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Application of The Problem Based Learning Model to Improve Student's Mathematical Problem Solving Ability of Class VIIIB SMPIT Al-Fityah Pekanbaru

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ABSTRACT

The research was based on low mathematical problem solving abilities of students in class VIIIB SMP IT Al Fityah Pekanbaru. The number of students who achieved the maximum score before action in each indicators were 56% - 60%, 0%, 64%, and 32% - 72%. The purpose of this research was to improve learning process and increase students' mathematical problem solving abilities. The research was carried out in 2 cycles by applying a problem-based learning model in relation and function material that consist of planning, action, observation and reflection. The aim is to improve the learning process and increase students' mathematical problem solving abilities. The data collection techniques used are observation techniques and KPMM test techniques. The number of students who achieved the maximum score after cycle I and cycle II there are 72%-76% and 84%-92% in understanding problems, 44%-48% and 76%-92% in planning problem solving, 40 %-80% and 48%-76% in implementing the completion plan, 28%-60% and 40%-72% in interpreting the results obtained. Based on the results, it can be concluded that the PBL model is a learning model that can be applied effectively in increasing students' KPMM.

1. Introduction

Minister of Education and Culture Regulation Number 58 of 2014 states that mathematics learning material at junior high school level is created to ensure that students have problem solving skills. This skill make them can solve simple problems in everyday life. Purnamasari & Setiawan (2019:207), Silalahi et al. (2021), Wahyuningsih (2019:75), Yuwono (2016:145) and Setiawan (2014:242) Mathematical Problem Solving Ability (KPMM) is an important mathematical ability for students to have in learning mathematics. In mathematics learning,

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problem posing has a strategic position in encouraging students' creativity in thinking. Problem solving is a complex process that requires a person to coordinate experience, knowledge, understanding and intuition to solve existing problems. According to Polya (in Hidayat & Sariningsih, 2018: 111; Maryati, 2018:65; Rani, 2022:218) steps in solving problems, there are: 1) understand the problem; 2) plan or design problem solving strategies; 3) carry out the plan; and 4) recheck the correctness of the results or solutions. Students are categorized as as being able to solve problems if they can carry out the four stages of problem solving that have been proposed by Polya.

The initial test of mathematical problem solving ability (KPM) was carried out by researchers in class VIII B of SMP IT Al Fityah Pekanbaru odd semester in 2023/2024 academic year. The initial test is given in 2 questions with set material. In the initial KPM test, it was found that students' answers did not meet the four indicators in the KPM. The third indicator, namely implementing a problem solving plan, has not yet been obtained because students are not yet able to make an appropriate problem solving plan. As a result, the third step that students take is to perform answer operations. The percentage results of the number of class VIII B students at SMP IT Al Fityah Pekanbaru who obtained maximum score there are in Table 1.

Table 1. Percentage of Class VIII B Students at SMP IT Al Fityah Pekanbaru with Maximum Score in Each Indicator

| Mathematical Problem Solving Indicators | Number of students with maximum scores | | | |
|---|--|------------|------------|------------|
| | Question 1 | | Question 2 | |
| | Total | Percentage | Total | Percentage |
| 1 Understand the problem | 15 | 60% | 14 | 56% |
| 2 Plan problem solving | 0 | 0% | 0 | 0% |
| 3 Perform answer operations | 16 | 64% | 16 | 64% |
| 4 Interpret the results obtained | 8 | 32% | 18 | 72% |

At the end of the initial test, the researcher interviewed two students with high and medium abilities and obtained the following information: (1) students still found it difficult to formulate the initial method for working on questions (type of question set); (2) students find it difficult to identify what actually needs to be identified in working on questions; (3) the questions given (non-routine questions) are not the same as those given by the teacher (routine questions); (4) students are very rarely given questions in the form of problems; (5) students are more often given questions in the form of direct completion instructions with the help of directions from the teacher in learning process. This is supported by the results interviews and observations carried out by researchers in class VII B of SMP IT Al Fityah Pekanbaru from September 2022 to July 2023. From the results of observations that were observed when the teacher was teaching, it was found that during the learning process, students presented problems in learning. not implemented. Teachers more often provide material and steps to use formulas in working on problems without applying any direction in solving everyday problems mathematically.

Researchers conducted interviews with class VIII B mathematics teacher at SMP IT Al Fityah Pekanbaru regarding process in learning. Information was obtained: (1) students were better able to accept learning by explaining directly the understanding of the material which included examples of questions with clear instructions for solving them; (2) when teachers apply PBL model in several lesson plans, students still find it difficult to follow the ongoing learning process due to limitations in understanding problems and using student worksheets; (3) the questions that are solved during the learning process are mostly questions with direct solving instructions, giving questions in the form of problems is still not used to it because it is difficult for students to understand; (4) students are not used to solving questions related to KPMM. Researchers' efforts to enhance the learning process and increase the KPMM class VIII B students at SMP IT Al Fityah Pekanbaru in the odd semester in 2023/2024 academic year require a learning innovation that is able to familiarize students with solving problems related to KPMM. According to Sumartini (2016:149), Nadhifah & Afriansyah (2016:34), and Zaozah et al. (2017:782) to improve students' problem solving capabilities, it needs to be supported by the right learning model. In Minister of Education and Culture Regulation No. 22 of 2016 concerning Standards for Primary and Secondary Education Processes, one learning model to increase problem solving abilities is the PBL model. According to Elizabeth & Sigahitong (2018:73) PBL is designed to help students develop their thinking skills, problem solving skills and intellectual skills. PBL is expected to provide ample chances for students to think and develop ideas in groups or individually so that students can have problem solving abilities.

Researchers interviewed mathematics teachers from class VIII B SMP IT Al Fityah Pekanbaru in September 2022 regarding the difficulties experienced by teachers in teaching relationship and function material. Based on the Ministry of Education and Culture (2019) from National Examination results data, mathematics is ranked lowest compared to other subjects. In 2019, the average achievement graph for the mathematics score for the MTs UNBK exam was 42,24, while for SMP it was 46,56. The most errors in answering questions are found in algebra material, one of which is the topic of relations and functions (Halawa & Oktaviani, 2021:12; Purba & Warmi, 2022:85). The teacher said that in relation and function material, students often had difficulty and were not careful in understanding what was asked and had to be done in the problem when it was presented in the form of a problem, one of which was in the process of learning the value of function and presenting relations and functions. So, the researcher decided to take the material Relations and Functions as an application for implementing the problem based learning model to increase KPMM of class VIII B students at SMP IT Al Fiyah Pekanbaru for the odd semester of the 2023/2024 academic year. This research goals to enhance the learning process and increase the KPMM of class VIII B students at SMP IT Al Fityah Pekanbaru in the main topic of Relations and Functions in the odd semester of the 2023/2024 academic year through the application PBL.

2. Methodology

This research is Classroom Action Research (PTK) which was carried out in class VIII B SMP IT Al Fityah Pekanbaru in the odd semester of the 2023/2024 academic year. PTK is an effort by teachers as researchers carried out in a class in the learning process with goal to improve lessoning process in the future (Susilowati, 2018:37). The research was conducted using the PBL which was applied to familiarize students with being more active in learning. There are stages in PTK, namely: (1) plan; (2) implementation; (3) observation; and (4) reflection (Arikunto et al, 2015:42; Wijaya & Syahrums, 2013:63; Novianti et al., 2020:67).

Subjects in this research consisted of 25 female students class VIII B of SMP IT Al Fityah Pekanbaru with heterogeneous academic abilities. Instruments that used, is consisted of learning tools and data collection instruments. Learning tools consist of a Syllabus, Learning Implementation Plan (RPP), and Student Worksheets (LKPD). Data collection instruments include teacher and student activity observation sheets, as well as KPMM tests. Data obtained was analyzed based on analysis of teacher and student activity data during action, as well as analysis of student KPMM test results. The research was carried out in class VIII B at SMP IT Al Fityah Pekanbaru in the odd semester 2023/2024 academic year. Implementation of class actions will be carried out from October 25 2023 to November 16 2023.

3. Result and Discussion

a. Description of Research Results

1) Action of Learning in Cycle I

Learning in cycle I uses the PBL model which consists of planning, implementing actions and observing and reflecting. Implementation and observation are carried out at the same time during the learning process. Cycle I consists of 3 learning material meetings and 1 KPMM-1 test meeting. The 1st meeting was held on Wednesday, October 25 2023 with the topic of relations. The 2nd meeting was held on Thursday, 26 October 2023 with functional material. The 3rd meeting was held on Wednesday, November 1 2023 with material on formulas and function values. The 4th meeting was held on Thursday, November 2 2023 for the KPMM-1 test. The shortcomings that occurred in cycle I and the improvement efforts that researchers will carry out in cycle II can be seen in Table 2.

Table 2. Deficiencies in Cycle I and Corrective Actions for Cycle II

| Number | Deficiencies | Improvements |
|--------|---|--|
| 1 | Students have difficulty determining what to know and ask the right questions about the problem without guidance. | Teachers optimize more in guiding and facilitating difficulties faced by students by providing directions and statements that stimulate students to think. |

| | | |
|---|--|---|
| 2 | Students were noisy in forming groups at the beginning of determining group members in cycle I. | The teacher maps and guides directly in group formation from the start to reduce the commotion of students in finding positions. |
| 3 | Students are fixated on always asking the teacher how to solve problems on the LKPD without actively discussing it with the group. | The teacher directs students with high abilities to be able to guide their group of friends who still cannot understand the material well. |
| 4 | Students' activeness in responding to presentations from the presenting group is still lacking. | Teachers provide more motivation for students to be more active in responding to the results of group work presented, and dare to express opinions and questions. |
| 5 | Teachers lack time management so they don't have time to give formative tests at the first meeting. | Teachers manage time better, so that each learning activity can be carried out according to plan. |

2) Action of Learning in Cycle II

Learning in cycle II uses the PBL model which consists of planning, implementing actions and observing and reflecting. Implementation and observation are carried out simultaneously during the learning process. Cycle II consists of 2 learning material meetings and 1 KPMM-2 test meeting. The 5th meeting was held on Wednesday, November 8 2023 with the topic of tables and graphs of functions. The 6th meeting was held on Thursday, November 9 2023 with material on the many functions of 2 sets and one-to-one correspondence. The 7th meeting was held on Thursday, November 16 2023 for the KPMM-2 test.



Figure 1. Students Process Problem Solving

In cycle II, researchers have corrected deficiencies based on reflection in cycle I, so that the implementation of the learning process has improved compared to cycle I. Discussions went according to plan, both in groups and classes. Students form groups in a more orderly manner based on guidance from the teacher in finding positions. Collaboration between members of the group becomes better because adjustments are not only made from grades, but based on the suitability of the student's characteristics. Students are more active in providing responses and questions with additional motivation from the teacher to write the names of those who actively participate in class.

Familiarization with the PBL model for 5 meetings (excluding the KPMM test) makes students understand and get used to problem-based learning activities. The increase in students participating in the problem-solving learning process makes the use of time more effective and optimal than in cycle I. Overall, teacher and student activities were carried out better until the end of the implementation of cycle II actions.

b. Analysis of Research Results

1) Teacher and Student Activity Data Analysis

Analysis of teacher and student activities is obtained from the results of observation sheets which contain aspects of the learning implementation plan. Aspects in the observation sheet are adjusted to modify the implementation of PBL of Minister of Education and Culture Regulation Number 103 of 2014 and 22 of 2016. Qualitative data analysis is carried out during data collection and after completing data collection within a certain period (Sugiono, 2020:321; Sucipto, 2017:70; Fadhilaturrahmi, 2017:115). Activities in data analysis are data collection, data reduction and data presentation. Data from the observation sheets that have been filled in from the first meeting to the end are then analyzed to see changes in the learning process that occur.

Teacher and student activity data were analyzed to see improvements in the learning process after taking action by implementing the PBL model in the learning implementation plan. The suitability of the steps in implementing the planned PBL model with the actions in the learning process can be seen from the observation sheet at each meeting. The data obtained was then analyzed by researchers including preliminary, core, and closing activities. Activities eachers and students at each meeting are increasingly in accordance with the plans that have been made in the RPP. Discussions, teacher direction in learning and the PBL learning process from cycle I to II are getting better and students are used to it. The deficiencies that occur in the learning process decrease as the actions in cycle I and II are implemented. Learning activities that were good in cycle I were maintained and improved by teachers and students in cycle II. Analysis of learning steps in cycle I and II shows that there has been an improvement in the learning process in class VIII B SMP IT Al Fityah Pekanbaru odd semester 2023/2024 academic year in Relations and Functions topic.

2) Analysis of Student's Mathematical Problem Solving Abilities

a) Analysis of Achievement of KPMM Indicators

Percentage of students who got the maximum score for each KPMM indicators in the KPMM-1 test can be seen in table 3. Table 3 shows that not all students achieve the maximum score on each KPMM indicator. The number of students who obtained the maximum score increased on the indicator of implementing a problem solving plan, but not on the indicators before and after. Small number of students who achieve the maximum score in the indicator of interpreting the

results obtained occurs because the number of students who work on indicator to plan problems correctly is also still small.

Table 3. Percentage of Students Who Get the Maximum Score on Each KPMM Indicator in Cycle I

| Information | KPMM indicators that are measured | | | | | | | | | | | |
|---|--|-----|-----|--|-----|-----|--|-----|-----|--|-----|-----|
| | Understand the problem (maximum score 3) | | | Plan problem solving (maximum score 2) | | | Implement a problem solving plan (maximum score 3) | | | Interpret the results obtained (maximum score 2) | | |
| | Question Number | | | | | | | | | | | |
| | 3 | 4 | 5 | 3 | 4 | 5 | 3 | 4 | 5 | 3 | 4 | 5 |
| Number of students with the maximum score | 18 | 19 | 18 | 12 | 11 | 11 | 20 | 15 | 10 | 8 | 15 | 7 |
| Percentage (%) | 72% | 76% | 72% | 48% | 44% | 44% | 80% | 60% | 40% | 32% | 60% | 28% |

The correlation is that when students interpret the results obtained, they are not successful in interpreting according to what is required by the problem. The percentage of students who got the maximum score for each KPMM indicator on the KPMM-2 test is like in table 4.

Table 4. Percentage of Students Who Get the Maximum Score on Each KPMM Indicator in Cycle II

| Information | KPMM indicators that are measured | | | | | | | |
|---|-----------------------------------|-----|----------------------|-----|----------------------------------|-----|--------------------------------|-----|
| | Understand the problem | | Plan problem solving | | Implement a problem solving plan | | Interpret the results obtained | |
| | Question Number | | | | | | | |
| Maximum Score | 3 | | 2 | | 3 | | 2 | |
| | 4 | 5 | 4 | 5 | 4 | 5 | 4 | 5 |
| Number of students with the maximum score | 21 | 23 | 19 | 23 | 12 | 19 | 10 | 18 |
| Percentage (%) | 84% | 92% | 76% | 92% | 48% | 76% | 40% | 72% |

Table 4 shows that not all students achieved the maximum score on each KPMM indicator, but in general the students' KPMM score increased in cycle II compared to I. The lowest percentage in cycle II was in question number 4 in the section on implementing a problem solving plan, and interpret the results obtained. These two indicators are closely related, so that when many students make mistakes in calculating the indicators for carrying out solutions, the conclusions made when interpreting the results obtained are also wrong.

b) Analysis of Student's KPMM Qualifications Befor and After Action

The scores from the KPMM results are used as analysis material to find out the students' KPMM criteria. According to Mawaddah & Anisah (2015:170) and Rista et al. (2020:1160) students' KPMM criteria can be categorized as very good, good, fair, poor and very poor. Analysis of students' KPMM qualifications on the main topic of relations and functions can be seen in Table 5.

Table 5. KPMM Qualifications of Students Before and After Action

| Value Interval | Number of Students | | | KPMM Qualification |
|-------------------|--------------------|---------|----------|--------------------|
| | First Test | Cycle I | Cycle II | |
| $85 < N \leq 100$ | 2 | 8 | 15 | Very good |
| $70 < N \leq 85$ | 11 | 4 | 3 | Good |
| $55 < N \leq 70$ | 8 | 5 | 7 | Enough |
| $40 < N \leq 55$ | 2 | 8 | 0 | Less |
| $0 < N \leq 40$ | 2 | 0 | 0 | Very less |

Implementation PBL in learning process improves students' KPMM qualifications. In the initial test, the KPMM qualifications of students who were classified as at least good were only 13 students, while the other students were still classified as fair to very poor. Action of PBL in cycle I gave mixed results. The "very good" qualification for students has increased and the "very poor" qualification for students has disappeared. Variation occurs in good and sufficient qualifications which is reduced. while the qualifications increase less.

Based on the researcher's analysis through observations during learning and the results of the KPMM-1 test, several causes were found. First, some students still have difficulties and are not used to the flow PBL model and application of KPMM indicators, especially the indicators for planning problem solving and interpreting the results obtained. As a result, in taking the KPMM-1 test, students skip the stage of planning the problem and interpreting the results obtained. There are some who make this step but make a mistake. Second, in the KPMM-1 test, most of the students' mistakes were in question number 5 regarding formulas and function values. Students make many calculation operations errors and work that is not completed to the stage of finding the function value (as requested by the problem).

c) Classical KPMM Analysis

Analysis of the classical increase in KPMM before and after implementing the PBL model on the subject matter of relations and functions can be seen in Table 6.

Table 6. Increase in the Average KPMM Score of Classical Students

| Information | Student KPMM Score | | |
|--------------------------------|--------------------|---------|----------|
| | First Test | Cycle I | Cycle II |
| Average KPMM score of students | 63,8 | 70,28 | 85,6 |
| Enhancement | | 6,48 | 15,32 |

Based on the data in Table 6, information was obtained that the average initial KPMM test score of students before the action was 63.8. The average KPMM test score of students in cycle I increased by 6.48 points to 70.28. In cycle II, the average KPMM test score of students increased again by 15.32 points to 85.6.

c. Discussion of Research Results

Teacher and student activity data analysis as well as student KPMM test results analysis can be seen and concluded that the proposed action hypothesis can be accepted as true. Therefore, PBL model can increase learning process and enhance mathematical problem solving competence of class VIII B students at SMP IT Al Fityah Pekanbaru on the material Relations and Functions in the odd semester 2023/2024 academic year. Classroom action research is declared successful if during the learning process there is a change in a better direction than before and the KPMM value increases from cycle I to cycle II (Andesma & Anggraini, 2019: 14). Based on the criteria for the success of the action, it can be said that the classroom action carried out by the researcher was successful because there was an improvement in the learning process after implementing the PBL model in class VIII B of SMP IT Al Fityah Pekanbaru and an increase in the KPMM of students in class VIII B of SMP IT Al Fityah Pekanbaru.

4. Conclusion

Based on data analysis and discussion, it can be concluded that the application of the Problem Based Learning model can improve the mathematics learning process in class VIII B SMP IT Al Fityah Pekanbaru odd semester of the 2023/2024 academic year on the main topic of relations and functions. Improvements in the learning process that occur with the application of the Problem Based Learning model are able to improve the mathematical problem solving abilities of class VIII B students at SMP IT Al Fityah Pekanbaru odd semester of the 2023/2024 academic year on the main topic of relationships and functions. Therefore, classroom action research can be a reference for recommendations for further better research.

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