metalinguistic corrective feedback on novice EFL students' digital game-based grammar learning performances, perceptions, and behavioural patterns. *British Journal of Educational Technology*. https://doi.org/10.1111/bjet.13400

Liu, Z.-Y., Shaikh, Z. A., & Gazizova, F. (2020). Using the Concept of Game-Based Learning in Education. *International Journal of Emerging Technologies in Learning (IJET)*, *15*. https://doi.org/https://doi.org/10.3991/ijet.v15i14.14675%0d

Mao, W., Cui, Y., Chiu, M. M., & Lei, H. (2022). Effects of game-based learning on students' critical thinking: A meta-analysis. *Journal of Educational Computing Research*, *61*(1). https://doi.org/https://doi.org/10.1177/07356331221100740

Passas, I. (2024). Bibliometric Analysis: The Main Steps. *Encyclopedia (Multidisciplinary Digital Publishing Institute)*, *Vol. 4*(2), 1.

https://doi.org/https://doi.org/10.3390/encyclopedia4020065

Pratiwi, A. C., Rahman, A. A., Haris, Mar'ah, Z., & Salsabila, R. (2023). Students' Attitude toward A Non-Digital Game-Based Learning in English for Biology Course. *Klasikal: Journal Of Education, Language Teaching and Science*, *5 (3)*. http://journalfkipuniversitasbosowa.org/index.php/klasikal/article/view/1123

Tsai, Y. L., & Tsai, C. C. (2020). A meta-analysis of research on digital game-based science learning. *Journal of Computer Assisted Learning*. https://doi.org/10.1111/jcal.12430

Wang, L.-H., Chen, B., Hwang, G.-J., Guan, J.-Q., & Wang, Y.-Q. (2022). Effects of Digital Game-based STEM Education on Students' Learning Achievement: A meta-analysis. *International Journal of STEM Education*, *9*. https://doi.org/10.1186/s40594-022-00344-0

Yu, Z., Gao, M., & Wang, L. (2021). The Effect of Educational Games on Learning Outcomes, Student Motivation, Engagement, and Satisfaction. *Journal of Educational Computing Research*. https://doi.org/10.1177/0735633120969214