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The Effect of Traditional Engklek Game Based on Problem Based Learning Model on Improving Crithical Thinking Ability of Elementary School Students in Science Subjects

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Abstract
Twenty-first-century education demands a transformation in teaching strategies, with a focus on cultivating higher-order thinking skills, especially critical thinking. Observations and interviews at SD Negeri 2 Bendoagung, SD Negeri 3 Bendoagung, and SD Negeri 2 Karangrejo revealed that students' critical thinking skills are still relatively low. One of the underlying causes is the application of instructional methods that fail to sufficiently stimulate critical thinking. This study seeks to investigate the effect of incorporating traditional engklek games into a Problem-Based Learning (PBL) model on students' critical thinking abilities in science education. The research employed a quantitative method with a quasi-experimental approach, specifically using a nonequivalent control group design. The sample was selected purposively, involving fourth-grade students from SD Negeri 2 and 3 Bendoagung as the experimental group, while students from SD Negeri 2 Karangrejo acted as the control group. Data were gathered using a critical thinking test, and analyzed using normality and homogeneity tests, followed by an independent sample t-test. Results showed a significant improvement in the experimental group, with a 46.55% increase in critical thinking performance, compared to only 11.11% in the control group. The hypothesis test produced a significance (2-tailed) value of 0.000, which is below the 0.05 threshold indicating that the integration of traditional engklek games within a PBL framework has a positive impact on students' critical thinking skills.

Keywords: Traditional Game of Engklek Based on the Problem Based Learning Model, Critical Thinking Skills, Learning, Science.

1. INTRODUCTION

The 21st century has brought about profound changes fueled by technological progress, globalization, and shifting social dynamics. In this context, students are required to compete in a global environment (Yunitasari et al., 2022). To navigate these

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challenges, they must develop key 21st-century skills, including critical thinking, communication, collaboration, and creativity (Rahardhian, 2022; Umam, 2021). Of these, critical thinking is essential for processing information and solving problems in a logical manner. It is a fundamental cognitive ability that distinguishes humans from other species (Setiawan et al., 2023). Despite its importance, data from the 2018 and 2022 PISA assessments reveal that Indonesian students generally perform poorly in critical thinking. Most are only capable of answering questions at a basic cognitive level, with limited skills in synthesizing information or drawing comprehensive conclusions (Putrawangsa & Hasanah, 2022). These findings emphasize the urgent need to reform instructional approaches. The success of educational objectives largely hinges on the quality of teaching and learning practices (Setiawan et al., 2022). Rigid, lecture-dominated teaching with minimal variation and lack of active student involvement is a major contributing factor to the underdevelopment of critical thinking skills (Suciono et al., 2020).

Additionally, learning is often hindered by inadequate infrastructure and a lack of teacher capacity in classroom management (Serin, 2018; Lisnawati et al., 2023). Unsupervised gadget use also contributes to a decline in students' awareness of their surroundings (Puspitasari et al., 2016). To address these challenges, innovative instructional models like Problem-Based Learning (PBL) offer promising solutions. PBL encourages students to engage actively, work collaboratively, and reflect while solving real-world problems (Anugraheni, 2018; Ardianti et al., 2021). This model becomes even more effective when integrated with traditional games. Hopscotch, for instance, is culturally rich, enjoyable, and promotes both physical and cognitive development. It allows children to learn through play, cultivate character, and strengthen thinking skills (Najiah & Jamaludi, 2023; Rahayu, 2023; Putri & Adhe, 2023). When combined with PBL, hopscotch creates meaningful learning experiences through observation, exploration, and active problem-solving (Putri, 2023).

The results of observations at elementary schools in the Bendoagung and Karangrejo areas showed that play activities had not been integrated into learning. Teachers still use conventional methods that do not stimulate critical thinking skills. The world of children who are closely related to play has not been utilized as part of the learning process (Wijayanti & Trisiana, 2018). A number of studies have demonstrated that hopscotch games can enhance both critical thinking skills and students' motivation to learn. According to Novitasari et al. (2023), this game has proven effective when applied to mathematics instruction. Yuniwanti et al. (2024) found that hopscotch positively influences problem-solving abilities in early childhood education. Similarly, research by Zein and Rahayu (2022) indicated improvements in learning outcomes and motivation through the use of traditional games in lessons on environmental pollution. The findings highlight the potential of instructional methods that integrate hopscotch with the Problem-Based Learning (PBL) model. Based on this insight, the current study aims to develop a science learning tool that merges the PBL approach with hopscotch games to enhance critical thinking skills among elementary students. This innovative strategy is expected to play a significant role in advancing students' critical thinking abilities in science, particularly within primary school settings.

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2. LITERATURE REVIEW

2.1. Traditional Games

Traditional games are a cultural heritage that has developed from generation to generation in Indonesian society. This activity is not only a means of entertainment, but also has high educational and cultural values. According to Rahesti, et al. (2023), Traditional games are indigenous Indonesian activities that embody the cultural identity and regional characteristics of the local communities. This game generally uses simple tools from the surrounding nature, such as wood, bamboo, or stone, so it does not require large costs in its implementation (Yulita, 2017). More than just entertainment, traditional games are also full of social and character values such as honesty, cooperation, responsibility, and discipline (Zuliyanti & Galuh, 2021). Therefore, traditional games need to be preserved as part of children's character education.

The types of traditional games in Indonesia are very diverse and spread across various regions. Some popular games include congklak, which trains strategy and calculation, and engklek, which improves dexterity and balance. Other games such as rope jumping, bekel, and sack racing not only hone motor skills but also foster cooperation and a spirit of sportsmanship. Games such as hide and seek and fort have high social interaction value because they involve many players and teach tactics and teamwork. Stilts, gobak sodor, and marbles also have their own cultural value and are symbols of creativity and local traditions of the community (Kurniawan, 2019). Not only games with tools, there are also games such as cas jadi Patung, Ular Naga, and Kuda Lancat which rely more on body movements and direct interaction between players (Yulita, 2017).

Traditional games have a very important function in the lives of Indonesian children. In addition to being a fun medium for playing, traditional games contain educational messages and moral values that enrich the process of child growth and development. The diversity of forms and types of games shows how rich Indonesian culture is in creating simple but meaningful activities. Preserving traditional games is very important, not only to preserve ancestral heritage, but also as an educational alternative that is relevant for the present and future of children (Zuliyanti & Galuh, 2021; Kurniawan, 2019).

2.2. Hopscotch Game (Engklek)

The game of hopscotch is a traditional game that has existed since Roman times, known as Hopscotch and used as physical training for soldiers. Over time, this game spread to various countries including Indonesia during the Dutch colonial period and was known by various names such as Sunda Manda, Piccek Baju, and others. The philosophical meaning of this game describes the struggle and perseverance in obtaining something through fair and patient rules and processes (Aqobah, et al., 2023). This game is played by throwing stones at a box and jumping on one leg while avoiding the box where the stones are, and is very popular especially among girls (Muslimah, et al., 2018; Anjani & Rissa Atika, 2020). The steps in the game of hopscotch are quite systematic. Players start by drawing a box on the ground then throwing the gaco into the first box without hitting the line. They then jump from box to box with one or two feet according to the specified pattern. If they successfully complete one round and take the gaco without error, the player can mark the box as their own and other players must pass the box. The player is declared the winner if he successfully completes all the

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boxes perfectly without any mistakes (Anjani & Rissa Atika, 2020; Aqobah, et al., 2023).

The game of engklek has various advantages such as easily obtained materials, the ability to improve children's motor skills, social skills, and dexterity (Maulida, et al., 2024). Children learn to maintain balance, interact socially, and have better physical endurance through this game. However, the disadvantages of the game of engklek include limited playing space and the tendency for coarse language to appear while playing. Supervision from teachers or adults is very important so that the positive values of the game of engklek are maintained during the learning and game process.

The diversity of forms and names of the game of engklek in various regions reflects the richness of local Indonesian culture. Variations such as sondah mandah, ingkling, taplak, and others show that although the principles of the game are the same, each region adjusts the game pattern according to local cultural values and traditions (Pebryawan, 2015). This makes engklek not just a game, but also a cultural heritage that strengthens local identity and enriches the treasury of folk games. In an educational setting, this game holds the potential to serve as an engaging, culturally rooted learning tool that integrates cognitive, social, and motor development in the learning process. By preserving traditional games like engklek, students gain more than just physical movement and social interaction—they also internalize cultural values woven into each aspect of the game.

2.3. PBL Model

Problem Based Learning (PBL) is a learning approach that places students at the center of learning activities. Through this approach, students not only act as recipients of information, but also as the main actors who actively make decisions about the most appropriate learning materials and methods. The teacher functions solely as a facilitator, providing support and guidance while students independently engage in the process of exploring and constructing knowledge. Students are expected to be actively involved through searching, analyzing, and building knowledge based on learning experiences rooted in real problems (Ardianti et al., 2021).

PBL provides students with the opportunity to face real problems from the beginning of the learning process. Problems are used as stimuli that can trigger curiosity and motivation to learn. This concept is rooted in the theory of constructivism learning which emphasizes the importance of direct student involvement so that knowledge can be understood more deeply. According to this theory, the thinking process and problem-solving skills will develop when students build their own understanding through active activities such as observation and exploration (Anugraheni, 2018).

This approach has characteristics that distinguish it from conventional learning models.

One of its main characteristics is that problems are used as the center of all learning activities. In addition, students are required to work collaboratively and independently. Collaboration is carried out through group discussions in solving problems, while independence is needed when students have to seek additional information and utilize the knowledge they have. The process becomes the main focus, not just the results. This encourages students to remain active, creative, and reflective throughout the learning process (Khakim et al., 2022).

Teachers in the context of PBL no longer act as the main source of information, but rather as learning companions. Teachers direct students to stay focused and able to explore information systematically. The involvement of various disciplines is a

characteristic of PBL, because solving one problem often requires cross-subject understanding. This approach also provides ample space for students to try various solution strategies, considering that the problems given do not have a single solution. Reflection is an important stage at the end of learning to evaluate the process, identify strengths and weaknesses, and formulate steps for improvement going forward (Ardianti et al., 2021; Khakim et al., 2022).

PBL has significant advantages in improving students' critical thinking skills. In addition, this approach makes the learning process more relevant to real life. Students are invited to understand that the knowledge they learn is directly related to the surrounding environment. Through problem-based learning, they are trained to examine problems from various perspectives, analyze, and formulate creative solutions. However, this model is not without challenges. Students often have difficulty determining problems according to their thinking abilities. The implementation of PBL also takes longer than conventional models and requires teacher readiness methodologically (Masrinah et al., 2019; Hermansyah, 2020). Despite having several shortcomings, PBL remains a relevant learning model to be applied at various levels of education. Its advantages in forming learning independence, increasing awareness of the surrounding environment, and strengthening collaborative skills make PBL an alternative that is able to answer the challenges of 21st century learning. The success of implementing this model is highly dependent on teacher readiness, student readiness, and adequate school environmental support. The combination of intellectually challenging and contextual learning is the main strength of this approach (Hermansyah, 2020).

2.4 Critical Thinking

Critical thinking is a complex and vital cognitive process used to filter information, assess arguments, and draw reasoned, evidence-based conclusions. Whether in academic settings or everyday life, critical thinking serves as a foundational skill for making sound and effective decisions. According to Ariadila et al. (2023), it involves the ability to analyze data, evaluate claims, and reach conclusions grounded in available evidence. Puspitasari et al. (2016) further describe critical thinking as a process that includes stages such as observation, analysis, and inference in decision-making.

Theoretically, critical thinking is anchored in cognitive and constructivist perspectives, particularly those of Jean Piaget and Vygotsky, who emphasize the roles of mental processes, knowledge construction, and interaction with the environment in developing understanding (Habsy et al., 2023). Key characteristics of critical thinking include the ability to identify specific elements within a broader context, differentiate between relevant and irrelevant data, and distinguish facts from opinions. Critical thinkers can build and critique arguments, assess logical consistency, and detect bias or unsupported assumptions. Chalkiadaki (2018) notes that critical thinking also involves generating alternative solutions, organizing information coherently, and distinguishing between rational and irrational reasoning. This skill set not only aids in problem-solving but also contributes to more thoughtful and informed decision-making in various contexts. In education, critical thinking is a core component of higher-order thinking skills, essential for addressing complex challenges in the future. Noviani et al. (2018) highlight that critical thinking enhances learning outcomes by helping students go beyond content comprehension to apply knowledge practically in real-world situations.

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Contemporary education systems aim to cultivate students who can think critically, work collaboratively, and innovate creatively. Therefore, critical thinking should be viewed not merely as an end goal but as an integral part of lifelong learning.

Facione (2023) outlines several key stages in the critical thinking process: interpretation, analysis, evaluation, inference, explanation, and self-regulation. Each stage includes sub-skills such as clarifying meaning, identifying arguments, judging credibility, making inferences, justifying conclusions, and reflecting on one's own reasoning. Additionally, Adisty et al. (2021) propose five core indicators: problem analysis, evaluation of information sources, interpretation and conclusion-making, understanding of concepts, and problem-solving. This study focuses on interpretation, evaluation, and inference, as these are most applicable for assessing students' ability to think concretely and practically within traditional engklek game-based learning using a Problem-Based Learning (PBL) approach. Multiple factors influence the development of critical thinking, including physical well-being, motivation, anxiety levels, intellectual maturity, and social interaction. Adisty et al. (2021) note that poor physical health can impair focus and reduce one's intellectual engagement in problem-solving tasks.

Motivation is an important driver in encouraging students to be active and dare to take risks in thinking. Anxiety also has two sides: constructive—which can motivate students, and destructive—which can limit thinking skills. In addition, intellectual ability to connect information and formulate solutions is also very influential. Interaction between students and teachers, as well as open communication, create a learning atmosphere that supports critical thinking. In conclusion, critical thinking skills are not something that comes naturally, but need to be developed through the right approach, both in terms of theory, practice, and learning environment support. Rosmaini (2023) emphasized that physical and intellectual aspects are the main foundations, while Dores et al. (2020) emphasized the role of intelligence in solving problems. Hasnan et al. (2020) added that factors such as basic clarification, argumentative support, and deductive abilities also contribute to critical thinking. Suciono et al. (2020) stated that the basic support factor is the most dominant in supporting critical thinking, while inference is still a common weakness.

3. METHODS

This study employed a quantitative approach using a quasi-experimental design, specifically the non-equivalent control group design. This design involved two groups: an experimental group that received instruction through traditional engklek games integrated with a Problem-Based Learning (PBL) model, and a control group that received conventional teaching methods. Both groups were administered pre-tests and post-tests to assess improvements in critical thinking skills within the context of fourth-grade science subjects. Although the group assignment was not randomized, this approach was chosen to objectively and measurably examine the causal relationship between the independent and dependent variables. The study population consisted of all fourth-grade elementary students in Kampak District during the 2024/2025 academic year, totaling 323 students across 21 schools. The sample was selected using purposive sampling based on specific criteria, including students with critical thinking scores below the minimum competency standard (KKM) of 70, schools that had not previously used traditional games as a learning medium, and those utilizing the 2020 edition of the

science textbook. The selected sample came from SD Negeri 2 Bendoagung, SD Negeri 3 Bendoagung, and SD Negeri 2 Karangrejo. Data were collected through observations, interviews, tests, and documentation. The critical thinking assessment instrument underwent validation procedures, including tests for validity, reliability, item difficulty, and discriminative power. Data analysis included prerequisite tests (normality and homogeneity) and hypothesis testing using the t-test to determine whether significant differences existed between the two groups.

4. RESULTS

4.1 The Use of Traditional Engklek Games Based on Problem Based Learning Models on Critical Thinking Skills of Experimental Class Students

Analysis of the use of traditional hopscotch games based on problem-based learning models to improve critical thinking skills of students at SD Negeri 2 Bendoagung and SD Negeri 3 Bendoagung using essay test instruments as data collection instruments. Researchers conducted initial research using pre-tests before learning began. The next stage was to conduct research using teaching modules that had been prepared and using traditional hopscotch games based on problem-based learning models as a means of improving critical thinking skills of students. Researchers gave a post-test in the form of an essay test after learning. In the experimental class, the average score was 55. The highest score was 75 and the lowest score was 42 with 2 students meeting the KKM while 45 students did not meet the KKM. In students who have not been able to achieve the KKM, it is due to their limited critical thinking skills and lack of understanding and observation of the conditions of the surrounding environment. While in students who have succeeded in meeting the KKM, it is due to their abilities that are more sensitive to their environmental conditions so that their critical thinking skills have begun to emerge. The test results after the treatment in the experimental class had an average value of 80.6 with the highest value of 89 and the lowest value of 70 with all students who had met the KKM. From the results of this post-test, it can be concluded that students' critical thinking skills have increased well.

4.2 The Use of Conventional Learning Media on Critical Thinking Skills of Control Class Students

Analysis of the use of conventional learning on critical thinking skills of students at SD Negeri 2 Karangrejo using essay tests as data collection instruments. The researcher conducted an initial study using a pre-test in the form of a test to determine the initial abilities of students. Then the researcher conducted a learning process using a module that had been prepared with conventional learning. Furthermore, the researcher conducted a post-test after learning to determine the final abilities of students. The results of the pre-test in the control class had an average value of 54. The highest value in the pre-test was 65 and the lowest value was 44. Critical thinking skills and sensitivity to the environment and understanding of the environment are still very limited so that this affects the fulfillment of the KKM so that from the results of the study all students did not meet the KKM. The results of the control class post-test got an average result of 60. The highest value in the control class post-test was 77 and the lowest value was 46 with 1 student meeting the KKM criteria and 36 students not meeting the KKM criteria. From the results of the post-test, it can be concluded that conventional learning can improve students' critical thinking skills although not significantly.

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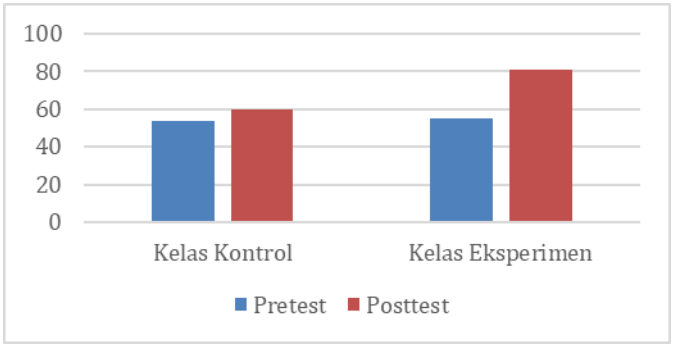


Figure 1. Comparison of Experimental Class and Control Class Test Results

4.3 Hypothesis test

Prerequisite tests were conducted to ensure that the data met the eligibility requirements for parametric statistical tests. The normality test using the Shapiro-Wilk method showed that all significance values were above 0.05. This indicates that the data in the experimental and control classes were normally distributed. In addition, the homogeneity test using the Levene test produced a significance value of 0.127, which was also above 0.05. These results indicate that the variance between data groups is homogeneous, so the selection of parametric statistical tests is declared appropriate and can be used to test the hypothesis.

Hypothesis testing using the independent sample t-test showed that the significance value was 0.000 <0.05. These results indicate that there is a significant difference between the experimental group that received treatment in the form of traditional engklek games based on problem-based learning and the control group that did not receive such treatment. Based on these results, the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. Thus, traditional engklek games based on problem-based learning have been proven to have an effect on improving students' critical thinking skills in the subject of science.

5. DISCUSSION

This research was carried out on fourth-grade students from SD Negeri 2 Bendoagung and SD Negeri 3 Bendoagung, designated as the experimental classes, and SD Negeri 2 Karangrejo, which served as the control class, during the 2024/2025 academic year. The pretest results in the experimental classes showed an average score of 55, with only 2 students achieving the Minimum Mastery Criteria (KKM), while 45 students fell below this benchmark. Following the intervention, the posttest results demonstrated a substantial increase, with an average score rising to 80.6, and all students successfully meeting the KKM representing a 46.55% improvement.

Conversely, in the control class, the initial average score was 54, with none of the students meeting the KKM. After undergoing conventional instruction, the posttest score increased modestly to 60. Only one student succeeded in reaching the KKM, while the remaining 36 did not. This reflects a total improvement of only 11.11%. Therefore, the difference in improvement between the experimental and control classes was 35.44%, indicating a notable disparity in outcomes. To confirm the effectiveness of the intervention statistically, the researcher conducted data analysis using tests for normality and homogeneity, which confirmed that the data was both normally distributed and homogeneous. The Independent Sample T-Test, conducted via SPSS 25,

revealed a significance value of 0.000, which is below the threshold of 0.05. According to the decision rule, since the significance value is less than α, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This confirms that the use of traditional hopscotch integrated with the Problem-Based Learning (PBL) model has a significant impact on improving students' critical thinking skills in science subjects.

Learning through hopscotch-based PBL has been shown to foster a joyful learning environment aligned with the nature of childhood, which is characterized by play. This supports the view of Wijayanti & Trisiana (2023), who argue that since play is central to children's lives, learning should include playful activities to avoid monotony. Moreover, incorporating hopscotch into classroom instruction not only enhances engagement but also helps revive and preserve cultural heritage that is fading in the modern era. Tussa et al. (2022) emphasized that hopscotch games can serve as effective cultural learning tools, ensuring cultural values are passed down through generations.

The integration of traditional hopscotch games with PBL aligns closely with 21st-century learning objectives, where educators are expected to continuously innovate and empower students with essential 4C skills: Critical Thinking, Creativity, Collaboration, and Communication. Among these, critical thinking is especially vital but remains underdeveloped among many Indonesian students. According to Mardhiyah et al. (2021), critical thinking encompasses the ability to analyze, assess, evaluate, and reconstruct information to make sound, logical decisions.

Supporting evidence comes from the study by Wijayanti & Trisiana (2018), which found that ethnomathematics-based hopscotch significantly influenced third-grade students' critical thinking abilities. This is attributed to the game's dual role in preserving cultural values and enhancing the quality of learning, particularly in fostering analytical skills. Similarly, Novitasari et al. (2023) demonstrated that the use of hopscotch media in learning improves both student understanding and engagement, enabling learners to better grasp content and apply it in real-world contexts. This ultimately boosts participation and enhances the overall educational experience.

By incorporating hopscotch into problem-based learning, students are encouraged to engage in active thinking, discussion, and creative problem-solving. The game introduces realistic challenges that require learners to interpret, evaluate, and generate solutions either independently or collaboratively thereby strengthening their critical thinking competencies. Such an approach not only targets cognitive development but also nurtures the higher-order thinking skills essential for navigating real-world problems. Therefore, using traditional games like hopscotch within a PBL framework represents a highly relevant and effective method for enhancing educational quality and fostering 21st-century competencies in students.

6. CONCLUSION

The results of the study showed that the traditional engklek game based on the problem-based learning model had a significant effect on improving students' critical thinking skills in the science subject. The increase in pre-test to post-test scores in the experimental class reached 46.55%, while the control class only increased by 11.11%. The difference in increase of 35.44% indicates that the learning approach through traditional games is able to encourage students' involvement and thinking power more effectively. The results of the analysis using the Independent Sample T-Test strengthen this finding through a significance value of 0.000 which is smaller than 0.05, so it can

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be concluded that the use of engklek games based on problem-based learning is effective in improving critical thinking skills. The application of traditional games as part of an innovative learning model can be an alternative teaching strategy at the elementary school level.

The development of learning media based on local culture also has the potential to strengthen the character and learning motivation of students. Suggestions for educators and policy makers to be more open to creative approaches that are contextual and fun, while still paying attention to pedagogical principles and competency achievements. Further research is suggested to explore other types of traditional games and their impact on other aspects of 21st century skills such as collaboration and communication.

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