Research on Educational Games in Learning in Indonesia: A Systematic Review of the Literatures

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Abstract: Research on educational games in learning contexts and advances in science and technology are becoming increasingly important. This research aims to analyze the use of educational games in the learning context in Indonesia, focusing on computer science and social science. The method used in this research is a Systematic Literature Review (SLR), with inclusion criteria of publication period between 2018 and 2023, English language articles, article accessibility, and relevance to computer science and social sciences. The results of this research analysis include several important findings, namely: 1) the number of educational game document publications has fluctuated, 2) affiliation trends vary, 3) author trends also vary, and 4) the results of the systematic analysis show that educational games can improve student academic achievement, problem-solving abilities, creative thinking, and independent learning abilities. In addition, the role of teachers and parents is recognized as an important factor in supporting and maximizing the benefits of digital educational technology. The findings from this research emphasize the importance of designing learning that integrates educational game-based approaches to improve the quality of learning and achieve better learning outcomes for students. The implications of this research provide a basis for developing innovative and sustainable learning strategies in the fields of computer science and social sciences in Indonesia.

Keywords: Educational games; Innovative strategies; Problem-solving ability; Self-regulation; Think creatively

Introduction

Education has a vital role in the progress of a country (Amorós et al., 2023; Godemann et al., 2014; Wan & Wang, 2023), furthermore good quality education can produce superior human resources in various aspects, such as critical thinking, problem-solving, communication, collaboration, creativity, and innovation (Mailisman et al., 2020; Matsun et al., 2023; Muramatsu et al., 2019; Sarlin et al., 2022; Sarwi et al., 2019; Supandi & Senam, 2019). Therefore, continuous improvement in the learning process is a must (Brown et al., 2019; Reese et al., 2021). Innovation in learning is essential in efforts to improve the quality of education (Farikah et al., 2019; Mukhadis et al., 2021; Putra et al., 2021; Widiasanti et al., 2023). Educators and educational researchers continue to search for learning methods and tools that can improve student understanding, motivate learning, and increase student engagement in learning (Widiasanti et al., 2023). Along with the rapid development of Information and Communication Technology (ICT), innovation in the field of education, primarily through educational games, is increasingly becoming a concern in efforts to increase learning effectiveness (Dlab et al., 2020; Martínez-Cerdá et al., 2018; Zhao et al., 2021).

Educational games are game variants specifically designed to provide education or knowledge to players in the context of the learning process (Clarke et al., 2020; Dubey & Sinha, 2023; Rüth et al., 2022). The main aim of educational games is to arouse students' interest in the subject matter being taught (Crovato et al., 2016; Ng et al., 2013; Schadenbauer, 2009). This game combines play elements with learning, creating an

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exciting and effective environment for the learning process (Fokides & Kefallinou, 2020; Suja'i et al., 2019). In educational games, players not only play for entertainment but also to gain a deeper understanding of the subjects taught in the game (Daungcharone, 2019; Li et al., 2022). In addition, educational games can stimulate students to think creatively and collaborate with classmates in a learning context (Moffett & Cassidy, 2023; Novia et al., 2020; Stojanovska, 2021). Therefore, the use of educational games as an alternative means of learning is increasingly emerging as an attractive option in the educational process.

However, document data indexed in Scopus regarding educational game research implemented in Indonesia shows that the information that can be accessed is still limited. As a result, teachers do not receive sufficient information regarding the critical role of educational games in the learning process. These aspects include creating an exciting and effective learning environment, increasing students' motivation, enthusiasm, and interest in learning, encouraging creative and collaborative thinking in the learning process, and increasing understanding of the subject matter. Therefore, there is excellent potential to continue more comprehensive and in-depth literature research on educational games.

This research aims to review the use of educational games in Indonesia's learning context, which is recorded in the Scopus database. This research will also identify the extent to which educational games have been applied in computer science and social sciences. The benefits obtained through using educational games for students will be analyzed, along with the obstacles faced in adopting educational games in learning. Thus, it is hoped that this research can provide a deeper understanding of the role of educational games in the academic context in Indonesia. The results of this research can become an essential basis for developing learning strategies supported by effective game methods. This research focuses on using educational games in formal learning contexts in Indonesia, covering various levels of education. Through this comprehensive approach, this research can provide valuable insights for educational practitioners, game developers, and policymakers in efforts to improve the quality of education in Indonesia.

Method

This research is a systematic literature analysis (SLR), which follows a similar study conducted by (Ahmad & Junaini, 2020 Denyer & Tranfield, 2009). This SLR involves identifying, evaluating, and collecting all relevant information to answer analytically determined research questions. To provide a comprehensive understanding of the chosen research topic, this research adopts an approach that has been proven effective. The first step in the SLR process is to formulate research questions that are the focus of the analysis clearly and precisely. Document searches were conducted through appropriate databases to identify documents relevant to the research questions. Document search results are evaluated and selected based on predetermined inclusion criteria. Articles that meet the inclusion criteria will be included in the analysis, while reports that do not meet the inclusion criteria will be excluded from the study. In-depth analysis of selected documents involves synthesizing data and findings from each record to identify patterns, similarities, differences, and critical results related to the research questions. The final step is to prepare a comprehensive summary of all the research that has been analyzed.
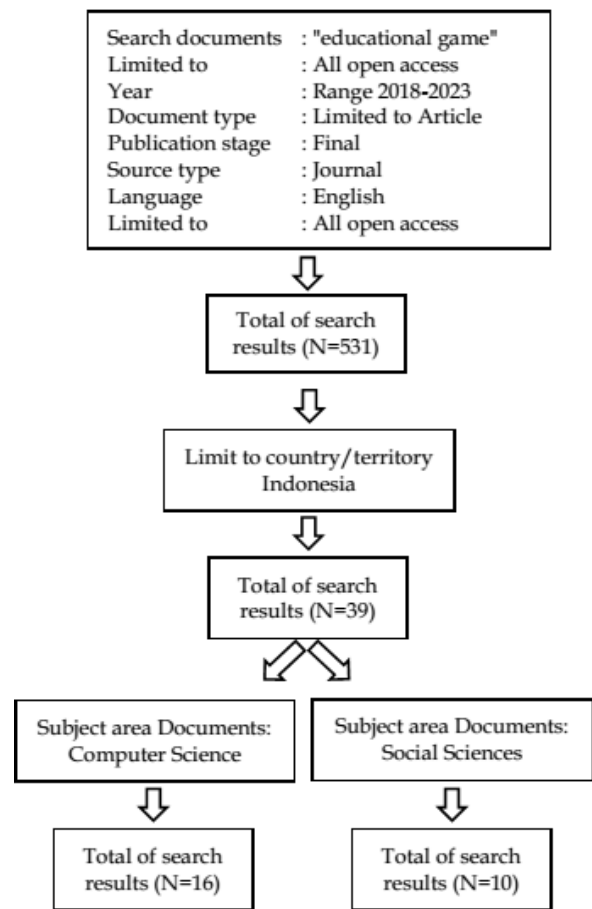
Figure 1. Review process for study selection

The research questions explained in this study include publication trends for educational game documents in Indonesia (RQ1), percentage of papers by affiliation (RQ2), number of articles by academic branch (RQ3), and essential information related to education. Games in the learning process (RQ4). This research searched for studies using the keyword "educational games" in the Scopus database to answer

this research question. The data found is then analyzed. The study selection and evaluation step involved an extensive search through the Scopus database, taking into account specific inclusion criteria, such as year of publication between 2018 and 2023, and focus on the study fields of computer science and social sciences. In addition, this research also considers all levels of education, from primary to higher education, to ensure a comprehensive understanding of academic learning. All stages in the literature research process are explained in detail in Figure 1, including keywords and filtering settings.

Result and Discussion

The line graph depicts the development of educational game document publications in the last five years, from 2018 to 2023. Based on the chart, we can see how the number of published documents changes over time and provides a better understanding of the fluctuations in this research subject. You can refer to Figure 2 for further visualization.
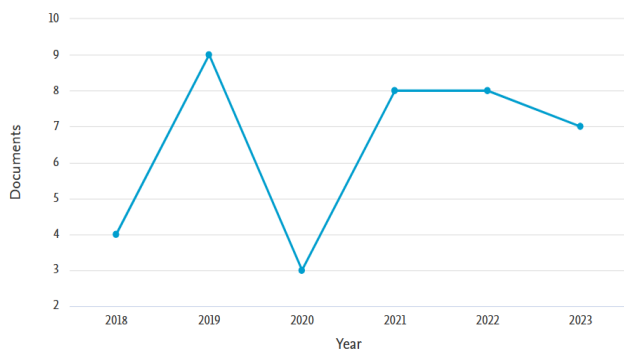

Figure 2. Trends in the number of documents by year range

Analysis by year of publication of documents shows exciting patterns in the development of research on this topic. The increase in the number of copies from 2018 to 2023 reflects increasing interest in the use of educational games in learning contexts. It can be seen that 2019 recorded the highest number, with nine documents showing the peak of interest then. Although there was a slight decline in 2020 with only three papers, the positive trend soon recovered, and the numbers increased in subsequent years. Moreover, in 2023, with a total of seven, it shows that this topic remains relevant and exciting for researchers in the face of continuous educational changes.

This increase likely reflects recognition of the critical role of educational games in enriching students' learning experiences and increasing the effectiveness of the learning process at various levels of education. This opinion is in line with the statement by Tarigan et al. (2023), who stated that educational games, which have been constructed in recent years, significantly

contribute to reviewing and strengthening learning material. Furthermore, Jamalludin et al. (2023) and Gani et al. (2022) reported that educational media technology innovation was able to improve student learning outcomes without causing boredom.

Figure Graph 3 depicts affiliation trends based on the number of published documents in the last five years, from 2018 to 2023. This graph will help us understand the relationship between affiliation and the number of printed copies and provide insight into variations in these affiliations. For a more detailed visualization, you can refer to Figure 3.
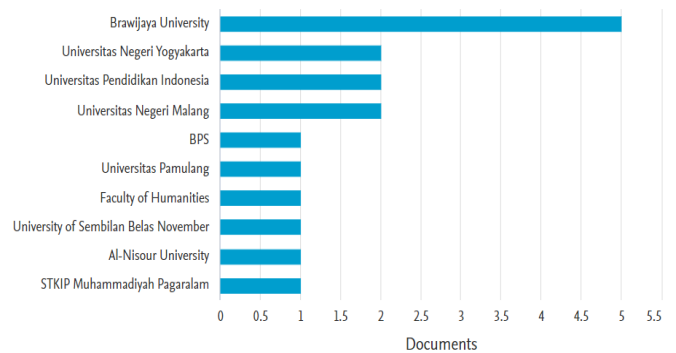

Figure 3. Affiliate trends by number of documents

Analysis based on author or institutional affiliation shows that several institutions are active in research on educational games in learning contexts. Brawijaya University is the most productive institution with five related documents, offering a solid commitment to developing this research. Yogyakarta State University, Indonesian Education University, and Malang State University each have two papers related to this topic, indicating significant contributions in this research domain. Apart from that, several institutions such as BPS, Pamulang University, Faculty of Cultural Sciences, Nineteen November University, Al-Nisour University, and STKIP Muhammadiyah Pagaralam contributed one document each. This shows the various institutions involved in educational game research in the Indonesian academic context. The presence of multiple institutions involved shows the importance of cross-institutional collaboration in developing research and best practices in integrating educational games into the learning process.

Figure Graph 4 visualizes author trends based on the number of published documents from 2018 to 2023 in the context of educational games. This graph provides information about the authors who have contributed to this field and the number of documents they published. For more complete visual details, refer to Figure 4.
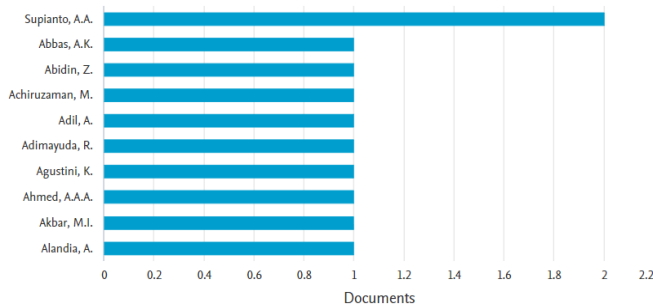
Figure 4. Trends in author names by number of documents

The analysis carried out by the author shows that Supianto, A.A. is the most productive writer with two documents related to educational games in the learning context in Indonesia. Apart from that, there are several other authors such as Abbas, A.K., Abidin, Z., Achiruzaman, M., Adil, A., Adimayuda, R., Agustini, K., Ahmed, A.A.A., Akbar, M.I., and Alandia, A.; each has 1 document related to this topic. This indicates that several authors have contributed to developing research on educational games in Indonesia. Collaboration and contributions from various authors can help enrich understanding and develop more effective game-based learning methods.

The results of a more in-depth systematic analysis of the branches of Computer Science and Social Sciences and contributions from various authors provide a strong foundation for understanding the development of educational games research in educational contexts. More detailed information and a more structured picture can be seen in Table 1 and Table 2.

Research by Syaliman et al. (2022) highlights the importance of gaming technology as a practical innovation, especially in the face of changing learning environments. Learning innovation can encourage the achievement of learning goals (Kerans, 2022). Findings from Agustini et al. (2023) show that the use of virtual reality-based gamification in prehistory learning can significantly increase student engagement, interest, motivation and understanding of prehistory material. Safiatuddin et al. (2023) reported that virtual laboratories based on virtual reality can improve student learning outcomes. This research is in line with other findings expressed by Fairuzabadi et al. (2018), Rosmansyah et al. (2019), Sarifah et al. (2022), and Sulistyarini et al. (2020), which shows that educational games are also able to increase learning satisfaction and students' perceptions of the learning process. Apart from that, the findings revealed by Florence et al. (2023) confirmed that using games in learning mathematics can trigger students' interest in education. Lutfi et al. (2021) also noted that using computer games in science subjects is effective and liked by students. Pratikto et al. (2021) added that educational games can help students hone their entrepreneurial analysis skills interactively and, interestingly, much more effectively than conventional learning methods.

Rumeser et al. (2019) underline that game-based education is currently recognized as an effective learning method. However, successfully implementing this approach requires a deep understanding of student needs and the technology used in the learning process (Khairini et al., 2021; Maghfiroh et al., 2023). A statement by Atmaja et al. (2020) strengthens this idea by emphasizing that the learning process involving computerized games requires the teacher's role as a game manager, not just as a facilitator. Therefore, teachers must understand how to operate, control and integrate educational games into the learning process. Susilowati et al. (2023) stated that plays in the learning process cannot replace the role of lecturers in the learning process. On the other hand, educational games function as a tool that can improve students' learning experiences and make the learning process more enjoyable. Furthermore, Amelia et al. (2023) stated that the more students use gadgets in learning, the higher the involvement of parents in supporting the learning process. So, teachers and parents must understand the role of technology and games in supporting the learning process.

The development and application of educational games in the learning process has proven to be effective in encouraging students' interest, involvement, understanding and motivation towards subjects (Yosimayasari, 2021). To achieve optimal results, teachers' comprehensive understanding of the use of computer games in learning is the primary key. Teachers need in-depth knowledge of operating, controlling, and integrating computer games into the curriculum. With this understanding, teachers can maximize the benefits of this technology in improving the quality of learning and student involvement in the teaching and learning process. Apart from that, the role of parents is also essential in supporting children's digital education. Parents need to realize how significant their involvement is in their child's learning process. They should better understand and be familiar with the applications or technology used in children's learning. That way, they can provide more effective support and understand how technology can help children learn.

Table 1. Contributions and Important Information in Chronological Order (in Order of Year) Computer Science

Important information	References
The use of virtual reality-based gamification in prehistoric learning has succeeded in improving several essential aspects of the learning process, such as 1) increased student activity, 2) increased interest in prehistoric subjects, 3) increased motivation to study, and 4) better understanding of prehistoric subject matter.	(Agustini et al., 2023)
This research reveals a positive relationship between children's use of gadgets and the mother's level of involvement in learning. Hence, the more children use devices in learning, the higher the mother's level of participation in supporting education.	(Amelia et al., 2023)
In the process of learning with computerized games, the teacher does not only act as a facilitator but also as a manager of the game itself. Teachers who have a deep understanding of how to run, control, and integrate computer games into the curriculum can maximize the learning benefits offered by these games.	(Atmaja et al., 2020)
The results of the statistical analysis show that the use of the proposed 3DMUVLE has a positive impact on several aspects, including increasing knowledge, level of satisfaction, interest in learning, engagement, and perception of the usefulness of the tool. This indicates that the 3DMUVLE educational game effectively increases the participants' understanding and learning motivation.	(Fairuzabadi et al., 2018)
The results of this study reveal that the use of games in learning mathematics has a positive impact on students' interest in learning; this can be seen in students being deeply involved in playing games and showing a strong desire to continue playing.	(Florensia & Suryadibrata, 2023)
The results of this research show that esports games have combined digital and physical aspects in an educational context, thereby creating opportunities to develop relevant skills in a fun and interactive way. This illustrates how technology and games can support student learning and development in the digital era.	(Ibda et al., 2023)
The results of this study indicate that using computerized games as a learning tool in science subjects is very effective and well-received by students, further increasing student learning activities.	(Lutfi & Hidayah, 2021)
These results demonstrate the great potential of using games in educational contexts. This game has helped students hone their entrepreneurial analysis skills interactively and interestingly, which may be more effective than conventional learning methods	(Pratikto et al., 2021)
This research reveals that children's responses to the educational game tools developed were very positive and helpful in learning.	(Ramadhani & Kusumanto, 2022)
The use of the proposed 3DMUVLE has a positive impact on several aspects, including increased knowledge, level of satisfaction, interest in learning, engagement, and perception of the usefulness of the tool. 3DMUVLE indicates that this educational game effectively increases participants' understanding and learning motivation.	(Rosmansyah et al., 2019)
This exploratory step is vital because severe or game-based education is increasingly recognized as an effective learning method. However, creating a genuinely effective game or serious project requires a deep understanding of various aspects, from student needs to the technology used in game development.	(Rumeser & Emsley, 2019)
This research indicates that Android-based educational games have proven effective in increasing interest in learning mathematics among sixth-grade students in Matraman District, East Jakarta, Indonesia.	(Sarifah et al., 2022)
This research reveals that the educational game developed in this research has great potential as a learning tool for children from kindergarten to elementary school level.	(Sulistyarini et al., 2020)
Educational games are learning tools that can complement various learning methods, but it needs to be emphasized that they cannot replace the role of the lecturer in the learning process. This game has the potential to support students in understanding the concepts of learning material and increase their involvement in the learning process. However, educational games should be seen as a learning support tool that can enrich students' learning experiences and make learning more enjoyable.	(Susilowati et al., 2023)
The research results show that game technology has great potential in improving the quality of education as an innovative and effective learning tool.	(Syaliman et al., 2022)
The survey results stated that the game "Baluk Olas Abjad" was easy to use and access. Furthermore, this game has the potential to help students make the learning process more enjoyable.	(Tajuddin et al., 2023)

Table 2. Contributions and Important Information in Chronological Order (in Order of Year) Social Sciences

Important information	References
The study results show that Iranian EFL students show a positive attitude towards gamification in learning English idioms. Moreover, the results show that fun, enjoyment, reduced anxiety, engagement, and direct feedback are the factors students mention for instructional games.	(Ahmed et al., 2022)
The results of this study indicate that during the beta testing phase, around 71.11% of respondents who were elementary school students succeeded in increasing their knowledge about the environment.	(Huda & Ramadhan, 2021)
The results of this study indicate that the use of educational games positively impacts student learning outcomes.	(Patmanthara et al., 2019)
The results of this study reveal that students have different mathematical problem-solving abilities in several aspects, which are measured through several indicators. In addition, this study shows that students tend to have better mathematical problem-solving skills through open-ended-based virtual reality games, which	(Pramuditya et al., 2022)

Important information	References
enable them to be more involved in exploration and creative thinking in solving mathematical problems.	
The results show that the use of educational games in learning has had a positive impact on introducing mathematical concepts, especially in terms of measuring length and volume.	(Rahayu et al., 2022)
This finding emphasizes the importance of paying attention to audio, visual, and special effects aspects and victory conditions in creating microgames on open platforms. Playing instructions that match the cellphone screen is also an essential factor.	(Rahmadi et al., 2021)
The results showed that most parents (76%) wanted "Cognitive Games" and "Teachers" for their children's education at home, while half of them (50%) spent "More than 30 minutes" for their children's education. About 30% spend "More than IDR 300,000," and 86% feel that "Books" and "Educative Play Tools" are essential for children's learning.	(Syaodih et al., 2021)
This analysis indicates that educational games, in this case, 'chemondro,' can potentially improve students' ability to learn independently.	(Wiyarsi et al., 2019)
The results of this study highlight three aspects observed in the context of learning: symbolic thinking, problem-solving, and logical thinking. 1) The results of the study show that symbolic thinking can be improved independently only with the help of audio. 2) The study results show that audio assistance can improve problem-solving independently. 3) The research results show that teacher assistance is needed to complete the game for the logical thinking aspect.	(Rakimahwati et al., 2022)
The results of this study indicate that the use of educational games or role plays has proven effective in overcoming motivational and self-confidence problems in children with learning difficulties.	(Asrowi et al., 2019)

Several studies from Ahmed et al. (2022), Huda et al. (2021), Rahayu et al. (2022) and Patmanthara et al. (2019) highlight the benefits of gamification in learning, namely reducing student anxiety, increasing their engagement, and expanding their knowledge. On the other hand, Pramuditya et al. (2022) show that open-ended virtual reality technology can improve students' mathematical problem-solving and stimulate creative thinking. In addition, Wiyarsi et al. (2019) emphasize the positive role of educational games such as 'Chemondro' in improving students' independent learning abilities, while Asrowi et al. (2019) support the use of educational games or role play to overcome motivation problems and increase feelings of self-confidence—Children who have learning difficulties.

On the other hand, Rakimahwati et al. (2022) revealed findings related to symbolic thinking, problem-solving, and logical thinking. The results showed that symbolic thinking could be improved independently with the help of audio alone, while problem-solving can be improved independently of the use of audio. However, for logical thinking skills, teacher assistance remains a key factor in completing the game. Meanwhile, Syaodih et al. (2021) present parents' preferences regarding education, stating that parents want "Cognitive Games" and "Guidelines" to support their children's education. These findings indicate that the use of educational games in learning can have a positive impact on student learning outcomes. Furthermore, Maryani et al. (2022) stated that learning media plays an important role in facilitating students' understanding of abstract phenomena and natural phenomena so that students can be better able to solve problems. Therefore, teachers are expected to be able to design learning by

considering an educational game-based approach. This statement aligns with the findings of Rosidah et al. (2021), which state that research and development of mobile learning media still needs to be improved to increase students' scientific literacy. Teachers can also encourage active communication in the classroom and utilize natural objects around students to create a learning environment that supports student understanding. Asma et al. (2020) reported that interactive electronic student worksheets could increase student learning activities. Doyan et al. (2023) reported that STEM-based physics learning media could improve students' critical thinking skills in a valid, practical and effective manner. Therefore, teachers are expected to improve the quality of learning and help students achieve better learning outcomes.

Conclusion

The results of the literature review analysis show that educational games are an effective tool or medium in improving academic achievement, problem-solving abilities, creative thinking, and developing students' independent learning abilities. Various studies show that educational games, gamification, and the use of technology in learning positively impact various aspects of education, including interest in knowledge, learning activities, understanding, motivation, satisfaction, and students' perceptions of the learning process. This confirms that game and technology-based approaches are crucial in facing the dynamics of an ever-changing learning environment. However, successfully implementing this approach depends on a deep understanding of student needs and the technology used in the learning process. The teacher's

role as a game manager, not just a facilitator, is an essential factor in maximizing the benefits of this technology in improving the quality of learning and student engagement. Apart from that, the role of parents is also very significant in supporting children's digital education. They need to understand the technology used in children's learning so they can provide more effective support. To achieve optimal results, implementing educational games must be supported by comprehensive understanding and collaboration between teachers, students and parents. Thus, game technology can be an effective tool to improve learning in this digital era. Teachers must design learning by considering an educational game-based approach and utilizing active communication in the classroom and natural objects around students to create a learning environment that supports a better understanding of mathematics. With this approach, the potential is open to improve the quality of learning and help students achieve better learning outcomes.

Conflicts of interest
The authors declare that they have no competing interests.

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