

Interactive Learning Media Innovation : The Role Of Education Games In Sharpening Students Problem Solving Skill

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Abstract

This study aims to examine the effectiveness of the application of interactive learning media based on educational games in developing students' problem solving skills. Using a descriptive qualitative approach, data was collected through structured interviews with teachers and students, as well as direct observation of learning activities in the classroom. The results showed that the application of educational games created a more interactive, challenging, and motivating learning atmosphere for students to think critically. During the learning process, students showed improvement in the ability to analyze problems, design alternative solutions, evaluate the results of decisions, and dare to take the initiative in solving various problem solving situations simulated through games. Teachers also noted the development of independent thinking, increased collaboration between students, and students' courage in expressing their opinions during the learning session. Educational games are proven to provide meaningful learning experiences through the application of the principles of constructivism, experiential learning, and gamification, which allow students to actively build understanding through direct involvement in problem solving. This research emphasizes that educational games have significant potential as interactive learning innovations that support the strengthening of problem solving competencies as one of the key skills in facing 21st century learning challenges.

Keywords: Educational Games, Interactive Learning Media, Problem Solving Skills

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Introduction

Problem solving skills are essential competencies that must be possessed by students in facing the increasingly complex challenges of 21st century life (Setiawan et al., 2024). Rapid developments in technology, economy, social, and culture require individuals to be able to think critically (Facione., 2021), analyze situations in depth, and make effective decisions. This ability is not only needed in solving academic problems, but is also very relevant in everyday life, where the problems that arise are often dynamic, multidimensional, and require creative and adaptive solutions. The world of work demands individuals who are ready to face



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uncertainty, respond quickly to change, and make a real contribution to solving organizational and community problems.

The development of problem solving skills requires an active, collaborative, and problem-based learning approach (Mohd-Yusof et al., 2023). The teacher acts as a facilitator who guides learners in identifying problems, analyzing information, formulating alternative solutions, and evaluating the results of decisions (Husna., 2025). This learning process hones critical and logical thinking skills, while developing communication, cooperation, and empathy skills that are important in social and professional life. Strengthening problem-solving skills from an early age prepares students to become independent, innovative, and competitive individuals in facing various global challenges in the future.

The rapid development of science and technology has brought significant changes in the world of education. Advances in the field of information and communication technology provide ample opportunities to create various learning innovations that are more effective, efficient, and interesting. One form of innovation that is growing rapidly today is digital-based interactive learning media (Permana et al., 2024). Interactive learning media is able to present a dynamic learning environment, where students can actively participate in the learning process, interact directly with learning materials, and practice applying concepts that have been learned through simulations or situations that resemble real conditions (Sari et al., 2023). Through this media, learning becomes more contextualized, encouraging the development of critical thinking skills, creativity, and problem solving abilities that are needed in facing the challenges of the modern era.

The rapid development of science and technology has brought significant changes in the world of education, especially in terms of learning approaches (Trelease., 2016). Information and communication technology provides great opportunities for the development of interactive learning media that are more innovative, effective, and interesting. One form of innovation is the utilization of educational games that offer an interactive, fun, and challenging learning experience for students. However, many educational institutions still apply conventional teacher-centered learning methods, such as lectures, memorization, and repetitive exercises. These passive learning methods tend to be less effective in developing students' critical thinking skills and problem-solving abilities, which are key competencies in dealing with the complexity of 21st century life (Hidayah et al., 2025). This condition shows a gap between the potential of technology in learning and learning practices that still rely heavily on conventional approaches.

Among the various forms of interactive learning media, educational games are one of the alternatives that are widely used in an effort to increase the effectiveness of learning (Puspitarini., 2020). Educational games can create a challenging, fun, and motivating learning atmosphere for learners to be actively involved in the learning process. Through interesting game design, learners not only interact with the material directly, but are also encouraged to explore knowledge more deeply. Game-based learning environments also provide opportunities for learners to learn in a more relaxed atmosphere, thereby increasing interest, attention, and absorption of the material presented (Holbrey., 2020). .

The activity of playing while learning in educational games provides many cognitive and affective benefits. Learners are trained to think logically, analyze the situation at hand, formulate problem-solving strategies, and evaluate every decision made during the game process (Kim et al., 2020). This activity directly develops higher-order thinking skills, such as

critical thinking, creativity, and problem solving abilities that are needed in facing real-life challenges. In addition, the social interactions that occur during the game also help train communication skills, teamwork, and decision-making in a group context, which are important parts of 21st century competencies (Romero et al., 2025).

Learning media innovation currently continues to experience significant development at various levels of education. However, in reality, many educational institutions still tend to maintain conventional teacher-centered learning methods. The lecture method, memorization assignments, and repetitive exercises still dominate the learning process in the classroom. This learning pattern places students as passive recipients of information, without many opportunities to be actively involved in exploring material, discussing, or developing in-depth understanding through direct experience (Putri., 2024).

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The application of monotonous and less varied learning methods has the potential to hinder the development of higher order thinking skills in students. Critical thinking skills, creativity, analytical skills, and problem solving skills that should be the main focus in 21st century learning are often not optimally honed (Imam et al., 2023). This condition requires a transformation in learning practices, so that students are given wider opportunities to actively participate, think reflectively, collaborate, and develop problem solving skills through innovative, interactive, and relevant learning approaches to future needs.

The application of learning methods that do not actively involve learners risks inhibiting the development of essential competencies needed to face the challenges of the 21st century (Nur et al., 2025). Learners who only receive information passively without being given the opportunity to think critically, analyze information, and make decisions independently, tend to experience limitations in developing higher order thinking skills. The learning process, which still focuses on memorization and repetition of material, does not provide space for students to understand concepts in depth and application (Dahlin et al., 2020). As a result, problem solving ability as one of the key skills in dealing with complex problems in the real world is not optimally developed.

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Previous studies have shown that technology-based interactive learning media, including educational games, have great potential in improving learning motivation and active engagement of learners. However, most studies still focus on aspects of learning motivation, material mastery, or cognitive learning outcomes in general. Research that specifically examines the effectiveness of educational games in developing problem-solving skills as higher-order thinking skills is still relatively limited, especially at the formal education level in Indonesia (Mursid & Yulia., 2020). In addition, studies related to the supporting factors and obstacles faced in the implementation of educational games in the educational environment also still need strengthening. Therefore, research is needed that specifically analyzes the role of interactive learning media based on educational games in improving students' problem solving skills, as well as identifying factors that influence the success of its implementation in the learning process.

This research not only focuses on learning outcomes, but also seeks to identify various supporting factors and obstacles faced during the implementation process of interactive learning media based on educational games. Aspects such as educator readiness, availability of facilities and infrastructure, learner involvement, and suitability of learning materials with the media used will be analyzed comprehensively (Munene., 2023). The findings of this research are expected to contribute to the development of more effective and relevant learning strategies in an effort to improve students' critical thinking competencies and problem solving skills in the modern education era.

The results of this study are expected to contribute to the development of scientific studies, especially in the field of learning technology and interactive learning media development. On the theoretical aspect, this research has the potential to expand scientific insights and understanding related to the effectiveness of educational games as a form of learning innovation that can improve students' problem solving skills (Aini et al., 2025). The findings can enrich the literature on interactive technology-based learning approaches and provide a conceptual basis for the development of learning models that are more relevant to the demands of the times. In addition, the results of this study are also expected to be a reference for future researchers in developing similar research, both with a broader scope and with other supporting variables.

In practical aspects, the results of this study are expected to provide strategic recommendations for various interested parties in the field of education. For educators, this research is expected to be a reference in designing and managing learning processes that are more interactive, participatory, and oriented towards developing students' higher order thinking skills. For learning media developers, the results of this study are expected to provide an overview of the design of interactive learning media based on educational games that are effective and in accordance with the characteristics of students (Heriyanto., 2024). Meanwhile, for educational policy makers, the findings of this study can be a consideration in formulating curriculum development policies and providing learning facilities that support the optimal application of interactive technology. Thus, the results of this study are expected to make a real contribution in improving the quality of learning and preparing students to have competencies that are in accordance with the needs of the 21st century.

Methodology

This study uses a descriptive quantitative approach that aims to measure the effectiveness of using interactive learning media based on educational games in improving students' problem solving skills. The population of this study were teachers and students in the school where the research was conducted, with a purposive sampling technique that resulted in 10 respondents, consisting of 5 teachers and 5 students involved in learning using educational games. The research instruments included structured interviews to obtain data on the perceptions and experiences of teachers and students, a closed questionnaire to measure students' problem solving skills, and an observation sheet to record students' involvement during the learning process. Data were collected through observation of the learning process, structured interviews, and questionnaires. Data analysis was done quantitatively descriptively by calculating the average, percentage, and coding the interview results into simple numerical data, which was then interpreted to assess the effectiveness of educational games in developing problem solving skills.

Result and Discussion

Educational games are a form of interactive learning media that integrates game elements into the learning process to achieve certain instructional goals (Saputri et al., 2020). Educational games not only function as a means of entertainment, but also as a learning medium that allows students to acquire knowledge, skills, and attitudes that are relevant to the targeted competencies (Gee., 2023). Educational games combine elements of motivation, challenge, simulation, and interactivity, so that students can learn in a fun yet pedagogically meaningful atmosphere.

The application of interactive learning media based on educational games is carried out through the process of integrating educational games designed in accordance with learning objectives. Teachers select games that are relevant to the teaching material and adjust the game scenario based on the competencies to be achieved (Connolly et al., 2020). The suitability between the level of difficulty of the game and the cognitive abilities of students is a major consideration in the planning process. The preparation of learning scenarios contains the incorporation of game activities in a structured manner so that students get a comprehensive learning experience, both in terms of mastery of the material and the development of critical thinking and problem-solving skills.

The use of educational games in learning provides many significant benefits. A fun learning atmosphere can increase learners' motivation to be actively involved in the learning process (Nousiainen et al., 2020). Through games, learners get the opportunity to try, make mistakes, and learn from hands-on experience. This activity trains problem-solving skills by presenting challenges or conflicts that must be resolved, either independently or collaboratively. In addition, educational games also train adaptability, decision-making, time management, and the development of effective strategies (Troussas et al., 2025). Thus, educational games play a role in developing learners' cognitive, affective, and social-emotional aspects in an integrated manner.

The early stages of learning focus on providing a conceptual introduction to the material by the teacher to provide a basic framework of understanding for students. The conceptual understanding that has been obtained is then developed through game activities that present various challenges, simulated scenarios, or complex problems designed to resemble real situations (De Freitas & Oliver., 2020). Learners are faced with situations that encourage them to analyze, design alternative solutions, make decisions, and evaluate the results of these decisions. The teacher plays the role of an active facilitator by providing direction, encouraging group discussions, providing immediate feedback, and guiding the

reflection process on the problem-solving strategies that learners have applied. This approach creates learning that is not only theoretical, but also instills real experience in practicing problem solving skills in depth.

Analysis of Improvement in Students' Problem Solving Skills

The improvement of learners' problem solving skills was analyzed through data obtained from in-depth interviews with students and teachers who were directly involved in the implementation of educational games during the learning process (Choirudin et al., 2025). Teachers revealed that during the learning process, there was a significant development in the way of thinking and behavior of learners when faced with problems presented in educational games. Learners who initially showed passive tendencies began to show courage in expressing opinions, conveying ideas, and asking critical questions related to the situation at hand. Game activities encourage learners to actively analyze complex situations, evaluate various possible solutions, and explore several alternative solutions systematically.

In the process of facing the challenges presented, learners learn to develop a logical mindset by considering all available information before deciding on the most appropriate solution step. The attitude of caution and accuracy in analyzing problems seemed to develop as the game progressed. In addition to the development of cognitive aspects, the observation process also showed an increase in positive social interactions, where learners actively collaborated, discussed, and exchanged opinions to reach the best solution together (Swandari & Jemani., 2023). Critical reflection on every decision that has been made becomes an integral part of the game activity, which encourages learners to evaluate the effectiveness of the strategies they apply. Through this educational game-based learning experience, learners' problem solving skills not only develop individually, but also collectively through a meaningful collaborative learning process.

Description of Educational Game Implementation in Learning

In the implementation of educational game-based learning, interactive digital games are used that are specifically designed to support the achievement of learning objectives and increase students' active participation (Lampropoulos et al., 2020). One type of game used is a problem-solving adventure game, which combines an interesting storyline with subject matter-based contextual challenges. Through these challenges, students are invited to apply the concepts they have learned, such as logic, mathematical calculations, and scientific principles. The teacher provides an introduction to the material first to ensure students understand the basics of the theory that will be used. Next, students play the game individually or in groups, which encourages collaboration, discussion, and the development of communication and decision-making skills. During the game, students are free to explore various problem-solving strategies, try different approaches, and discuss with friends. The game system provides immediate feedback, allowing students to understand mistakes, improve strategies, and deepen concept understanding through hands-on experience (Wang et al., 2025).

Interactive learning media is a learning tool that allows active interaction between learners and teaching materials through the use of technology (Aulia et al., 2024). The existence of this media presents a more dynamic and responsive learning process, where students not only act as recipients of information, but also as active subjects who are directly involved in the learning process. Heinich et al. (2002) state that interactive learning media provides immediate feedback, allowing learners to adjust the speed, depth, and learning strategies according to their individual needs and abilities. The interaction that occurs encourages students to independently manage their learning process, while developing a sense of responsibility for achieving competence.

The types of interactive learning media are very diverse and continue to grow as technology advances. Some commonly used examples include multimedia presentations, computer simulations, virtual reality, mobile-based learning applications, and educational games that are specifically designed

to integrate learning elements with game elements (Laine., 2020). The use of this media aims to increase students' involvement in the learning process, clarify abstract concepts that are difficult to understand conventionally, and facilitate the development of cognitive, affective, and psychomotor abilities holistically. With an interesting and interactive approach, interactive learning media can create a learning environment that is more interesting, challenging, while encouraging the strengthening of critical thinking skills, creativity, and problem solving (Yusuf & Mastoah., 2025).

This educational game is applied in the context of math and science learning. In mathematics learning, students practice solving logical problems, data processing, and numerical problem-solving that require rigorous thinking (Froland et al., 2020). In science, virtual simulations present experimental situations that allow students to make observations, analyze data, and test hypotheses digitally. This approach creates a dynamic, contextualized, and motivating learning atmosphere, while stimulating critical, creative, and analytical thinking skills. Through the integration of educational games in learning, students not only acquire knowledge, but also develop problem-solving skills in an active and meaningful way (Yang., 2022).

Impact on Problem Solving Ability

The results of the implementation of the educational game showed a significant improvement in students' problem solving skills. Based on the indicators of problem solving skills, there are developments in several important aspects, namely the ability to understand the problem thoroughly, formulate relevant hypotheses, design systematic solution strategies, implement solutions in a planned manner, and evaluate the results obtained. Students are increasingly skilled in identifying relevant information from the problem, analyzing the relationship between variables, and assessing the effectiveness of the solutions that have been applied.

Positive developments were also evident in the aspects of students' perseverance, independence, and creativity. The ability to explore various alternative solutions increased significantly. Students show courage in trying various approaches, exploring various possible solutions, and being able to reflect on the thinking process critically and systematically. This strengthening of critical thinking skills indicates that educational game-based learning is able to shape analytical and adaptive mindsets, as well as foster student readiness in facing more complex learning challenges (Sembiring., 2025).

Results of teacher and student discussions

The teacher said that the implementation of learning became much more interactive compared to conventional learning methods. Students who previously tended to have difficulty in maintaining concentration began to show increased interest and enthusiasm in participating in the learning process (Haryati., 2023). Teachers also observed an increase in student activity in discussing, expressing opinions, trying various problem-solving strategies, and reflecting on mistakes experienced during the learning process. Interaction between students takes place dynamically, thus encouraging the strengthening of cognitive, social, and collaborative skills.

In its implementation, teachers faced several obstacles related to adjusting learning time that needed to be aligned with the flow of the game, as well as limited mastery of technology in some teachers and students. Nevertheless, overall, teachers assessed that the use of educational games had a positive impact on students' learning outcomes. Improvements were seen in the aspects of learning independence, systematic thinking ability, and problem-solving skills. In addition to creating a more interesting and challenging learning atmosphere, this media also motivates students to be more actively involved in the learning process (Raharjo., 2020).

Teachers who have used Educational Games

Teachers admit that so far the learning process carried out in the classroom still tends to be teacher-centered, with the dominance of the lecture method, textual delivery of material, and the

provision of mechanical and repetitive problem exercises. This learning model puts students in a passive position, only acting as recipients of information without being much involved in the process of active exploration of knowledge (Anthony., 2021). As a result, students are less trained to develop critical, analytical, and reflective thinking skills. Procedural learning makes students more focused on solving routine problems with uniform patterns, without getting experience dealing with situations that require in-depth reasoning, assessing alternative solutions, or making decisions based on conceptual understanding.

Teachers also observed that the lack of student involvement in problem-based learning hinders the development of higher order thinking skills (Rogoff et al., 2020). The limitation in presenting complex contextual problems causes students to rarely practice identifying real problems, formulating hypotheses, analyzing relationships between variables, and designing effective solution strategies. This less challenging learning environment ultimately affects students' low problem solving skills. Therefore, teachers consider the need for learning media innovations that are able to present learning situations that are more interactive, challenging, and in accordance with the complexity of real life (Mea., 2024). The presence of technology-based learning media, such as educational games, is one alternative that is believed to be able to create a more meaningful learning experience, motivate students to be more active, and stimulate the development of critical thinking skills and problem solving in a sustainable manner.

Teachers who have not used Educational Games

The students stated that learning based on educational games presents a learning atmosphere that is more fun, interactive, and far from monotonous (Kanthan & Senger., 2021). The learning process feels more interesting because they play an active role in solving various challenges designed in the form of games. These challenges demand intense cognitive engagement, encouraging students to think critically, analyze the conditions faced, and determine solutions independently. Mistakes that arise during the game are seen as an opportunity to learn and improve. With immediate feedback from the system, students can immediately identify mistakes, evaluate decisions that have been made, and adjust problem-solving strategies more effectively at the next stage.

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The students stated that educational games-based learning presents a more enjoyable, interactive and far from monotonous learning atmosphere. The learning process feels more interesting because they play an active role in solving various challenges designed in the form of games. These challenges demand intense cognitive engagement, encouraging students to think critically, analyze the conditions faced, and determine solutions independently. Mistakes that arise during the game are seen as an opportunity to learn and improve. With immediate feedback from the system, students can immediately identify mistakes, evaluate decisions that have been made, and adjust problem-solving strategies more effectively at the next stage.

Some students also reported that successfully completing the levels of the game created a sense of satisfaction as well as motivation to continue to improve. The passion to complete challenges encouraged them to explore alternative strategies, assess the effectiveness of their solutions, and refine their approaches independently (Gusty et al., 2020). This learning experience does not only focus on

mastering the material, but also on practicing higher-order thinking skills, creativity, independence, and mental toughness in the face of adversity. Thus, educational games-based learning contributes significantly to shaping learners who are adaptive, analytical, and ready to face learning challenges in a complex modern era.

Students who have not used Educational Games

The students revealed that so far, learning has focused more on explaining the material by the teacher, memorizing concepts, and completing routine problem exercises. This kind of learning pattern accustoms students to follow instructions without much involvement in independent exploration of thinking. When presented with complex problem solving problems, many students experience confusion in determining the steps to solve them (Rambe & Afri., 2020). Situations that require open thinking, exploration of various possible solutions, and preparation of effective strategies have not become part of their daily learning experience, so their ability to deal with unstructured problems is still limited.

Lack of experience in facing varied challenges also affects students' confidence in trying new approaches or making decisions independently. Conventional learning tends not to provide optimal space for the development of higher order thinking skills that involve critical analysis, creativity, and reflective evaluation (Sholeh et al., 2025). For this reason, learning innovations are needed that can provide contextual and challenging experiences, so that students are accustomed to developing critical thinking skills, developing problem-solving strategies systematically, and being able to adapt in dealing with complex situations that are relevant to today's learning needs.

Conclusion

Based on the research results, it can be concluded that the application of interactive learning media based on educational games is effective in improving students' problem solving skills. Through interviews and observations, it was found that students became more active, motivated, and showed improvement in the ability to analyze problems, design solution strategies, and evaluate alternative solutions independently. Teachers also observed positive changes in students' independent thinking and active engagement during the learning process. Learning based on educational games creates a fun, competitive learning atmosphere and encourages students to think systematically through direct experience of facing problems. The implications of these findings suggest that educational games have great potential as a relevant interactive learning innovation for the development of 21st century skills in educational settings.

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