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Improving mathematics learning outcomes of students in the matriculation class of Santa Maria Senior High School Yogyakarta through tutoring activities

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Abstrak
Penelitian ini dilatarbelakangi oleh hasil belajar matematika siswa yang belum maksimal ditinjau dari hasil Penilaian Tengah Semester dan penilian harian materi sebelumnya yaitu relasi. Penelitian ini bertujuan untuk meningkatkan hasil belajar matematika peserta didik dengan model pembelajaran Problem Based Learning (PBL) di kelas X yang mengikuti kegiatan bimbingan belajar di suatu sekolah menengah atas yang tinggal di asrama. Jenis penelitian ini adalah jenis penelitian tindakan kelas (PTK) dengan dua siklus. Desain PTK menggunakan model Kemmis dan Mc Taggart yang terdiri dari empat tahapan yaitu perencanaan, pelaksanaan, pengamatan, dan refleksi. Subjek penelitian adalah 32 siswa kelas X yang mengikuti kegiatan bimbingan belajar di suatu sekolah menengah atas yang tinggal di asrama. Instrumen pengumpulan data terdiri dari tes hasil belajar dan lembar observasi keterlaksanaan pembelajaran. Teknik analisis data adalah analisis deskriptif. Kriteria keberhasilan penelitian ini adalah lebih dari 78% peserta didik tuntas KKM yaitu 75. Hasil penelitian menunjukkan adanya peningkatan hasil belajar matematika dengan model pembelajaran PBL. Pada kondisi awal hanya 50% peserta didik yang tuntas KKM dengan rata-rata nilai 62,25. Pada siklus I, sebesar 65,63% peserta didik tuntas dengan rata rata nilai 70,61 dan pada siklus II 84,39% siswa tuntas dengan rata-rata nilai 86,67. Oleh karena itu dapat disimpulkan bahwa model problem based learning (PBL) dapat meningkatkan hasil belajar matematika peserta didik kelas X yang mengikuti kegiatan bimbingan belajar di suatu sekolah menengah atas yang tinggal di asrama.
Kata Kunci: Hasil Belajar, Problem Based Learning, Matematika

Abstract

This research is motivated by the suboptimal mathematics learning outcomes of students, as seen from the Mid-Semester Assessment and daily assessments on previous material, specifically relations. This study aims to improve the mathematics learning outcomes of students using the Problem-Based Learning (PBL) model in class X students participating in tutoring activities at a senior high school who reside in a dormitory. This research is a classroom action research (CAR) study with two cycles. The CAR design follows the Kemmis and McTaggart model, which consists of four stages: planning, implementation, observation, and reflection. The research subjects were 32 class X students participating in tutoring activities at a senior high school who reside in a dormitory. Data collection instruments included learning outcome tests and observation sheets on the implementation of learning. Data analysis was conducted using descriptive analysis. The success criterion for this research was that more than 78% of students achieved the Minimum Completeness Criteria (KKM) of 75. The results showed an improvement in mathematics learning outcomes using the PBL model. In the initial condition, only 50% of students met the KKM with an average score of 62.25. In cycle I, 65.63% of students met the KKM with an average score of 70.61, and in cycle II, 84.39% of students met the KKM with an average score of 86.67. Therefore, it can be concluded that the Problem-Based Learning (PBL) model can improve the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory.

Keywords: Learning Outcomes, Problem-Based Learning, Mathematics

Introduction

Mathematics is a universal science that is useful in human life and underlies the development of modern technology. It also plays an important role in various disciplines and advances human thinking. Based on the Regulation of the Minister of National Education of the Republic of Indonesia No. 21 of 2016 on the Content Standards for Primary and Secondary Education, mathematics is one of the subjects taught to students from elementary to secondary school to develop critical, analytical, logical, careful, responsible, responsive, and persistent thinking skills in solving problems.

Rosalina and Rooselyna (2017) state that learning mathematics is not only about calculation and logic but also about connecting mathematical ideas with modern life contexts through creativity in solving problems encountered in daily life. From the above explanation, mathematics is an important subject to learn because it provides many benefits in life. However, despite being taught since elementary school, mathematics is often considered difficult by students, and many still achieve low learning outcomes.

Based on the results of the Mid-Semester Assessment and daily assessments on previous material, the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory are not optimal. This is evident from the many incomplete scores in the daily assessments on the topic of plane figures. The students' mathematics learning outcomes can also be seen from the pre-test scores obtained during the pre-research phase. Based on the pre-test scores of class X students participating in tutoring activities at a senior high school who reside in a dormitory, the average mathematics score was 62.25. The KKM at the school is 75, and out of 32 students, 16 did not meet the KKM or scored below 75.

This data indicates that the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory still need to be optimized. According to Slameto (2013), learning is a process characterized by changes in behavior as a result of experience and practice. These changes, as learning outcomes, can manifest in various forms, such as changes in knowledge, understanding, attitudes, behavior, skills, and abilities. Rusman (2017) states that learning is an activity that can be carried out both psychologically and physiologically. Psychological activities include mental processes such as thinking, understanding, concluding, listening, analyzing, comparing, differentiating, expressing, and analyzing. Furthermore, Rusmono (2012) states that learning outcomes are changes or new abilities acquired by students after engaging in learning activities. From the above opinions, it can be concluded that mathematics learning outcomes are changes in students' learning activities after receiving mathematics instruction, in the form of knowledge, skills, and attitudes aimed at measuring learning abilities.

Learning outcomes are influenced by three factors: (1) cognitive ability, (2) achievement motivation, and (3) the quality of teaching. The quality of teaching involves the teacher's ability in the teaching process using appropriate methods and models (Ahmadi, 2011). Darmadi (2017) agrees that learning outcomes are influenced by three factors: (1) internal factors such as talent, interest, motivation, intelligence, and personality, (2) external factors such as family, school, and environment, and (3) teaching approaches, including strategies and teaching methods. Additionally, Nurfadillah (2020) states that factors contributing to low student learning outcomes include: 1) low student understanding of the material taught by the teacher, making it difficult for students to answer the teacher's questions; 2) low student activity and motivation, characterized by a lack of initiative in seeking information; 3) teacher-centered learning, leading to low student activity in collaborating and sharing ideas. According to Law No. 20 of 2003, teaching should be conducted in an engaging manner so that students can effectively develop their knowledge and abilities and actively participate in the learning process.

Knowledge construction should follow constructivist theory, where students reconstruct their experiences or prior knowledge to achieve optimal learning outcomes. Permendiknas No. 22 of 2016 states that teaching should actively involve students and provide more opportunities for students to develop

themselves. Teaching should no longer be teacher-centered but should instead focus on active student participation in the learning process.

The achievement of learning objectives is highly influenced by the teacher's ability to select and develop teaching methods (Novianty et al., 2017). Based on initial observations and interviews with the mathematics teacher, it was found that students' motivation in learning mathematics is still low, the media used has not been able to engage students, leading to boredom, and the teaching models lack variety. These factors are believed to contribute to the suboptimal mathematics learning outcomes of students. A potential solution is to involve students more in the learning process and apply a contextual problem-based learning model to challenge students and make learning more meaningful, thereby increasing motivation and learning outcomes. One such problem-based learning model that actively involves students is Problem-Based Learning (PBL). Problem-Based Learning is a teaching model that begins with a problem, requiring students to actively think, communicate, search for and process data, and ultimately draw conclusions (Rahmat, 2018). Problem-based learning is an innovation in 21st-century teaching because it optimizes students' thinking abilities through systematic teamwork, allowing students to continuously develop their thinking skills. Sulaeman (2016) states that the Problem-Based Learning model is a strategy that focuses on presenting learning through problem-solving, giving students the opportunity to build and develop their knowledge, independence, critical thinking, analytical skills, innovation, and active participation in the learning process. Arends (2008: 57) outlines five main phases of PBL, as detailed in Table 1 below.

Table 1. Phases of Problem-Based Learning according to Arends

Phase	Activities
Phase 1: Orienting students to the Discussing	learning objectives, problem describing important logistical needs, and motivating students to engage in problem-solving activities.
Phase 2: Organizing students for Helping students	define and learning organize learning tasks related to the problem.
Phase 3: Assisting independent and Encouraging	students to gather group investigation appropriate information, conduct experiments, and seek explanations and solutions.
Phase 4: Developing and presenting Helping students	plan and prepare artifacts and exhibits appropriate artifacts such as reports, video recordings, and models to present to others.
Phase 5: Analyzing and evaluating The teacher helps	students reflect the problem-solving process on their investigations and the processes they used.

According to Putra (2013), the Problem-Based Learning model has several advantages, including: (1) students better understand the concepts taught because they discover them themselves, (2) students are actively involved in problem-solving, (3) knowledge is embedded based on students' existing schemas, (4) students can feel the benefits of learning as the problems solved are directly related to real-life situations, (5) students become more independent and mature, able to express their opinions and accept others' views, and develop positive social traits with their peers, (6) students interact with each other and the teacher in group learning, (7) the model fosters students' thinking abilities. Given these advantages, it is hoped that the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory can improve with the Problem-Based Learning model. Several previous studies have found that PBL can improve learning outcomes for both elementary and secondary school students. Novianti et al. (2022) concluded that PBL can improve student learning outcomes, class averages, classical learning completeness, and student learning activities in class V of SDN 02 Temuireng. Based on the results of Melissa's (2016) research, it was found that Problem-Based Learning (PBL) can improve the independence and mathematics achievement of class VII E students at SMP N 15 Yogyakarta. Research conducted by

Darma et al. (2022) on class VII B students at SMP IT Darul Huda Ukui also concluded that Problem-Based Learning can improve the learning process, as indicated by increased student activity and improved learning outcomes.

Based on the background described above, the author conducted classroom action research titled "Improving Mathematics Learning Outcomes of Class X Senior High School Students Residing in a Dormitory Using the Problem-Based Learning Model."

Method

The type of research conducted is classroom action research in October 2024. According to Ananda (2019), classroom action research is defined as action research conducted by a teacher who is also a researcher in their own classroom or in collaboration with others, by designing, implementing, and reflecting on actions collaboratively and participatively, with the aim of improving or enhancing the quality of the learning process in the classroom through specific actions in a cycle. The research consists of two cycles, each cycle consisting of four stages following the design developed by Kemmis and McTaggart as described by Arikunto (2015), namely planning, action, observation, and reflection. The results of each cycle's reflection are used to improve the shortcomings and weaknesses of the previous cycle. If the desired results are not achieved in cycle I, then cycle II is added as an improvement, and so on. The research subjects were all class X students participating in tutoring activities at a senior high school who reside in a dormitory, consisting of 32 female students. The research object was the mathematics learning outcomes of the students.

Mathematics learning outcome data were collected using test instruments, and the data were analyzed descriptively. The success indicator in this research was that the average learning outcome score of the students should meet the KKM of 75, and the classical completeness should be at least 78%.

Result and Discussion

This classroom action research was conducted in two cycles, each cycle consisting of two meetings. Cycle I was conducted with four hours of action and one hour of cycle testing. The planning stage in cycle I began with analyzing Learning Outcomes (CP) and formulating Learning Objectives (TP) on the topic of statistics. Based on the determined TP, the next step was to prepare teaching modules using the Problem-Based Learning model, Student Activity Sheets (LKPD), observation sheets, and cycle test assessment instruments to measure student learning outcomes. The implementation stage involved conducting the planned learning using group discussion methods to solve problems in the LKPD, which included activities related to data collection and presentation in tables and diagrams, as well as cycle testing. The observation stage focused on the suitability of the learning steps with the PBL model, student activities, recording progress and obstacles during the action, and the results of cycle I testing. The results of cycle I observation included that the learning was quite suitable with the designed PBL syntax, and student learning activities began to show. Reflections on cycle I implementation included that students needed more time for discussion, the learning environment was less conducive because some students were not serious during discussions, many students still had difficulty completing the LKPD, some groups did not complete the LKPD by the end of the discussion time, the discussion process was still dominated by certain students, the presentation activity was not optimal because other students were less attentive and responsive, and many had difficulty completing the cycle test. The reflection results of cycle I showed that there were still many shortcomings in both student learning activities and learning outcomes, so improvements would be made in cycle II. The activities in cycle II were based on the reflection of cycle I.

The planning stage involved preparing teaching modules on statistics, LKPD, and cycle II test assessment instruments. The implementation stage involved conducting the planned learning using group discussion methods to solve problems in the LKPD, which included activities related to measures of central tendency (mean, median, mode), as well as cycle testing. The observation stage involved checking the suitability of the learning steps with the PBL model, student activities, recording progress and

obstacles during the action, and the results of cycle II testing. In cycle II, all students were more active in participating in the learning, were able to complete the LKPD on time, the discussion process went well, making the learning environment more conducive, and students were quite capable of completing the cycle test. In the reflection stage, an analysis was conducted on the observation results during the action. The results of cycle II implementation had already met the success indicators, namely improved student learning outcomes, so the classroom action research was not continued. The data on student learning outcomes using the Problem-Based Learning model are presented in Table 2.

Table 2. Distribution of Student Learning Outcomes

Aspect	Pretest	Cycle 1	Cycle 2
Average	62.25	70.61	86.67
Highest score	100	100	100
Lowest Score	0	22	60
Incomplete	16	11	5
Complete	16	21	27
Precentase	50%	65.63%	84.39%

Based on the data analysis in the pre-cycle, the average student learning outcome was 62.25, which was still far from the KKM, and the classical completeness percentage was only 50%. In cycle I, the average student learning outcome was 70.61, an increase of 8.36 points compared to the pre-cycle, and the classical completeness percentage also increased by 15.63%. This means that the actions in cycle I had already made changes to student learning outcomes, but the success indicators had not yet been achieved. The final results of cycle II had already met the success indicators, namely an average learning outcome of 86.67, which exceeded the KKM, and a completeness percentage of 84.39%, which exceeded 78%. Compared to cycle I, there was a significant increase in the average score of 16.06 and an increase in the classical completeness percentage of 18.76. Therefore, the improvement in learning using the Problem-Based Learning model can be considered successful, as evidenced by the improvement in student learning outcomes.

Discussion

The Problem-Based Learning model applied in cycles I and II introduced students to problems close to their daily lives or related to their surrounding culture, making the learning more relevant and helping students understand the concepts being learned. The implementation of mathematics learning in the research class used the five main phases of PBL as outlined by Arends.

Using PBL, students were faced with contextual problems, and through the phases mentioned, students constructed their own knowledge. Students were directly involved in identifying problems, understanding, searching for data, analyzing data, formulating solutions to the problems, and presenting their findings to others. This made students more creative, able to think critically, analytically, and independently. The use of LKPD and group discussion methods was intended to actively involve students, making the learning student-centered and more structured with the guidance provided in the LKPD. Group members exchanged ideas, debated to find solutions together, helped each other, and collaborated to solve the given problems. Through this process, the knowledge gained would be retained longer in their minds and easier to recall when needed.

This also shows that with PBL, students can construct knowledge through social interaction with others. During the learning process, the teacher also strived to perform well by providing guidance to each group and verifying and reinforcing the material. Based on the research conducted, PBL can improve student learning activities due to their learning environment. It was evident from cycles I and II that students became more enthusiastic and motivated in learning, initially passive but eventually contributing to the group, actively asking the teacher questions, trying to find solution references from provided sources or the internet, daring to present their results in class, and willing to respond to their peers' work with appreciation or questions if there were differences or things they did not understand. The increase in student learning activities improved their learning outcomes. From the above explanation, it can be concluded that learning with PBL successfully improved the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory. These research results are in line with the research

conducted by Sriwati (2021), which concluded that the application of the PBL learning model can improve mathematics learning outcomes on the topic of sets for class VIIA students in semester I at SMP Negeri 3 Denpasar.

Conclusion

Based on the research results and discussion, it can be concluded that learning with the Problem-Based Learning model can improve the mathematics learning outcomes of class X students participating in tutoring activities at a senior high school who reside in a dormitory. The improvement in mathematics learning outcomes with PBL can be seen from the percentage of completeness and the average scores of the students. In the initial condition, only 50% of students met the KKM with an average score of 62.25. In cycle I, 65.63% of students met the KKM with an average score of 70.61, and in cycle II, 84.39% of students met the KKM with an average score of 86.67.

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