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Research Article

THE EFFECT OF ANIMATED VIDEO-ASSISTED PROBLEM-BASED LEARNING MODEL ON THE CRITICAL THINKING SKILLS OF JUNIOR HIGH SCHOOL STUDENTS

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Abstract

This study aims to determine the differences and the effect of the Problem-Based Learning (PBL) model assisted by animated videos on junior high school students' critical thinking skills in the solar system topic. A quantitative approach with a quasi-experimental nonequivalent control group pretest–posttest design was employed. The research subjects consisted of two seventh-grade classes at a public junior high school in Yogyakarta, selected using cluster random sampling. Research instruments included multiple-choice tests to measure critical thinking skills and observation sheets to evaluate the implementation fidelity of the learning model. Data were analyzed using the Independent Sample T-Test and effect size calculated through Cohen's d. The results showed that the PBL model assisted by animated videos significantly improved students' critical thinking skills, with the effect size categorized as moderate. The novelty of this study lies in the integration of animated video media within the PBL framework, which enhances contextual understanding and supports students in problem exploration related to astronomical phenomena. The findings imply that combining PBL with animated media can serve as an effective pedagogical strategy for strengthening higher-order thinking skills in science learning, and can be considered for wider implementation in junior high school settings.

Keywords: Problem Based Learning, animated videos, critical thinking, science learning, solar system.

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INTRODUCTION

Education is an important aspect for a nation because it can influence the quality of that nation (Utomo, Narulita, & Billah, 2020). At the secondary school level, the curriculum presents subjects that serve as essential components, namely science (IPA) (Lestari, Wardani, & Khusniati, 2019). Science is closely related to daily life and emphasizes process skills and scientific attitudes in helping students discover knowledge (Patonah, 2014). Although science serves as a means of solving real-life problems, students are still not sufficiently exposed to complex and varied problems (Safira, Setiawan, & Citrawari, 2020). Science involves facts, data, concepts, principles, and theories; therefore, students need guidance to construct their own knowledge and be trained in problem solving, independent inquiry, and idea development (Lestari, Wardani, & Khusniati, 2019).

This need aligns with the "Framework for 21st Century Learning," which emphasizes critical thinking, communication, collaboration, creativity, and innovation skills (Karyatin, 2016). The 21st-century learning paradigm also requires students to seek information from various sources, formulate problems, think analytically, and work collaboratively to solve problems (Litbang Kemdikbud, 2013). However, students' critical thinking skills remain low, as indicated by their limited participation in learning, difficulties in understanding science concepts, and less-than-optimal academic performance (Fatimah & Widiyatmoko, 2014).

International studies further support this condition. TIMSS 2023 reported that Indonesian junior high school students ranked 44th out of 49 participating countries in science achievement with a score of 406, below the TIMSS scale center of 500 (Martin, Mullis, Foy, et al., 2012). In addition, 45.7% of students experienced reading errors, resulting in inaccurate answers (Utomo, Narulita, & Billah, 2020). PISA 2018 also showed that Indonesian 15-year-old students scored 396 in scientific literacy, lower than the OECD average of 489 and below the PISA proficiency benchmark of 500 (OECD, 2022). These results indicate that students' critical thinking skills are still relatively low. Both TIMSS and PISA assess higher-order thinking skills, including critical thinking, highlighting the need for students to be trained to analyze problems holistically and construct their own understanding. Critical thinking can be defined as a thought process involving analysis and careful evaluation of information, which leads to appropriate actions (Ridho, et al., 2019).

The low level of critical thinking skills is also caused by science learning that remains passive, teacher-centered, and heavily dependent on student textbooks (Utomo, Narulita, & Billah, 2020). Therefore, it is necessary to implement a student-centered learning model. One model that can address this issue is Problem Based Learning (PBL). PBL is designed to solve problems and actively engage students throughout the learning process, enabling them to develop and enhance their thinking skills and conceptual understanding (Fatmawati, 2018).

The application of PBL can be supported by appropriate science learning media, such as animated videos. Animated videos are effective for topics requiring imaginative understanding and can help visualize abstract or intangible materials such as human organs, cells, and the solar system, provided that school facilities support their use (Melisa, 2015). PBL assisted by animated videos is highly relevant for the solar system topic because the content is extensive and closely related to real-life phenomena.

Based on these needs, the use of the Problem Based Learning model assisted by animated videos in the solar system topic warrants investigation regarding its influence on the critical thinking skills of seventh-grade junior high school students. Previous studies have only measured learning outcomes; therefore, a quasi-experimental study is required under the title: "The Effect of the Problem Based Learning Science Model Assisted by Animated Videos on the Critical Thinking Skills of Seventh-Grade Junior High School Students."

RESEARCH METHOD

Research Design

This study used a quantitative approach with a quasi-experimental nonequivalent control group pretest–posttest design. This design was chosen to compare learning outcomes between two groups that received different learning treatments (Priadana & Sunarsi, 2012). The experimental class was taught using the Problem-Based Learning (PBL) model assisted by animated videos, while the control class used the Direct Instruction model assisted by PowerPoint.

The research was conducted at a public junior high school in Yogyakarta. The study took place during a regular academic period when seventh-grade learning activities were ongoing. The school was selected because it had a homogeneous academic background across its students, which supported the implementation of a quasi-experimental design.

Research Target/Subject

The research subjects consisted of two seventh-grade classes from the selected junior high school. Although purposive sampling was used, the selection process was conducted based on clearly defined criteria. First, teacher readiness was operationalized as the teacher's ability and willingness to implement the PBL model supported by animated videos, as evidenced by prior training participation and lesson plan preparation. Second, class characteristics referred to students' initial academic profiles, class size, and observed learning behavior, which were verified through school records and preliminary observations. These criteria ensured that the selected classes had comparable baseline conditions and were aligned with the research objectives (Tajik et al., 2025).

Research Procedure

The research procedure began with administering a pretest to both the experimental and control classes to measure their initial critical thinking abilities. After the pretest, treatment was given according to each class's assigned learning model. The experimental class received the PBL learning model supported by animated videos, while the control class received Direct Instruction supported by PPT. At the end of the learning process, a posttest was administered to both groups to determine changes in students' critical thinking abilities. Throughout the treatment, observations were conducted to assess the implementation of learning in each class.

Instruments, and Data Collection Techniques

The instruments used in this study consisted of a critical thinking ability test and a learning implementation observation sheet. The test used multiple-choice questions designed to measure students' critical thinking skills, while the observation sheet was used to evaluate how well the learning process was carried out in both classes. Before being used, the test items underwent validity and reliability testing to ensure that the instruments were appropriate and accurate. Data were collected through written tests and structured classroom observations.

Data Analysis Technique

The collected data were analyzed using the Independent Sample T-Test to determine whether there was a significant difference in critical thinking ability between the experimental and control groups after the intervention. In addition, the effect size of the treatment was calculated using Cohen's d formula to measure the magnitude of the impact of using animated video–assisted PBL on students' critical thinking skills.

RESULTS AND DISCUSSION

The results of the Independent Sample T-Test showed a significant difference between the posttest scores for critical thinking skills in the experimental class and the control class ($p < 0.05$). The average value of the post t scores in the experimental class was higher than that in the control class. In addition, Cohen's d value showed an effect size of 0.65, which is classified as moderate.

Table 1. Average Pretest and Posttest Scores for Critical Thinking Skills

Class	Pre-test	Posttest
Experiment	57.25	81.13
Control	55.75	71.00

The results of this study indicate that the application of the PBL model assisted by animated videos has a positive impact on improving students' critical thinking skills. This is in line with the research by Ichsani and Muthia (2017), which found that video-based PBL can significantly increase learning engagement and critical thinking skills.

In science learning, especially in abstract and complex solar system material, the use of animated videos is very helpful in visualizing scientific concepts. Students can directly see simulations of planetary motion, orbits, Earth's rotation and revolution, and other astronomical phenomena. This provides visual stimuli that can increase understanding and learning engagement.

The PBL model encourages students to actively seek information, discuss, and formulate solutions to the problems given. This learning process requires students to think logically, express opinions, evaluate information, and draw conclusions. These activities are highly relevant to critical thinking skills indicators, which include interpretation, analysis, evaluation, and conclusion (Aini, 2024; Yusanti, 2024).

To clarify the difference in pretest and posttest score improvements between the experimental and control groups, the following graph compares the average scores:

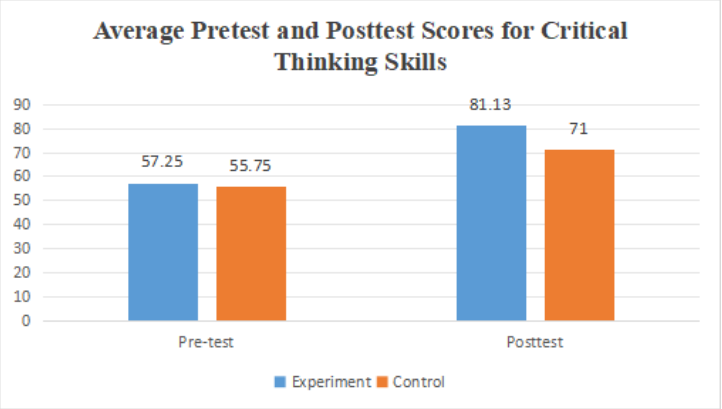

Figure 1. Comparison of Average Pretest and Posttest Scores for Critical Thinking Skills

Figure 1 shows that there was a higher score increase in the experimental class compared to the control class. This indicates that the use of animated videos in the context of PBL can significantly improve understanding and critical thinking skills.

In addition, PBL-based learning also provides space for students to learn collaboratively. In group work, students learn to communicate, share tasks, and respect each other's opinions. This indirectly shapes scientific attitudes such as tolerance, responsibility, and openness.

Thus, the findings of this study reinforce that the use of the animation video-assisted PBL model is very appropriate to be applied in science learning, especially in materials that require visual understanding and critical problem solving. These findings also support the Merdeka Curriculum policy which emphasizes meaningful, contextual learning that is oriented towards strengthening character and 21st century competencies.

CONCLUSION

The animated video-assisted Problem-Based Learning model has been proven to have a positive effect on improving the critical thinking skills of junior high school students in solar system material. The use of this model is recommended as an innovative alternative in science learning to encourage 21st-century skills.

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AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Investigation; Project administration; Validation; Writing – review and editing; Data curation; Formal analysis; Methodology; Writing – original draft; Resources; Visualization.
Author 2: Validation; Formal analysis; Other contributions; Resources; Supervision.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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