

Analysis of Game-Based Learning in Enhancing Elementary School Students' Numeracy Literacy: A Literature Review

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Keywords

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Abstract

Numeracy literacy is closely related to learning and daily life. However, it has become a challenge in elementary school education due to students' low interest. Applying an effective learning model is essential to increase students' interest in numeracy literacy. One such model is Game-Based Learning (GBL). This study aims to analyze the effectiveness of Game-Based Learning in improving elementary students' numeracy literacy, using the Systematic Literature Review (SLR) method. The reviewed articles are sourced from national journals published between 2020 and 2025. From the 30 articles initially identified, a screening process was conducted based on title relevance, resulting in 15 articles with more specific alignment to the research topic. These were then further selected based on criteria indicating an improvement in students' interest in numeracy literacy. As a result, 6 articles were chosen for in-depth analysis. The results show that numeracy literacy improved after using Game-Based Learning. In conclusion, implementing Game-Based Learning can effectively enhance elementary school students' numeracy literacy.

1. Introduction

Literacy refers to an individual's ability to understand information and solve problems in various contexts. The primary purpose of literacy is to enhance knowledge, develop critical thinking skills, and more. Basic literacy is categorized into six types: reading and writing literacy, numeracy literacy, scientific literacy, financial literacy, digital literacy, and cultural and civic literacy. Among these, numeracy literacy is closely associated with everyday life. Numeracy literacy involves the use of numbers and basic mathematical symbols to solve practical problems in various aspects of daily life (Haloho & Napitu, 2023). Numeracy literacy is crucial in learning because it deals with numbers and symbols essential for problem-solving.

Although numeracy literacy is fundamentally linked to education and daily activities, it tends to be less favored by students. Based on the 2022 Program for International Student Assessment (PISA) report, Indonesia ranked 69th out of 80 countries, with a numeracy score of 366 points. This indicates a very low level of numeracy literacy interest in Indonesia, highlighting the urgent need for improvement. Teachers' efforts during the learning process greatly influence students' interest in numeracy literacy. Thus, teachers must create effective and enjoyable learning environments to foster numeracy literacy.

The low interest in numeracy literacy poses a significant challenge in elementary school education. Therefore, the application of effective teaching methods is crucial to enhance students' engagement with numeracy literacy. One such method is Game-Based Learning (GBL). According to Mochammad Arbayu Maulidina et al. (2018), Game-Based Learning is an instructional method that utilizes specially designed games to support and facilitate the learning process. The use of this method can stimulate students' interest, optimize learning processes, and provide interactive and enjoyable learning experiences in developing numeracy literacy.

Numerous studies have discussed the use of Game-Based Learning in education. For instance, a study by Sanki et al. (2025) titled Implementation of Game-Based Learning to Improve Literacy and Numeracy Skills revealed that there was a significant improvement in both students' literacy and numeracy skills. Thus, GBL can make learning more enjoyable and effective. Another study by Rahayu and Hadi (2023) titled Improving Literacy and Numeracy Skills through Problem-Based Learning Assisted by Game-Based Learning demonstrated that a combination of problem-based and game-based learning models can enhance elementary students' reading, writing, and arithmetic abilities, as evidenced by the improvement in students' average scores from one cycle to the next. However, only a few studies have specifically focused on the application of Game-Based Learning to improve elementary school students' numeracy literacy through a Systematic Literature Review (SLR) method. The novelty of this study lies in the methodology employed.

Based on the background described, the research problem formulated in this study is: How does the implementation of Game-Based Learning improve elementary school students' numeracy literacy? This study aims to analyze the effectiveness of Game-Based Learning in enhancing elementary students' numeracy literacy. Through this research, it is expected that deeper insights into innovative strategies for mathematics education at the elementary level can be gained, along with recommendations for educators on implementing more engaging and effective teaching methods.

2. Method

This study employs the Systematic Literature Review (SLR) method to examine in depth how the implementation of Game-Based Learning (GBL) can improve numeracy literacy among elementary school students in mathematics instruction. This approach was selected because it enables researchers to systematically collect, filter, and analyze findings from previous studies that are relevant to the topic. The articles included in this review were chosen based on specific criteria: they focused on the application of Game-Based Learning in elementary education and addressed the enhancement of numeracy literacy.

The article search was conducted using Google Scholar. The process involved several stages. First, during the identification phase, national journal articles published between 2020 and 2025 were retrieved using keywords such as "game-based learning" and "numeracy literacy," yielding a total of 30 articles. In the screening phase, the titles of these articles were reviewed to determine relevance to the research focus, narrowing the selection to 15 articles. In the evaluation phase, the full texts of these articles were read carefully to assess their eligibility based on the inclusion criteria. Finally, in the analysis phase, the selected studies were examined to identify patterns in the findings, instructional approaches employed, and their impact on improving students' numeracy literacy.

3. Results and Discussion

The strategy for selecting articles to be analyzed is presented as follows:

Table 1. Article Selection Strategy

No	Category	Search Engine	Search Result
1	Initial Identification	Google Scholar	30
2	Relevant Titles	Google Scholar	15
3	Showing Numeracy Literacy Improvement	Google Scholar	6
	Result		6

Based on the criteria, six relevant articles were selected, all focusing on the application of Game-Based Learning (GBL) to improve students' numeracy literacy. The following table summarizes the selected articles:

Table 2. Summary of Relevant Articles

No	Authors (Years)	Title	Finding
1	Fitri & Juliani (2024)	Efforts to Improve Students' Numeracy Skills Through Contextual Learning Assisted by Simple Games	Contextual learning with simple games significantly improved numeracy mastery, from 12.5% to 75%. The study encourages developing games tailored to students' needs as a learning tool.
2	Fatafani & Rozie (2025)	Utilizing Game-Based Learning Media to Support Literacy and Numeracy Skills	This study shows that game-based learning media can help improve the literacy and numeracy skills of fifth-grade students. This is evidenced by the significant difference between the pretest and posttest results. The statistical values indicate that the effect is real, thus it can be concluded that the use of game media has a positive impact on students' abilities.
3	Anggraeni et al. (2024)	Systematic Literature Review: Improving Elementary School Students' Literacy and Numeracy Skills Through Game-Based Learning Media Approach	Through a systematic literature review, it was concluded that both digital and traditional games can enhance numeracy literacy. Media such as Quizizz, Etnomatematics, Puzzle, and Congklak offer engaging and contextual variations for students.
4	Wulandari & Widiansyah (2023)	The Application of Game-Based Learning to Improve Literacy and Numeracy	The Game-Based Learning model has been proven to help elementary school students learn with more enthusiasm and enjoyment. In this study, after applying this model, students showed an improvement in literacy skills from 0% to 66.7%, and in numeracy skills from 0% to 60%. This means that this approach can be used to simultaneously improve both of the students' fundamental skills.
5	Putri & Handay	Improvement of Numeracy Skills in Fifth-Grade	This study was conducted in four stages: Pretest AKM, Implementation of the GBL method, Posttest AKM, and T-test. The use of Game-Based Learning

	ani (2024)	Students of SDN Jatirejo with the Kahoot-Based Game-Based Learning Method	(GBL) based on Kahoot has proven effective in improving the numeracy skills of fifth-grade students at SDN Jatirejo. The effectiveness is evidenced by the significant difference between the pretest and posttest scores, as well as the potential for greater improvement if applied continuously.
6	Septian	Efforts to Improve	The GBL method with a Snakes and Ladders media has shown effectiveness
	a & Afnizar (2023)	Numeracy Skills Through the Implementation of Game-Based Learning in Fifth-Grade Students at SDN 06 Rantau Bertuah	in improving students' counting skills. There was a significant improvement from Cycle I to Cycle II, emphasizing that GBL can be an enjoyable and educational method in elementary schools.

The study results should be clear and concise. Restrict the use of tables and figures to depict data that is essential to the message and interpretation of the study. The results should be presented in a logical sequence in the text, tables and illustrations. The part of result exposes the findings obtained from research data which is related to the hypotheses. The results should summarize (scientific) findings rather than providing data in great detail. The discussion should explore the significance of the results of the work. Explains the findings obtained from research data along with theory and similar research comparison. Make the discussion corresponding to the results, but do not reiterate the results. The following components should be covered in discussion: How do your results relate to the original question or objectives outlined in the Introduction section (what/how)? Do you provide interpretation scientifically for each of your results or findings presented (why)? Are your results consistent with what other investigators have reported (what else)? Or are there any differences?. Include in the discussion the implications of the findings and their limitations, how the findings fit into the context of other relevant work, and directions for future research.

Based on the relevant articles summarized in the table, it can be seen that Game-Based Learning (GBL) utilizes a variety of media. This model has a positive impact on learning activities at the elementary school level. The consistent application of the Game-Based Learning model has shown a positive influence on the improvement of numeracy literacy skills in elementary education. This can be observed from several previous studies, which reported an increase in student learning outcomes after the implementation of the Game-Based Learning model. Several factors may contribute to this improvement, including the use of varied media that encourages enthusiasm, enhances the quality of numeracy learning, fosters greater student engagement, offers attractive and contextual variations for learners, and provides a learning experience that is enjoyable yet still educational.

In the first study listed in the table, research by Fitri & Juliani (2024) demonstrated that Game-Based Learning significantly improved numeracy skills, with mastery increasing from 12.5% to 75%. The second study, conducted by Fatafani & Rozie (2025), showed that game-based learning media could enhance literacy and numeracy skills, as evidenced by significant differences between pre-test and post-test results. The third study by Anggraeni et al. (2024) indicated that game-based learning improved numeracy literacy and provided engaging and contextual learning variations for students. The fourth study by Wulandari & Widiensyah (2023) reported that students' literacy skills increased from 0% to 66.7%, and numeracy skills improved from 0% to 60% after implementing the GBL model. In the fifth study, Putri & Handayani (2024) found that GBL was effective in enhancing students' numeracy skills, with significant differences noted between pre-test and post-test scores, and highlighted the potential for even greater improvements with sustained application. Finally, the sixth study by Septiana & Afnizar (2023) confirmed the effectiveness of GBL in improving students' arithmetic skills, marked by a significant increase from Cycle I to Cycle II, further emphasizing GBL's role as a fun and educational method for elementary students. The analysis of the selected articles also shows that the types of games used vary widely, ranging from traditional to digital games. This diversity enriches students' learning experiences, making them more engaging and better suited to the characteristics of elementary school learners. In general, the findings indicate that the Game-Based Learning model holds significant potential for application in elementary education, particularly in enhancing numeracy literacy skills

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References

- Anggraeni, R., Rahmadanti, DA, Aryanti, RD, Zahra, ASA, Fakhriyah, F., & Fajrie, N. (2024). Systematic Literature Review: Improving Elementary School Students' Numeracy Literacy Skills Through Game-Based Learning Media Approaches. *Intellektika: Student Scientific Journal* , 2 (5), 84-99.
- Fatafani, SR, & Rozie, F. (2025). Utilization of Game-Based Learning Media to Support Numeracy Literacy Skills of Grade V Students of SDN 1 Kudu. *Wahana Pendidikan Scientific Journal* , 11 (1. C), 228-232.
- Fitri, Y., & Juliani, S. (2024). Efforts to Improve Students' Numeracy Skills Through Contextual Learning with the Help of Simple Games. *PERISAI: Journal of Science Education and Research* , 3 (1), 118-127.
- Haloho, B., & Napitu, U. (2023). Implementation of Literacy and Numeracy Activities for Upper Elementary School Students. *Serunai Journal of Educational Administration* , 12 (2).
- Maulidina, M., Susilaningih, S., & Abidin, Z. (2018). The development of game based learning based on a scientific approach in fourth grade students of primary school. *JINOTEP (Journal of Inov. and Technol. Learning) Kaji. and Ris. in Technol. Learning* , 4 (2), 113-118.
- Putri, ARE, & Handayani, AD (2024, October). Improving the Numeracy Ability of Grade 5 Students of SDN Jatirejo with the Game Based Learning Method based on Kahoot. In *Proceedings of the National Seminar on Health, Science and Learning* (Vol. 4, No. 1, pp. 742-747).
- Rahayu, DA, & Hadi, FR (2023). Improving Literacy and Numeracy Skills Through Problem Based Learning Model Assisted by Game Based Learning. *Pendas: Scientific Journal of Elementary Education* , 8 (2), 5603-5616.
- Ramadhan, DN, Hermawan, HD, & Septiyanti, ND (2023). Implementation and development of reading, writing and arithmetic game learning media to improve literacy and numeracy at SD N 04 Kemuning. *Jurnal Ilmiah Kampus Mengajar* , 13-25.
- Rifqi, AH, Predina, SS, & Rusdianto, R. (2023, December). Learning innovation: exploring arcademics digital games to improve literacy and numeracy of elementary school students. In *National Seminar on Education and Learning*.
- Sanki, HA, Listyarini, I., Kholifah, PN, & Purnamasari, I. (2025). IMPLEMENTATION OF GAME BASED LEARNING TO IMPROVE LITERACY AND NUMERACY ABILITIES OF ELEMENTARY SCHOOL STUDENTS. *PeTeKa* , 8 (1), 301-311.
- Septiana, L., & Afnizar, E. (2023). Efforts to Improve Numeracy Ability Through the Implementation of Game Based Learning for Class V Students at SDN 06 Rantau Bertuah. *Swordsman: Journal of Character Education* , 1 (6), 288-297.
- Wulandari, W., & Widiensyah, AT (2023). Application of Games Based Learning Model to Improve Students' Literacy and Numeracy Skills. *Indonesian Journal of Science Education and Learning* , 13 (3), 113-119.