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Enhancing Science Learning: The Role of Educational Games in Elementary Classrooms

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Abstrak

Rendahnya hasil belajar IPA di sekolah dasar menjadi tantangan yang memerlukan pendekatan inovatif dalam proses pembelajaran. Penggunaan game edukasi sebagai media pembelajaran interaktif diyakini dapat meningkatkan minat dan pemahaman siswa terhadap pelajaran IPA di SD. Penelitian ini bertujuan untuk menganalisis efektivitas penggunaan media game edukasi dalam meningkatkan hasil belajar IPA di SD. Metode yang digunakan dalam penelitian ini adalah Systematic Literature Review. Peneliti mengumpulkan artikel jurnal dari Google Scholar, Research Gate, SINTA, dan Web of Science dalam rentang waktu dari 2019 hingga 2023. Teknik analisis data yang digunakan adalah deskriptip kuantitatif yang diperoleh dari 10 review artikel yang sesuai dengan kajian penelitian. Hasil analisis menunjukkan bahwa game edukasi memiliki sifat interaktif yang mampu menarik perhatian siswa, sehingga meningkatkan keterlibatan dan motivasi mereka saat proses belajar mengajar. Selain itu, penelitian ini juga mengidentifikasi berbagai jenis media game edukasi yang telah diterapkan dalam pembelajaran IPA, serta faktor-faktor yang mempengaruhi efektivitas penggunaannya. Temuan ini diharapkan mampu memberi pengetahuan untuk guru dan pengembang kurikulum untuk merancang strategi pembelajaran yang inovatif dan efektif dalam meningkatkan hasil belajar siswa dalam pembelajaran ipa di sekolah dasar.

***Kata kunci*:** Game *Edukasi, Hasil Belajar, Pembelajaaran IPA, Sekolah Dasar*

Abstract

The low learning outcomes of science in elementary schools is a challenge that requires an innovative approach in the learning process. The use of educational games as interactive learning media is believed to be able to increase students' interest and understanding of science lessons in elementary school. This study aims to analyze the effectiveness of using educational game media in improving science learning outcomes in elementary schools. The method used in this research is Systematic Literature Review. Researchers collected journal articles from Google Scholar, Research Gate, SINTA, and Web of Science in the time span from 2019 to 2023. The data analysis technique used is quantitative descriptive obtained from 10 review articles that are in accordance with the research study. The results of the analysis show that educational games have interactive properties that can attract students' attention, thus increasing their engagement and motivation during the teaching and learning process. In addition, this study also identified various types of educational game media that have been applied in science learning, as well as factors that influence the effectiveness of their use. The findings are expected to provides knowledge for teachers and curriculum developers to design innovative and effective learning strategies in improving student learning outcomes in science learning in elementary schools.

Keywords: Educational Game, Learning Outcomes, Science Learning, Elementary School

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1. INTRODUCTION

Natural science education is an important subject that must be learned in elementary school which aims to equip students with a basic understanding of natural phenomena and scientific concepts (Asmadi, 2022; Mutohar & Eka, 2022). Effective science learning can help students develop critical thinking skills, solve problems, and deep curiosity about the environment around them Thus, it is necessary to apply interesting and interactive teaching methods so that students can better understand and apply science concepts (Gumilar & Kristina, 2022; Lampropoulos et al., 2019). Despite its importance, the majority of students in elementary schools have barriers to mastering science materials that are often considered complex and abstract (Irawan et al., 2019; Salsabila & Supriatna, 2021). Conventional teaching methods, such as lectures and textbooks, are often not enough to attract students'

attention, which results in low interest and motivation to learn. This has a negative effect on student learning outcomes, which will certainly affect their mastery of the material (Fidya & Oktaviana, 2021; Sholichah & Ahmad, 2023). One promising approach is the use of educational game media in science learning (Rohmani, 2020; Rohmani et al., 2021). Educational games offer an interactive and fun learning experience, where students are able to learn while playing. With elements of competition and challenge, educational games can increase student engagement, making them more motivated to learn (Abdurrasyiid & Halidjah, 2023; Satria et al., 2021; Zulfah, 2023). In addition, this media can present scientific concepts in a more concrete and easily mastered form, so that students are able to link theory with real practice.

Several previous studies have shown that the application of educational game media can improve student learning outcomes in various subjects, including science. For example, previous study found that the application of educational games can improve students' understanding of the animal life cycle (Nugroho & Ma'arif, 2022). Other study also reported an increase in grade IV learning outcomes with Wordwall educational game media (Pamungkas et al., 2023). Other research, such as that conducted revealed the effectiveness of the "Blood Mission" game in teaching circulatory system material (Rana & Mahfudzah, 2023). These findings show the great potential of educational game media to improve student learning outcomes.

Although there have been many studies that discuss the use of educational game media, there are still few that systematically analyze their effectiveness in the context of science lessons in elementary school. This research aims to fill this gap by conducting a thorough analysis of various types of educational game media and their impact on student learning outcomes in science lessons. Thus, this research is expected to have a new impact on developing effective learning methods. The purpose of this study is to analyze and evaluate the impact of using educational game media on concept understanding, learning interest, and student academic results in science learning. Thus, it is hoped that this research will be able to provide useful recommendations for educators to design innovative and effective teaching strategies.

2. METHODS

This research uses the Systematic Literature Review (SLR) method, SLR is a literature review method that is carried out sequentially and structured in identifying, assessing, and synthesizing all scientific evidence relevant to a particular research topic (Lusiana & M, 2018). The main purpose of a systematic literature review is to provide a comprehensive and unbiased summary of existing insights on a particular topic, identify gaps in the literature, and provide direction for future research. Researchers collected journal articles from Google Scholar, Research Gate, SINTA, and Web of Science in the time span from 2019 to 2023. The data analysis technique used is quantitative descriptive obtained from 10 review articles that are in accordance with the research study. The steps of literature review can be seen in Figure 1.

Sources of articles related to the research themes reviewed in this study were taken from the Google Scholar, Research Gate, SINTA, and Web of Science databases in the time span from 2019 to 2023. The initial literature search focused on the article title "The Use of Educational Game Media in Improving Science Learning Outcomes in Elementary Schools," which resulted in 18,700 published articles. After that, the literature search was limited to the range of 2019-2023, which resulted in 15,700 articles. Furthermore, the literature search was expanded by adding the first keyword "Educational Game Media" which resulted in 2,400 articles, and the second keyword "Learning Outcomes" which resulted in 1,600 articles, the

third keyword “Science” resulted in 485 and the fourth keyword “Elementary School” resulted in 392. From these 392 articles, researchers selected data and limited the data according to criteria relevant to the research theme, so that articles were obtained that would be reviewed, which can be seen in Figure 2.

Figure 1. Literature Review Stages

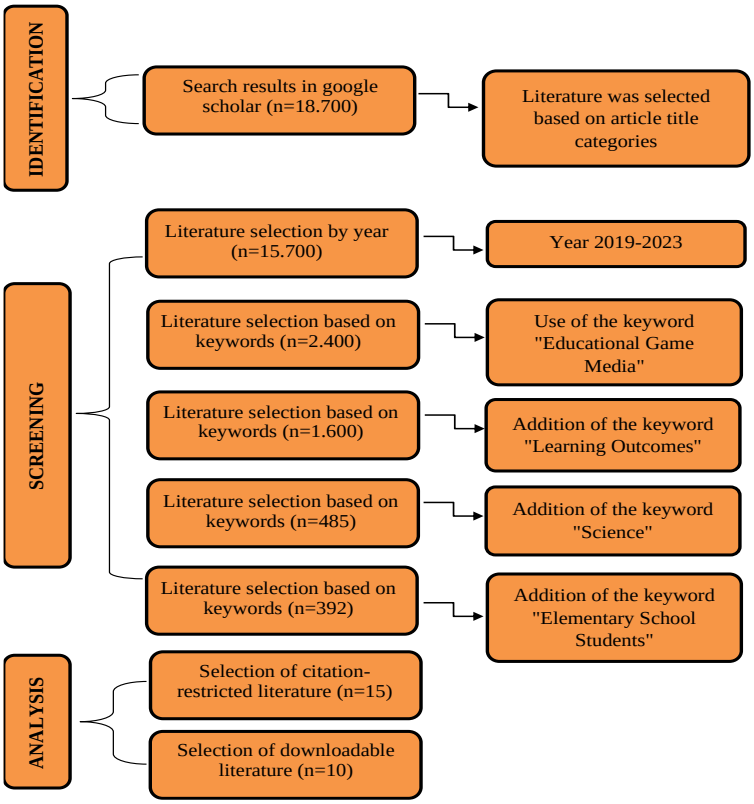

Figure 2. Stages of Inclusion Criteria for Search Analysis

3. RESULTS AND DISCUSSION

Results

The data in this study consisted of documents in the form of articles. The literature analysis process was carried out through the scholar.google.com site as much as 18,700

literature was successfully obtained from the scholar database, which consists of two main categories, namely books and articles. This research specifically focuses on articles, with searches conducted using four main keywords namely educational game media, learning outcomes, science learning, and elementary schools. The development of research from 2019 to 2023 can be seen in Figure 3.

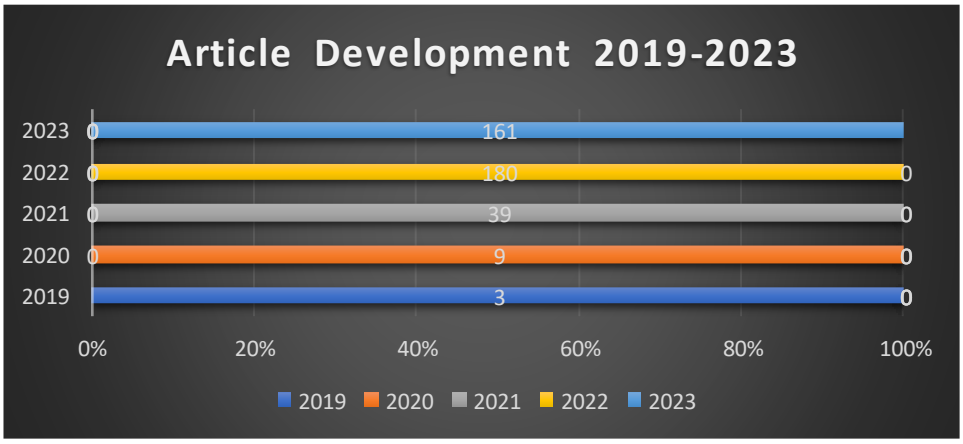

Figure 3. Article Development from 2019-2023

Based on the graph above, there is an increase in the number of article publications regarding the analysis of the effectiveness of educational game media in improving science learning outcomes in elementary school on Google Scholar from 2019 to 2023. In 2019 and 2020, there were 3 and 9 articles published on Google Scholar, respectively. This number increased sharply in 2021, with 39 articles published. This trend continued with an increasing number of publications, reaching 180 articles in 2022 and decreasing to 161 articles in 2023. The year 2023 recorded the highest number of publications on Google Scholar related to the use of educational game media in improving science learning outcomes in elementary schools. The following is a calculation of the average or mean number of articles published in the Google Scholar database during the period.

So, the average number of articles published in the Google Scholar database per year is rounded up to 78.4 articles. From the literature search related to the use of educational game media in improving science learning outcomes in elementary schools, 18,700 articles were found, with the 2019-2023 period producing 15,700 articles. Furthermore, using the keywords "Educational Game Media" and "Learning Outcomes," 1,600 articles were found, then further limited with the keywords "Science" and "Elementary School," resulting in 392 articles. After restriction based on citations with a minimum of 15 citations, 10 articles were finally obtained. From the results of this screening, 10 articles that discuss the effectiveness of using educational game media in improving science learning outcomes in elementary schools will be reviewed. The results of the review of 10 suitable articles in the use of educational game media in improving science learning outcomes in elementary schools are presented in the following Table 1.

Table 1. Results of Review Articles Related to the Research Title

No	Title	Journal Identity	Research Results	Recommendations
1	Improving Student Learning Outcomes in Science Learning	Al-Nafis: Journal of Biology and	Learning using educational game media in the form of	It is recommended to use puzzle educational games regularly in

No	Title	Journal Identity	Research Results	Recommendations
	on Life Cycle Material Animals Using Puzzle Media Educational Games (Nurasia et al., 2022)	Biology Education, 3 (1), 2023	puzzles can improve grade IV learning outcomes on animal life cycle material in science lessons at SDN 2 Pinceppute.	teaching science at SDN 2 Pinceppute to improve student learning outcomes.
2	Implementation of Wordwall Educational Game Media to Improve Learning Outcomes Learning Outcomes of Fourth Grade Students of SDN Mojoroto 4 Kediri City (Kurnia et al., 2023)	Simki Pedagogia Journal, 6 (2), 2023	The use of wordwall educational game media can improve student learning outcomes.	The use of video-based learning media and assessment media in the form of Wordwall educational games is good for improving student learning outcomes.
3	Development of Android-based "Blood Mission" Game Media on the Material of the Human Blood Circulatory System for Grade V Elementary School (Rana & Mahfudzah, 2023)	JPGSD, 11 (4), 2023	Android-based Blood Mission game media has a very high level of validity, with material validation reaching 95% and media validation of 90%, both categorized as very valid.	Blood Mission game media can be applied well in learning human circulatory system material in elementary schools.
4	The Effect of Whack A Mole Game on Learning Outcomes of Elementary School Students on Plant Adaptation Material (Nailiyah, 2023)	JPGSD, 11 (8), 2023	Good results were obtained, where the N-Gain calculation in the experimental class reached 73.5, while the control class obtained 64.2 results.	The use of whack a mole game has an effect on the learning outcomes of elementary school students.
5	Development of Learning Media Using Wordwall in Science Subjects (Darniyanti & Sapitri, 2023)	INNOVATIVE: Journal Of Social Science Research, 3 (3), 2023	Learning media using Wordwall, after being tested in the classroom during the learning process, proved to be very effective.	The effectiveness obtained from the results of the effectiveness sheet filled out by students on learning media using Wordwall reached a percentage of 85.18%, which is classified as very effective.
6	Feasibility of	Proceedings	Website-based	Researchers

No	Title	Journal Identity	Research Results	Recommendations
	Website-Based Wordwall Learning Media on the Theme of Exploring Outer Space for Grade VI Elementary School Students (Pamungkas et al., 2023)	of the Basic Scientific Conference, 4, 2023	Wordwall learning media is very feasible to be used by grade VI elementary school students as thematic learning media with the theme of exploring outer space, because the media product is right for student needs.	recommend other researchers to conduct research on the effectiveness and practicality of website-based Wordwall learning media.
7	Development of Educational Game Media "Adventure of the ISAAC" Based on Android on the Material of Style Class IV Elementary School (Firdaus & Yermiandhoko, 2020)	JPGSD, 8 (2), 2020	Educational game media "The Adventure of Isaac" based on Android can be considered valid and very practical to be used by grade IV elementary school students who face difficulties in learning force material.	Improvements are needed in this Educational Game Media "The Adventure of Si Isaac", and it is hoped that other researchers can adjust it to the times when developing the media.
8	Development of Educational Game Media "Marbel Fauna" for Elementary School Students (Nugroho & Ma'arif, 2022)	Basicedu Journal, 6(4), 2022	There is a positive influence on improving student learning outcomes by using educational game media.	The use of Marbel Fauna educational game media is systematically declared very feasible for use in learning at school.
9	Development of Android-based "Physics Word" Educational Game for Elementary School Children on the Concept of Force (Erfan et al., 2020)	Lectura: Journal of Education, 11 91), 2020	Educational games that have been validated by media experts with an average score of 3.88 and by material experts with an average score of 3.39 are declared feasible.	The Android-based educational game "Physics Word" is categorized as a feasible media and can be used in learning science for the material of the Concept of Force for elementary school students.
10	The Effect of Educational Game Learning Media on Student Learning	caXra: Journal of Elementary School	Application of educational game learning media is well implemented	It is expected that teachers at SDN 2 Lengkongjaya can apply more diverse

No	Title	Journal Identity	Research Results	Recommendations
	Interest in Science Learning (Fauzi et al., 2022)	Education, 2 (2), 2022	and effective.	learning media in science learning.

Research on the use of educational game media in science learning shows that educational games consistently improve student learning outcomes on a variety of materials, such as the animal life cycle, the circulatory system, and the concept of force. Platforms such as Wordwall and Android-based games, such as “Blood Mission” and “The Adventure of ISAAC,” have been shown to be effective in improving understanding and creating an interactive learning experience. The use of educational games also increases students' interest in learning and keeps them more engaged. Educational games are considered an effective innovative tool to support science learning in elementary schools, with the hope that their development will continue to be improved according to technological developments.

Discussion

From the results of the analysis, 10 relevant articles were found regarding the use of educational game media in improving science learning outcomes in elementary schools. Based on the results of research revealed that the use of educational game media in the form of puzzles in learning can improve the learning outcomes of class IV animal life cycle material in science lessons at SDN 2 Pinceppute (Nurasia et al., 2022). Other research revealed that the application of Wordwall educational games is declared effective for improving student learning outcomes through more interactive and innovative learning (Kurnia et al., 2023). Through game elements that actively involve students, Wordwall helps strengthen their understanding of the material and increase their learning motivation. Other research revealed that Android-based Blood Mission game media has a very high level of validity, with material validation obtaining 95% and media validation obtaining 90%, both categorized as very valid (Rana & Mahfudzah, 2023). Other research revealed if there is a differentiating power of understanding from experimental classes that use games and control classes that only use interactive PowerPoint presentations (Nailiyah, 2023). Research revealed that media using Wordwall, after being tested in class on learning activities, proved to be very good (Darniyanti & Sapitri, 2023).

Previous research revealed that the website-based Wordwall learning media is very suitable and can be applied for grade VI elementary school students to become thematic learning media with the theme of exploring outer space, because the product meets student needs (Pamungkas et al., 2023). Previous research revealed that the Android-based educational game media "The Adventure of Isaac" can be considered a valid and very useful media for grade IV students who experience obstacles in understanding force material (Firdaus & Yermiandhoko, 2020).

The results of other research revealed that there is a positive influence on improving student learning outcomes by using educational game media (Nugroho & Ma’arif, 2022). The results of hypothesis testing show that the feasibility test in small groups reached 86.8%, while in large groups it reached 87.3%. Other research revealed that educational games that have been validated by media experts with a value of 3.88 and by material experts with an average value of 3.39 are declared feasible (Erfan et al., 2020). The results of the assessment from users, namely students, show that the game is very feasible to be developed further. Another study revealed that there was an effect of educational game media on student interest in science lessons (Fauzi et al., 2022).

Various studies have shown that the use of educational game media consistently improves student learning outcomes and interest in science learning. Others research proved that educational games based on puzzle and Wordwall media are effective in improving student understanding (Ibrahim et al., 2022; Nurasia et al., 2022). The development of games such as "Blood Mission" and "Whack A Mole" also showed a positive impact on understanding complex concepts and learning interest (Rana & Mahfudzah, 2023). In addition, previous research by emphasized the importance of educational games in increasing student engagement, while a study on the feasibility of Wordwall media (Fauzi et al., 2022). Research shows the potential of digital platforms to support learning (Pamungkas et al., 2023). Thus, educational game media is very effective in improving learning outcomes and creating an interesting learning experience for students.

Analysis of the Effectiveness of Educational Game Media in Improving Science Learning Outcomes

Analyzing the effectiveness of educational game media to improve science learning outcomes has been the focus of research in recent years. Educational game media offers an interactive approach that is able to encourage students' attention and encourage them to learn. In the context of science learning, the use of educational games allows students to explore scientific concepts through fun and challenging strategies (Aini & Abdul, 2022; Swandi et al., 2023). This method does not just make learning interesting, but provides opportunities for students to practice and apply their knowledge in relevant situations. The results showed that students who use educational game media tend to have good mastery of the subject matter compared to conventional learning methods (Akbar & Hadi, 2023; Asmaryadi et al., 2022).

One of the main advantages of educational gaming media is its ability to increase student engagement in the learning process (Astutik et al., 2019; Ghozali et al., 2019). With interactive game elements, students are active and engaged as learning takes place. Educational games often create a competitive and collaborative environment, where students can learn through their peers (Fajria et al., 2019; Hidayatullah et al., 2023; Zulfah, 2023). In addition to this, this media also allows students to get immediate feedback, so that they are able to see where they have mastered the material learned (Ferawati & Saputri, 2022; Muhammad et al., 2023). This high engagement contributes to increased student motivation, which is an important factor in successful learning (Fajar et al., 2022; Riskyana & Noperman, 2022).

In analyzing the effectiveness of educational game media, the assessment of student learning outcomes is a very important aspect. Better learning outcomes can be measured through improved academic grades, concept understanding, and the ability to apply knowledge in real situations (Mulya & Huda, 2022; Nur & Ika, 2018). Previous research revealed that students who applied educational games in science learning experienced significant improvements in these aspects (Hermansyah et al., 2023). In addition, educational games also function to build students' critical thinking and problem solving skills. Thus, the application of educational game media is not only useful in short-term learning outcomes, but also for developing skills that are useful in the future (Fidya & Oktaviana, 2021; Sholichah & Ahmad, 2023).

Overall, the analysis of the effectiveness of educational game media in improving science learning outcomes shows positive results. Although there are challenges in implementation, such as the need for teacher training and access to technology, the benefits gained from using educational games are valuable (Atika et al., 2021; Simaremare et al., 2022). Therefore, it is recommended that schools start integrating educational gaming media in their curriculum (Aditia & Hamka, 2021; Widuroyekti et al., 2023). Through this approach, it is expected that students will be able to learn in a fun and effective way, and

improve their understanding of science materials. With the right support, educational game media can be a powerful tool in supporting quality learning in schools (Agustin et al., 2023; Akhwani et al., 2021).

The use of educational game media in science learning not only improves student learning outcomes, but also opens up opportunities for further exploration of the types of interactive technologies that can be used in education (Riskyana & Noperman, 2022; Salsabila & Supriatna, 2021). By considering various approaches to educational game development, there is potential to increase student engagement and support the continuous development of knowledge and skills. This suggests the importance of adapting curricula that are responsive to technological developments to maximize students' learning experiences.

4. CONCLUSION

The use of educational games as learning media in science lessons in elementary school has been proven to have a major good effect on student learning outcomes, from its interactive and fun nature that is able to attract attention and increase student enthusiasm. To make the use of educational games in science learning more effective, it is recommended that schools integrate this media into the curriculum in a more structured manner. Teachers also need to receive special training to optimize the use of educational games in daily learning. In addition, periodic evaluation of the effectiveness of the games used needs to be done to ensure that the media remains relevant and in accordance with the needs of students. Developing educational games that fit the school curriculum also requires collaboration between developers and educators. Finally, parents should be involved during this learning process to support their children in learning at home. Thus, the use of educational games can continue to have a good influence on student learning outcomes.

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