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The Effectiveness of Problem-Based Learning in Improving Fourth-Grade Students' Creative Thinking in Science

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ABSTRACT

Purpose – This study aims to examine the effect of the Problem-Based Learning (PBL) model on the creative thinking skills of fourth-grade students in Natural and Social Sciences (IPAS) at SD Negeri 091608 Sinaksak. The research was motivated by students' low creative thinking ability due to teacher-centered instruction and limited active participation.

Methodology – A pre-experimental design using a one-group pretest–posttest approach was employed. The sample consisted of 23 fourth-grade students (12 boys and 11 girls). Data were collected through pretest and posttest instruments measuring creative thinking skills. Instrument validity and reliability were tested, and data were analyzed using the N-Gain test to determine the level of improvement after the PBL intervention.

Findings – The results indicate a significant improvement in students' creative thinking skills following the implementation of PBL. The average score increased from 50.22 (pretest) to 83.86 (posttest). Initially, most students did not achieve mastery, whereas after the intervention almost all students met the learning criteria. N-Gain scores ranged from 0.56 to 1.00, indicating moderate to high improvement. These findings suggest that PBL effectively enhances creative thinking in IPAS learning.

Novelty – This study provides empirical evidence of the effectiveness of PBL in improving elementary students' creative thinking skills within the integrated IPAS subject context.

Significance – The findings benefit teachers, school administrators, and curriculum developers seeking effective student-centered learning strategies to foster creativity in primary education.

Keywords: Creative thinking; Elementary education; IPAS learning; Problem-based learning; Student-centered learning.

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1. Introduction

A learning model constitutes a systematic conceptual framework that guides teachers in organizing learning experiences to achieve predetermined instructional objectives. It encompasses teaching goals, learning procedures, classroom management, and the learning environment (Suprihatiningrum, 2013; Trianto, 2010). In contemporary education, there is a growing emphasis on student-centered approaches that actively engage learners in constructing knowledge rather than passively receiving information. However, many elementary classrooms still rely on teacher-centered instruction, which may limit students' opportunities to develop higher-order thinking skills, particularly creativity.

Problem-Based Learning (PBL) has emerged as a promising pedagogical model to address this challenge. PBL is characterized by learning activities centered on authentic, real-world problems that students encounter in everyday life (Erwin, 2018). Through problem investigation, collaboration, and inquiry, students construct knowledge independently, reducing reliance on direct teacher explanation. Scholars emphasize that PBL requires learners not only to solve presented problems but also to identify related issues, thereby fostering independence and creative problem solving (Eggen & Kauchak, 2012). Similarly, Toharudin et al. (2011) highlight that real-world problems in PBL serve as a catalyst for the development of creative thinking and problem-solving abilities.

The distinctive characteristics of PBL further differentiate it from conventional instructional models. These include the use of ill-structured problems as the starting point of learning, the necessity for multiple perspectives, self-directed inquiry, collaborative learning, and continuous reflection on both process and outcomes (Rusman, 2013). Such features encourage students to explore diverse information sources, challenge prior knowledge, and construct new understanding through meaningful engagement. Consequently, PBL not only enhances conceptual comprehension but also promotes essential 21st-century competencies such as critical thinking, creativity, communication, and collaboration (Amir, 2009). The implementation of PBL typically follows several structured stages: orienting students to the problem, organizing them for learning, guiding individual or group investigations, developing and presenting solutions, and evaluating the problem-solving process (Ibrahim & Nur, 2020). These stages provide systematic support for students to engage in inquiry while maintaining clear instructional direction.

Creative thinking itself is a multidimensional cognitive process involving the ability to generate novel and useful ideas. Individuals with strong creative thinking skills demonstrate curiosity, persistence, self-discipline, and the capacity to connect diverse concepts (Ananda, 2019). In educational contexts, creative thinking is commonly assessed through four main dimensions: fluency (producing many ideas), flexibility (generating diverse solutions), originality (producing unique responses), and elaboration (developing ideas in detail). These competencies are essential for solving complex problems and adapting to rapidly changing societal demands.

In Indonesia's elementary curriculum, the subject of Ilmu Pengetahuan Alam dan Sosial (IPAS) integrates natural and social sciences to help students understand the

interconnectedness of environmental and societal phenomena. This integrated approach encourages learners to manage their natural and social environments holistically (Meylovvia, 2023). Given its contextual nature, IPAS provides an ideal platform for implementing PBL, as real-world problems often involve both scientific and social dimensions.

Despite the theoretical advantages of PBL, empirical evidence regarding its effectiveness in enhancing creative thinking among elementary students—particularly within the integrated IPAS subject—remains limited. Therefore, this study investigates The Effectiveness of Problem-Based Learning in Improving Fourth-Grade Students' Creative Thinking in Science (IPAS). By examining learning outcomes before and after PBL implementation, this research seeks to contribute to the development of effective student-centered instructional strategies that foster creativity at the primary education level.

2. Methods

2.1 Research Design

This study employed a pre-experimental research design, specifically the one-group pretest–posttest design, to examine the effectiveness of Problem-Based Learning (PBL) in improving students' creative thinking skills. This design involves measuring the dependent variable before and after the intervention within the same group to determine the magnitude of change attributable to the treatment (Muliandari, 2019). The research procedure consisted of three stages: (1) administering a pretest to assess baseline creative thinking ability, (2) implementing the PBL intervention, and (3) administering a posttest to evaluate improvement. The research design is presented as follows:

Table 1 - Research Design: One-Group Pretest–Posttest Model

Pretest	Treatment	Posttest
O_1	X	O_2

O_1 represents the pretest score, X the PBL intervention, and O_2 the posttest score.

2.2 Participants

The population comprised all fourth-grade students at SD Negeri 091608 Sinaksak. The sample consisted of one intact class of 23 students, which served as the experimental group. This class received instruction using the Problem-Based Learning model throughout the study period.

2.3 Intervention Procedure

The intervention involved the systematic implementation of the PBL model during IPAS (Integrated Science and Social Studies) lessons. Learning activities followed established PBL stages: problem orientation, organization of students for investigation, guided inquiry in groups, development and presentation of solutions, and reflection on the problem-solving process. The problems used were contextual and related to students' daily lives to stimulate active engagement and creative thinking.

2.4 Research Instrument

Data were collected using an essay-type test designed to measure students' creative thinking skills across key dimensions such as fluency, flexibility, originality, and elaboration. The same instrument was administered as both pretest and posttest.

Table 2- Content Validity Test

No	Number of Question	Information
1	1,2,5,14,15	Valid
2	3,4,6,7,8,9,10,11,12,13	Invalid

Based on Table 2, of the items validated by the validators, five questions were declared valid, while ten were considered invalid. Therefore, only the five valid questions met the validity criteria and were subsequently used as research instruments in the pretest and posttest. The pretest results indicate that most students did not achieve the established mastery criteria. This finding suggests that students' creative thinking skills prior to implementing the Problem-Based Learning model were relatively low and required improvement through the application of a more innovative learning model.

2.5 Validity and Reliability

Instrument validity was examined through expert judgment covering content, construct, and language aspects using Aiken's V coefficient. The formula is:

$$V = \frac{\sum s}{2(n-1)}$$

Description:

V = Aiken Index

∑ S = Score determined by the validator minus the lowest score in the category used

c = Highest assessment score

n = Number of validators (assessments)

where V is Aiken's index, s is the score assigned by validators minus the lowest possible score, c is the highest score in the rating scale, and n is the number of validators. The validation results indicated that 5 out of 15 items met the validity criteria and were retained, while the remaining 10 items were discarded.

2.6 Data Analysis

Descriptive statistics were used to summarize pretest and posttest results. To determine the effectiveness of the intervention, improvement in creative thinking skills was analyzed using the normalized gain (N-Gain) score. The pretest findings showed that most students did not meet the minimum mastery criteria, indicating low initial creative thinking ability. This baseline condition justified the implementation of the PBL model as an innovative instructional strategy aimed at improving students' creative thinking skills.

3. Results and Discussion

3.1 Results

The pretest diagram above illustrates the students' initial ability level prior to implementing the Problem-Based Learning (PBL) model. It shows that only a small proportion of students

achieved learning mastery (Completed), while the majority remained in the non-mastery category (Not Completed). This finding indicates that students' initial abilities—particularly in terms of creative thinking—were relatively low and required instructional intervention that is more innovative, participatory, and student-centered.

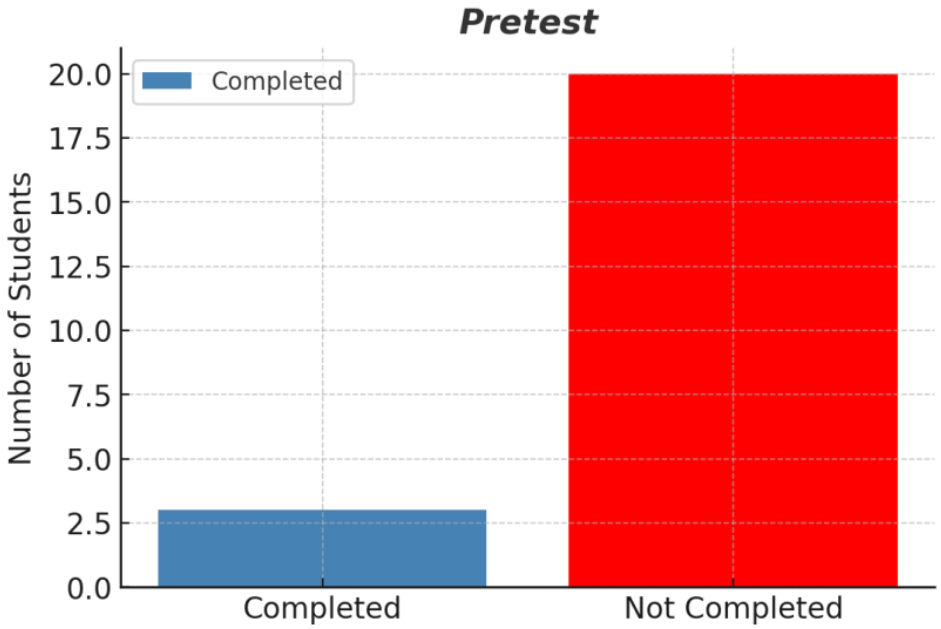

Figure 1. Pretest Learning Mastery Distribution Before PBL Implementation

These pretest results provide an essential baseline for implementing the PBL approach. With most students not yet achieving mastery, the application of learning strategies that promote active engagement, real-world problem solving, and collaboration is expected to significantly enhance students' creative thinking skills. Therefore, this initial data not only highlights the challenges in the learning process but also underscores the urgency of adopting more effective instructional models to achieve optimal learning outcomes. Based on the data in the Pretets diagram above, it is known that the learning outcomes of students who have scores above the KKTP, namely having a score of 70 or above, only number 3 students, while the number of students whose scores are below the KKTP is 20 students.

The researcher gave questions after being given treatment, namely the problem-based learning model. Below are the results of the grade data of fourth-grade students at SD Negeri 091608 Sinaksak. It can be seen that the highest student posttest score is 100 while the lowest score is 65. The number of students who scored above the KKTP was 22 students and the number of students who did not complete was 1 student where the student had to be given special attention because he had a disease in the brain, as a result of the disease he experienced, the student made the child less focused in learning. So it can be concluded that the completion of student scores increased after the implementation of the Problem Based Learning model in the learning.

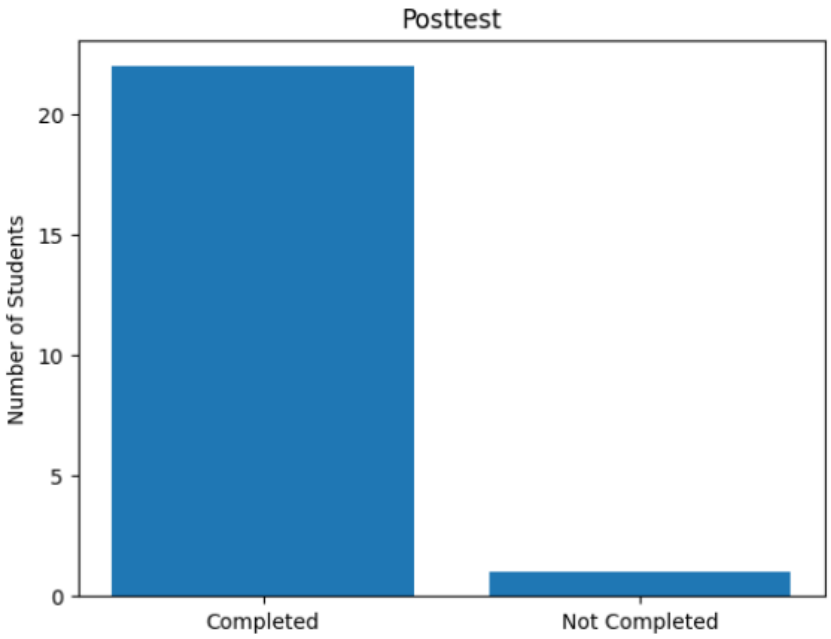

Figure 2. Posttest Learning Mastery Distribution After PBL Implementation

After conducting the pretest and posttest, the researcher inputted the learning outcomes data into Microsoft Excel to obtain the N-Gain value. The results obtained will later serve as a benchmark for the effectiveness of the use of the Problem Based Learning model on the creative thinking skills of fourth-grade students in the science subject at SD Negeri 091608 Sinaksak.

Tabel 3 N-Gain Test

	Score
Mean Pretest	50,22
Mean Postest	83,86
N-Gain Score	0,69

Based on the results of the N-Gain test, it shows that there is an N-Gain value of 0.56 - 0.67 which is in the medium category with a number of 15 students. Then the N-Gain results of 0.70 to 1.00 are said to be in the high category with a number of 8 student.

3.2 Discussion

This study was conducted to determine the effect of the Problem Based Learning model on students' creative thinking abilities in grade IV of SD Negeri 091608 Sinaksak in the 2025/2026 academic year. There were 23 students, 12 male and 11 female. Before conducting the study, the questions were validated by a validator. Ten invalid questions and five valid questions were found. Questions that are declared valid will later be used in the pretest and posttest in the research class. After knowing the questions that have been declared valid, the next step for the researcher is to use valid questions to test the research experimental class, namely SD Negeri 091608 Sinaksak, to find out the students' initial abilities before applying the Problem-

Based Learning model. Based on the pretest scores, 20 students did not meet the Minimum Mastery Criteria (KKTP), and 3 students did, with the lowest score being 30 and the highest being 75. Based on these percentages, it can be concluded that students' learning outcomes prior to the implementation of the Problem-Based Learning model were relatively low.

After learning the students' pretest scores, the researcher then applied the Problem-Based Learning model. Koeswanti, (2018:7) stated that the Problem-Based Learning model helps students develop problem-solving skills, increase understanding and knowledge, and be active in acquiring knowledge. According to Toharudin, 2011:99). The Problem-Based Learning Model is a learning model that uses real-world problems as a basis for fostering creative thinking and problem-solving. Based on the theory above, it can be concluded that the Problem-Based Learning Model is an approach that is centered on real problems as the basis for the learning process. After the material was delivered using the Problem-Based Learning model assisted by learning videos, the researcher will administer a posttest to fourth-grade students. Based on the collected data, the researcher will determine whether the Problem-Based Learning model affects students' creative thinking skills in fourth-grade science. Based on the posttest results, the highest score was 100 and the lowest was 65. Of 23 students, 22 achieved scores above the Minimum Mastery Criteria (KKTP), while 1 scored below it. The average posttest score increased to 85.4, compared to the pretest mean of 52.3, indicating an overall improvement of approximately 63%. These results suggest that implementing the Problem-Based Learning model effectively enhanced students' learning outcomes.

After conducting the Aiken'V to determine the validity of the questions that had been done by the validators (Lecturers and Teachers), then continued with the N-Gain Test, there was a minimum value of 0.67 and a maximum value of 1.00, this indicates that all students experienced improvements that were in the medium and high categories. So it can be concluded that the Problem Based Learning model has been used effectively.

4. Conclusions

Based on the results of research and discussions conducted by researchers, it can be concluded that there is an influence of the Problem Based Learning model at SD Negeri 091608 Sinaksak. This can be seen from the students' pretest scores (before the treatment was given), namely the highest was only 75 with a total of 3 students and after the posttest (after the treatment was given) there was an increase in students' scores with the highest score being 100 with the number of students who completed as many as 22 and the lowest score being 65 with the number of students who did not complete 1 student. Therefore, it can be concluded that the Problem-Based Learning (PBL) model is effective not only in improving students' test scores but also in enhancing their creative thinking abilities. This effectiveness is attributed to the PBL process, which encourages students to explore real-world problems, collaborate with peers, and generate innovative ideas through critical inquiry and reflection.

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Conflict of Interest

The author declares no conflict of interest. The entire research process, data analysis, and preparation of this thesis were conducted independently without any influence from any party, whether personal, academic, or financial, that could influence the representation or interpretation of the research results.

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