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USING PROBLEM-BASED LEARNING TO IMPROVE 12TH GRADE STUDENTS' LEARNING OUTCOME OF MATHEMATICAL THREE-DIMENSION

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ABSTRACT

Background: Mathematics learning about three dimensions has difficulties in solving learning, for that it requires a fixed learning method, one of which is problem-based learning.
Aim: This study aims to understand and solve mathematics learning problems about the third dimension with the problem-based learning method.
Method: The samples taken were class XII IPA 4 in the 2019/2020 academic year as many as 25 students. The instrument used is a written test with 5 assessments. It is a Classroom Action Research (CAR) on mathematics learning problems about three dimensions in class XII IPA-4 Semester 1 of the 2019/2020 academic year at SMA N (Public Senior High School) 9 Cirebon City. The data collection techniques conducted were observation, interviews, data processing, and documentation.
Findings: The results of the research from the initial study data obtained that from the number of students 25 students only 9 students who have a complete score and the rest, namely 16 students do not get a complete score, with a total student score of only 1702 and an average of 68.08 and gets a percentage of completeness 36%. Then improvements were made in two cycles, in the first cycle with two assessments, in the first cycle it produced an average score of 74.92 and the percentage of completeness was 56%. While in Cycle II, the average score was 78.64 and the percentage of completeness was 80.77%, thus the percentage of completeness from Pre Cycle I, Cycle I, and Cycle II increased.

KEYWORDS

improvement, learning outcomes, problem-based learning learning method

INTRODUCTION

Three-Dimensional Matter is a branch of mathematics that studies three-dimensional builds (Sekarwulan, 2019). Dimension Three is the material taught in high school class XII odd semester of the 2019/2020 academic year. The study discussed in dimension three includes point-to-point distance, point-to-line distance, and point-to-plane distance (Setiawan, 2019).

Learning mathematics, especially Dimension Three, requires the ability to analyze and think critically in completing case studies, and it is not enough just to see and memorize formulas (Hendriana, 2014). Based on observations on the implementation of learning, the problems that often arise are students have difficulty in conveying questions and problems in the learning process faced, lack of interaction among students in learning both group work and discussion, lack of ability to solve learning problems, students are still passive in their studies that only receive material from the teacher, and not searching and finding from other references either from library books or from the Internet (Sabil, 2011).

Mathematics as a universal science on which the development of science, technology and information is based, contributes in various disciplines and improves human thinking ability

(Anshori, 2014). Siswono (2004) states that in the process of learning mathematics a thought process occurs, because a person is said to think if the person is doing mental activities and the person who learns mathematics must be doing mental activities. According to the National Standards Board for Education (2006), mathematics subjects need to be given to all students to equip students with the ability to think logically, analytically, systematically, critically, creatively, and the ability to cooperate (Akmalia et al., 2016).

According to Siswono (2004), the components used to measure mathematical creative thinking ability consist of three key components, namely fluency, flexibility, and novelty. Fluency refers to the number of problems posed, flexibility refers to the number of different categories of the problem created and the novelty of seeing how out of habit (different from habitual) a response is in a set of all responses. In this study, the components of mathematical creative thinking ability that were measured were fluency, flexibility, and novelty (Akmalia et al., 2016).

Problem-based Learning (PBL) is an approach in education that means helping students find real problems, collect information with self-determined strategies and make decisions (Timor et al., 2021). PBL helps learners improve their skills in terms of critical thinking and solving problems (Fatimah et al., 2021).

Problem-based Learning (PBL), is one of the innovative learning models that can provide active learning conditions to students. Learning using the Problem-based Learning (PBL) model has the main characteristics, which begin with a problem. The problems given are usually related to everyday life and according to the material to be taught. The existence of this problem can arouse students' curiosity and will later make students challenged to solve it (Maghfiroh et al., 2017).

The PBL model has several characteristics, namely: (1) Stimulus in learning starts from a problem; (2) problems related to unstructured real life are the problems presented; (3) the problems provided require the identification of learning needs, the use of diverse sources of knowledge, and the evaluation of information sources are important processes in PBL; (4) learning self-direction comes first; (5) the development of problem-solving skills is as important as the mastery of knowledge in finding solutions to problems (Samsi et al., 2022).

Problem-based learning is a learning approach that starts with the submission of problems and continues with solving problems. Usually the problem is based on a real-life problem that has been chosen to meet educational goals. As stated by Shoimin (2014) that problem-based learning means creating a learning atmosphere that leads to daily problems. Problem-based learning model is a learning model that in the process uses real problems related to daily problems so that it can develop students' thinking abilities and skills (Puspitasari et al., 2022).

The Problem-based Learning (PBL) learning model is superior to conventional in the aspect of shiva's critical thinking skills. PBL also changes students' interest and learning achievement for the better (Mashuri et al., 2019), because problem-based learning is an approach in education that means helping students find real problems, gather information with self-determined strategies and make decisions (Fatimah et al., 2021).

The problem-based learning (PBL) approach is a learning approach that uses real-world problems as a context for students to learn about critical thinking and problem-solving skills, as well as to acquire essential knowledge and concepts from the subject matter (Widayat, 2019). Research by Juliawan et al. (2017) proved that problem-based learning positively affects

students' problem-solving skill regarding mathematics. The fact alone incites the researcher's curiosity in any further application of problem-based learning.

Therefore, with the use of the problem-based learning approach, this study seeks to comprehend and resolve third-dimension mathematics learning challenges. The benefits of research as input for teachers to improve the quality of the mathematics learning process, and are expected to add innovation and creativity in learning activities and as input to choose the right learning model in mathematics learning, namely by using cooperative learning problem-based learning to increase student interest in learning, and can be used as a reference in making policies on improving the quality of learning in schools, through training for teachers on teaching methods to improve the quality of learning (Widayat, 2019).

METHOD

This type of research is class action research which is carried out through two cycles and follows the stages proposed by Kemmis and McTaggart (1990), with the components of the action being planning, implementation, observers, and reflection. This research was conducted at SMA N (Public Senior High School) 9 Cirebon City starting from July to October 2019. The subjects of this study were class XII IPA-4 students of SMA N (Public Senior High School) 9 Cirebon City for the 2019/2020 academic year, totaling 25 students consisting of 10 male students and 15 female students.

The implementation consists of two cycles and each cycle consists of two assessments, with previously carried out pre Cycle I as a pre-test with the aim of knowing in general the ability of students about three-dimensional space material. Each cycle begins with planning, implementing actions, observations, and reflections are carried out at the end of each cycle. The planning of activities includes compiling learning plans, making discovery learning learning methods, making teaching materials for three-dimensional spaces. The implementation of actions includes teaching and learning activities to evaluate learners. Obervation activities are collaborations with colleagues to monitor research activities. Meanwhile, the reflection activity is to find out the results of the implementation and find problem solving in order to improve learning outcomes (Widayat, 2019).

The results of this research data processing by taking research instruments based on obesrvation sheets, processing learning outcomes assessments, and learning documentation. The data used to determine the use of the Problem-based Learning learning model was obtained through pre-tests and post-tests given to students before and after using the problem-based learning learning model in mathematics subjects. Effective results on learning learning can refer to Hake's theory of nominalized Gain. Richard R. Hake explained that the gain score is the difference between the final test score (post-test) and the initial test (pre-test) (Sumardi et al., 2018).

RESULTS AND DISCUSSION

Planning

Some of the planning stages carried out in Cycle I in grade 12 IPA-4 1st Semester of the 2019/2020 Academic Year on three-dimensional material are compiling a Learning implementation plan, compiling material on dimesion three, determining the Problem-Based Learning, swiping worksheets, and compiling student observation sheets.

In Cycle I, two assessments are carried out to ensure learning outcomes. If in Cycle I this has not achieved the expected results, cycle II is carried out with the same pattern in Cycle I in order to get the results of learning evaluation according to the expected learning objectives.

Implementation of Actions

During the learning process, the teacher teaches in accordance with the rpp made. In this case, by using the Problem-based Learning learning model with learning steps as follows:

1) Identify student needs;
2) Preliminary selection of the principles, understanding of the concepts and generalizations studied;
3) Selection of materials and problems;
4) Help clarify the task or problem to be studied, as well as the role of each student;
5) Prepare class settings and necessary tools;
6) Examine students' understanding of the problem to be solved and the student's assignments;
7) Give students the opportunity to make discoveries;
8) Help students with information or data, if it is necessary for students;
9) Lead self-analysis with questions that direct and identify the process;
10) Helps students formulate principles and generalizations of the results of their discoveries.

Observation

Observations are made by researchers in this case teachers who will conduct Class Action Research (CAR) and are assisted by obeservers or peer teachers who are relevant to history subjects to observe the teaching and learning process and observe student activity during the learning process.

Reflection

The data obtained at the time of observation were evaluated to see an increase in student activity, development and progress in learning outcomes. From this data, discussions and discussions were then carried out between teachers and researchers to find out the results of the implementation and find solutions to problems in order to improve learning outcomes, and used as improvement plans

Discussion

In this research, 25 students took data from Class XII IPA-4 with data processing from the results of learning evaluations carried out in Pre-Cycle I, Cyclone I and Cycle II. With the Results of Value Processing, the Results of Learning Evaluation in the Pre-Cycle were held on Thursday, July 25, 2019. Meanwhile, Cycle I using the Problem-based Learning learning method was held on Thursday, August 22, 2019 and Thursday, September 12, 2019. Then The Implementation of Cycle II is carried out on Thursday, October 3, 2019 and on Thursday, October 24, 2019 which is shown in the table below.

Table 1. Pre Cycle I Learning Evaluation Results

Results of Evaluation of Pre-Cycle I Mathematics Learning	
Number of Samples	25
Highest rated	78
Lowest Value	50
Sum of Values	1702
Average	68.08
Percentage of Completeness	36%

Source: Data Processed

From the table above, it illustrates that the results of processing scores from the number of students were 25 students, with a total of 1702 data and a grade point average of 68.08. The percentage of completion in Pre-Cycle I was 36% as many as 9 students completed out of 25 students. Furthermore, an assessment was carried out in Cycle I by conducting two assessments with the results in the table below.

Table 2. Results of Learning Evaluation cycle I and cycle II

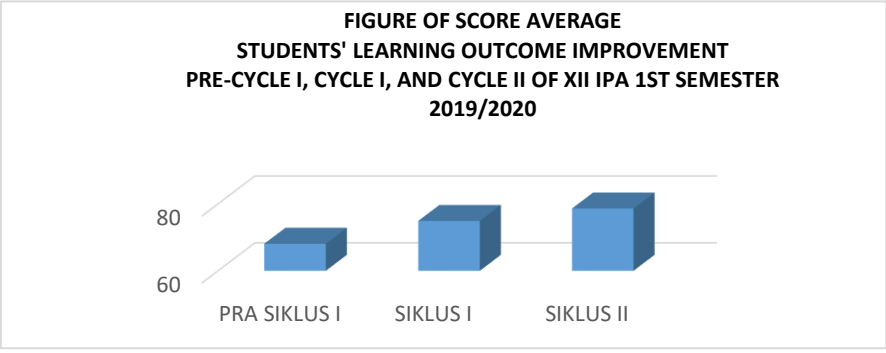
Results of Evaluation of Mathematics Learning Cycle I and Cycle II		
	Cycle I	***Cycle II***
Sum of Values	1873	1966
Average	74.92	78.64
Percentage of Completeness	56.00	80.77

Source: Data Processed

In Cycle I, an assessment was carried out twice which showed that by producing a total of 1873 and a grade average of 74.92 and a percentage of completion of 56%. Meanwhile, in Cycle II, it produced the 1966 Total Value, with a grade average of 78.64 and a percentage of completion of 80.77%. so that the data shows an increase in the results of the learning process from Pre Cycle I, Cycle I, and Cycle II using a problem-based learning learning model.

So that if shown in the graph below as a result of improving learning outcomes using problem-based learning methods in mathematics subjects with three-dimensional material.

Figure 1. Average Learning Outcomes of Each Cycle



Source: Researcher's Data, Processed

Constraints and Solutions in learning

The obstacle faced by SMA N (Public Senior High School) 9 Cirebon in mathematics learning is because the motivation and interest in learning students are still low so that teachers must have strategies and efforts by using various learning models so that learning can be conveyed properly by students. The large number of students from the lower middle class who only graduate the high school causes students to be less enthusiastic in learning so that they only have a learning target only to be completed to the extent of KKM. Hence, teachers must carry out coaching and guidance so that mathematics learning is achieved optimally and based on the aforementioned result, problem-based learning helps students in this case. This is supported Juliawan et al.'s statement (2017), in which problem-based learning positively affects students' problem-solving skill, especially in mathematics.

CONCLUSION

Problem-based learning learning model there are mathematics subjects about the third dimension in class XII Science 4 Semester 1 SMA N (Public Senior High School) 9 Cirebon City Academic Year 2019/2020 is sought to improve knowledge, skills, motivation, achievements, creativity, and problem solving mathematics learning. The problem-based learning model can be carried out on all subjects in solving learning problems and produces an increase in learning outcomes in individual and group-based case studies so that teachings aremore active and creative. The problem-based learning model can increase the learning motivation of class XII science students 4 Semester 1 SMA N (Public Senior High School) 9 Cirebon City for the 2019/2020 academic year in mathematics subjects about three dimensions.

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