

Efforts to Improve Mathematics Learning Outcomes on Plane Geometry Material Through the PBL (Problem-Based Learning) Model

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Abstract

This Classroom Action Research was conducted with fourth-grade students at Sint Yoseph Elementary School, based on initial observations showing low mathematics achievement in the topic of plane figures, where 50% of students' scores were below the school's established Learning Objective Achievement Criteria (KKTP) of 75. To address this issue, the Problem-Based Learning (PBL) model was implemented, which was expected to improve student learning outcomes. The study aimed to improve mathematics learning outcomes on the topic of plane figures by implementing the PBL model. The results showed that: 1) the implementation of the PBL model in mathematics learning was categorized as very good, and 2) student learning outcomes increased in each cycle, with the average score rising from 63 in cycle I, to 70 in cycle II, and 77 in cycle III, exceeding the KKTP. The application of the PBL model proved effective in enhancing student learning outcomes through more interactive and problem-based learning, leading to an improvement in mastery of the learning material.

Key Word: Learning Outcomes, Mathematics, Problem Based Learning

1 INTRODUCTION

Education is an important aspect of life, prioritized by almost every country to build a nation. Quality education, through formal, non-formal, and informal pathways, produces high-quality human resources with strong competitiveness. Mathematics, taught from elementary school to university with a greater allocation of instructional hours, highlights its significance in education.

Learning outcomes are the process of tangible changes in student behavior in line with educational objectives, encompassing cognitive, affective, and psychomotor aspects. Learning outcomes are a form of information that can be used to assess students' ability to understand and comprehend the material taught. These outcomes can be influenced by the students' abilities (internal factors) and by the quality of the learning process (external factors), which are related to the level of expertise and professionalism of the teacher.

Mathematics is a standalone discipline that plays a significant role in education. This is because mathematics is encountered in everyday life. When students learn and acquire mathematical knowledge, it can be applied to solve daily problems. The main goal of mathematics education is to train students' thinking and reasoning skills in drawing conclusions, which helps develop creative abilities by engaging imagination and curiosity,

enabling them to make predictions and hypotheses, followed by experimentation. The skills gained from mathematical knowledge can enhance students' abilities to analyze, solve problems, and sharpen their thinking, reasoning, and imagination.

The competency standards for mathematics subjects are designed to enhance reasoning, critical thinking, and abstract thinking skills. With the continuous and inevitable advancement of science and the easy access to information, this progress can be highly beneficial for society and the world of education

Mathematics education provides broad benefits for students in developing attitudes, knowledge, and skills. According to the Ministry of Education and Culture Regulation No. 20 of 2016, graduates are expected to possess factual, conceptual, procedural, and metacognitive knowledge. However, mathematics learning outcomes are often overlooked in the learning process. Many factors contribute to low learning outcomes, including social factors and the lack of appreciation for students' creativity.

At Sint Yoseph Elementary School in Central Jakarta, the learning process is predominantly teacher-centered, with educators actively delivering information while students passively receive procedures or formulas. This conventional lecture-based approach results in passive student participation, limiting opportunities for critical thinking. Consequently, students' understanding of mathematical concepts remains underdeveloped, making it challenging to apply these concepts in daily life. Moreover, students often experience confusion and stress when faced with mathematical problems that differ from the examples provided.

Educators must be creative and capable of recognizing the diverse thinking abilities of students. The goal of mathematics education is for students to fully understand concepts, develop reasoning skills, solve problems, communicate mathematical ideas, and foster a positive attitude towards mathematics. Therefore, an appropriate method or approach is needed to help students enjoy mathematics. (Nurul'Azizah, et al 2019)

With improvements in teaching methods and how the material is presented, it is hoped that students' mathematics learning outcomes can be enhanced. The approach in teaching refers to a general view of the learning process and should be used actively and wisely by educators. Based on observations in August 2023 in the fourth-grade class at Sint Yoseph Elementary School, consisting of 17 students (14 boys and 3 girls), several issues were identified in the learning process. Students lacked critical thinking, analytical skills, problem-solving abilities, and information evaluation. Mathematics learning outcomes were also low, with 50% of students scoring below the minimum passing criteria (KKTP). The conventional teaching approach, which focused solely on practice exercises and procedures, made the teacher's activity more dominant than that of the students.

A more effective approach is the Problem-Based Learning (PBL) Model, which places problem-solving at the core of learning. In PBL, students are presented with complex problems that require solutions, working in groups to analyze and find solutions, thereby developing critical thinking skills and applying knowledge in real-world contexts. PBL also promotes collaboration, independent learning, and understanding the relevance of knowledge.

The PBL (Problem-Based Learning) model is an innovative teaching approach that starts with real-world problems faced by students, helping them learn how to think critically in solving issues. According to Ronis, Problem-based learning is based on the idea that individuals shape their understanding largely through what they experience (Diane & Ronis, 2019).

Bound and Feletti (in Barbara) state, The basic principle supporting the concept of PBL is older than formal education itself. Learning is initiated by a posed problem, query, or puzzle that the learner wants to solve (Barbara et al 2021) This statement, when translated, implies that the basic principle underlying the concept of PBL predates formal education itself. Learning is initiated by the presence of a problem, question, or puzzle that the learner will solve independently.

In PBL, the teacher acts as a facilitator, supporting the development of students' skills. PBL is increasingly accepted in Indonesia as an innovative approach to enhance active student engagement and prepare them to face future challenges.

With this background, it is expected that PBL can increase students' interest and learning outcomes in mathematics, as well as foster the development of systematic, logical skills and personality. Therefore, the researcher intends to conduct a study on "Efforts to Improve Mathematics Learning Outcomes on Plane Geometry through the Problem-Based Learning Model."

2 RESEARCH METHODS

The type of research applied in this study is Classroom Action Research (CAR). This classroom action research refers to a series of directed, planned, and focused steps taken by the teacher to address learning issues that arise in the classroom in order to achieve predetermined learning objectives. Throughout the study, collaboration occurs between the researcher and the teacher, beginning with problem identification, action planning, implementation, observation, and reflection.

In this research, the researcher applies the Classroom Action Research model developed by Kemmis and Taggart, as cited by Aqib. This model outlines three cycles, each consisting of several stages of action. The model aligns with the success criteria of the research, represented by the following components: (1) planning, (2) action implementation, (3) observation, and (4) reflection. This approach was chosen for its simplicity, making it easy for the researcher to understand. Each research cycle includes four stages: (1) planning, (2) action implementation, (3) observation, and (4) evaluation and revision of the plan to achieve the expected results. The evaluation results are then used to guide the next cycle. The research design can be seen in the diagram below:

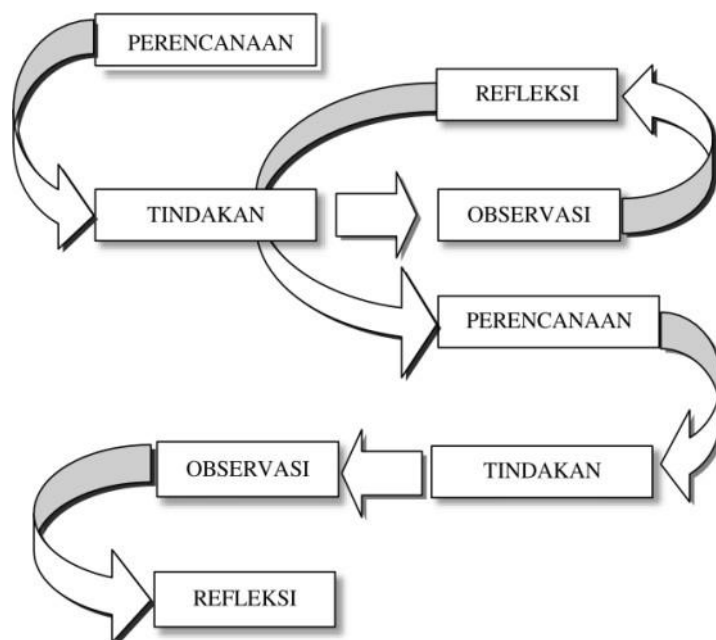


Figure 1. Model Type Kemmis and Taggart

Data were collected through four main techniques: observation, interviews, tests, and documentation. Tests were administered to students after the implementation of actions during the second meeting of each cycle. These tests consisted of individual assessments

with 20 multiple-choice questions and 5 essay questions. Data analysis in this Classroom Action Research was conducted in three stages: data reduction, data description, and data verification. The success of student learning was measured based on the Minimum Passing Criteria (KKTP), with a target score above 75.

3 RESULT AND DISCUSSION

From the research conducted, the findings regarding the mathematics learning outcomes on the area and perimeter of plane figures for fourth-grade students in the second semester of the 2023/2024 academic year at Sint Yoseph Elementary School in Central Jakarta are as follows:

3.1 Research result

Based on the results obtained in the pre-cycle, the students' average mathematics score was still below the criteria for achieving learning objectives (KKTP), namely a score of 51 with details of student scores, three students with a score of 35, three students with a score of 40, six students with a score of 45, and five students with a score of 75, while the score for the criteria for achieving learning objectives (KKTP) is 75. This shows that 70.59% of students are still unable to understand the material and 29.41% of students are able to understand the material.

Cycle I actions were carried out in 2 meetings. In the first cycle, it was obtained that the average class test results for mathematics lessons on spatial building material as a whole were still below the criteria for achieving learning objectives (KKTP), with the number of students who had not completed as many as 8 students (64.71%) while the class average was 63 while the learning objective achievement criteria (KKTP) is 75.

Cycle II actions were carried out in 2 meetings. In cycle II, it was found that the learning outcomes of cycle II had increased, where the average class score was 70 and there were 5 students (29%) who had not completed it. With the change in learning media using PowerPoint and Wordwall, there has been quite a good increase in learning outcomes in line with student enthusiasm continuing to increase.

Cycle III actions were carried out in 2 meetings. In cycle III, the results obtained from cycle III learning showed that there was an increase in learning outcomes using the Problem Based Learning (PBL) learning model through power point and quizizz media which was much better than using image media drawn on a whiteboard. From this data, it is known that the test results in cycle III, the class average for mathematics lessons on flat shapes, was above the minimum completion criteria (KKM), namely 77, with the number of students who had not completed as many as 3 students (18%) and students who had completed as many as 14 students (82%). This data shows that 82% (14 students) can understand the material.

3.2. Discussion

From research that has been carried out on fourth grade students at Sint Yoseph Elementary School which consists of three cycles, there is an increase in mathematics learning outcomes in each successive learning process from the first cycle, second cycle and third cycle, through the Problem Based Learning (PBL) learning model. as seen in the percentage of student learning outcomes achieved. The average student scores and teacher and student observation scores between the first cycle and the second cycle are as shown in the following table:

Tabel 1. Flat Shape Mathematics Learning Outcomes			
Category	Cycle I	Cycle II	Cycle III
Learning Outcome	63	70	77
Teacher Observation Results	3,4	3,75	4,0
Student Observation Results	3,1	3,8	4,0

The table above shows that there was an increase in the percentage of student achievement in learning, the average student score in a row for students from cycle I, Cycle II and cycle III, namely the percentage in student learning achievement in cycle I was 35.29% with an average score 63. Increased in cycle II by 71% with an average value of 70 and increased in cycle III by 82% with an average value of 77.

The increase in the percentage of student learning outcomes compared to the average student is in line with the improvement in the learning process. Both teachers and students. From the first cycle of activities the teacher obtained a score of 3.4 in the very good category, in the second cycle he obtained a score of 3.75 in the very good category and in the third cycle he obtained a score of 4.0 in the very good category. Meanwhile, student activities got a score of 3.1 in the good category, in cycle II they got a score of 3.8 in the good category and in cycle III they got a score of 4.0 in the very good category. Based on a comparison of student learning outcomes data in pre-cycle, cycle I, cycle II and cycle III, it can be concluded that the use of the Problem Based Learning (PBL) learning model can improve student learning outcomes in Mathematics for fourth grade students at Sint Yoseph Elementary School. As can be seen in the following graph.

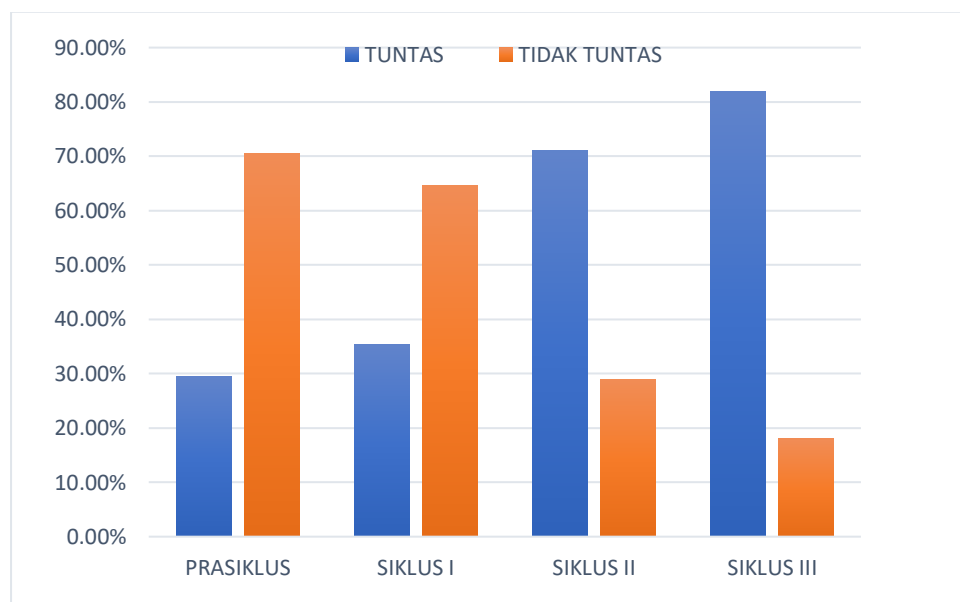


Figure 2. Presentation of Pre-cycle Completion to Cycle III

The graph above shows that there has been an increase in student learning outcomes in successive lessons according to the comparison of learning outcome data from pre-cycle, cycle I, cycle II and cycle III. Pre-Cycle was 29.41%, increased in Cycle I by 35.29%, increased in Cycle II by 71% and increased again in Cycle III by 82%. By increasing student learning outcomes in learning, the application of the Problem Based Learning (PBL) model is able to improve student learning outcomes, especially in the Mathematics subject material volumes of flat shapes at Sint Yoseph Elementary School, Central Jakarta.

Based on the results of research and data analysis, the application of the Problem Based Learning (PBL) learning method to flat shape material in class IV has proven effective in improving student learning outcomes. The significant increase in learning completion from cycle to cycle shows that the PBL approach is able to facilitate deeper understanding and active involvement of students in the learning process. Apart from that, an increase in learning outcome scores also indicates that students are more able to apply the concepts learned independently. Thus, the PBL method can be recommended as an effective alternative learning strategy to improve the quality of learning at the elementary school level.

4 CONCLUSION

The implementation of the Problem Based Learning (PBL) learning model in class IV of Sint Yoseph Elementary School, Senen District, Central Jakarta, in the Even Semester of the 2023/2024 Academic Year succeeded in improving student learning outcomes. This can be seen from the increase in learning outcome scores in each cycle. In the initial stage (pre-cycle), the completion rate reached 29.41%, then increased to 35.29% in cycle I. This percentage continued to increase in cycle II to 71%, and finally reached 82% in cycle III, with Goal Achievement Criteria Learning (KKTP) of 75.

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