

The Effectiveness of the Problem Based Learning Module on Student Learning Outcomes in the Material of One Variable Linear Equations and Inequalities at SMP Negeri 29 Sijunjung

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Abstract

This research is motivated by the low results of students' mathematics learning. The purpose of this study was to find out whether the use of problem-based learning (PBL)-based modules was effective in increasing student learning outcomes in the material of one-variable linear equations and inequalities at SMP Negeri 29 Sijunjung. This type of research is experimental research using a quantitative approach with the one-group pretest-posttest design. The research population was all students of class VII SMP Negeri 29 Sijunjung. The sampling technique used in this study is random sampling. The sample class for this study was class VII 3. The research instrument used was the pretest and posttest, in the form of an essay test with a reliability of 0.696. Furthermore, testing the hypothesis using the t test. The results showed that after using PBL-based modules it had an average value of 71.96 and before implementing PBL-based modules it had an average value of 16.05. The results of the hypothesis test obtained $t_{count} = 4.89$ and $t_{table} = 1.708$, then $t_{count} > t_{table}$ so that the hypothesis is accepted. Thus it can be concluded that the Problem Based Learning (PBL) based module is effective in improving students' mathematics learning outcomes.

Keywords: Mathematics learning outcomes, Problem Based Learning Modules



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INTRODUCTION

Mathematics is one of the subjects that has an important role in school, mathematics is a science that is widespread because it is used by various teaching and is used in everyday life. Mathematics is obtained from elementary school to further education, which in its learning system can prepare individual abilities in a mature way through the use of thoughts or thoughts obtained while studying mathematics. Mathematics learning is a process of interaction that occurs between educators and students with the aim of developing students' thinking skills. In accordance with its objectives, learning mathematics aims to, (1) improve intellectual abilities, especially students' high-level abilities, (2) form students' abilities to solve a problem systematically, (3) obtain high learning outcomes, (4) train students in communicating ideas, especially in writing scientific papers, and (5) developing student character (Rambe & Afri, 2020).

The process of learning mathematics is a process of interaction between teachers and students in order to achieve learning objectives where students as students at the same time and receive lessons resulting in a learning process. Achievement of learning objectives can be seen from student learning outcomes. Learning outcomes are the main benchmark for determining student success (Hasanah, 2021).

The reality in the field based on observations made on September 1 2022 in class VII of SMP Negeri 29 Sijunjung shows that student learning outcomes are still low. Based on observations, information was obtained that learning activities were less active, students tended to be bored, not interested, and not motivated to learn, this was indicated by the

attitude of copying friends' answers, being busy alone, not paying attention to the information conveyed by the teacher, the learning process had used the 2013 curriculum but has not been implemented optimally so that the learning process tends to be one-way, the learning resources used are still less varied. This can be seen from the percentage of completeness in mathematics learning outcomes for class VII students of SMPN 29 Sijunjung for the 2022/2023 academic year which is presented in Table 1:

Table 1. Daily Math Test Scores for Class VII Students of SMPN 29 Sijunjung

Class	Total	Complete		Not Complete	
		Total	%	Jumlah	%
VII.1	29	13	44,82	16	55,17
VII.2	28	13	46,43	15	53,57
VII.3	28	12	42,86	16	57,14
Total	85	38	44,71	47	55,29

Source: Class VII teacher at SMPN 29 Sijunjung

Based on Table 1, it can be concluded that the mathematics learning outcomes of class VII students of SMPN 29 Sijunjung are still below the Minimum Completeness Criteria (KKM) set by the school, namely 71, where students who complete are fewer than students who do not complete. Based on the results of interviews with mathematics teachers at SMP Negeri 29 Sijunjung, information was obtained that students were more likely to wait for answers from high-skilled friends to complete the assigned tasks. Students explained that they had difficulty understanding the questions given. Students are embarrassed to ask questions about material they do not understand. Students are busy themselves in the learning process and like to go in and out during class hours. Overcoming this problem the teacher has tried to use LKPD with the aim that students can understand the material well and easily. But in fact student learning outcomes are still low. After tracing the LKPD made by the teacher, it turned out that the LKPD only had practice questions without clear examples of questions, and the LKPD had more words and less illustrations and pictures so it didn't attract students' attention.

Based on the results of interviews with students, information was obtained that mathematics was boring, the material was difficult because there were many formulas, learning mathematics made drowsy and learning resources difficult to understand, so students were afraid to ask about material that they did not understand, the LKPD used too many exercises and sample questions. not in accordance with the practice questions so lazy to do it.

Moving on from the problems above, the teacher must be more creative in the learning process so that learning becomes fun and more meaningful for students. This is in line with Juano's opinion in Sobarningsih, et al (2019) which states that success in the process of learning mathematics is important in carrying out education in schools. This success can be increased by applying media and applying student-centered learning methods in order to improve student learning outcomes. One strategy that can be carried out by the teacher is to use learning media. The learning media used must be in accordance with the characteristics of students so that students can easily understand the material presented.

One of the learning media that can be applied by teachers is printed media in the form of teaching materials. One form of teaching material that can be applied is a module. The module is one of the teaching materials that can help students understand the material, as well as activate students in the learning process so that learning can be student-centered. The use of modules can increase the effectiveness and efficiency of learning in schools (Gustinasari et al., 2017). Meanwhile, according to Suprihatiningsih & Annurwanda (2019) modules are teaching

materials that are arranged in a systematic and interesting manner which include material content, methods and evaluations that can be used independently to achieve the expected competencies. From the two opinions above it can be concluded that the module must be able to make students interested in learning the module and can train students in solving mathematical problems.

In previous research, Wini Wirawan (2021) developed a PBL-based module on one-variable equations and inequalities which has been tested for validity and practicality with the results of a valid and practical PBL-based module so it is feasible to use. In previous research, the research was carried out only up to three stages, namely the define stage, the design stage, and the develop stage. This research is a follow-up research that aims to see the effectiveness of using PBL-based modules on student learning outcomes.

RESEARCH METHODS

This research was conducted in class VII of SMP Negeri 29 Sijunjung in the odd semester of the 2022-2023 academic year. This research is an experimental research with a quantitative approach. The experimental method is a way to look for a causal relationship (causal relationship) between two factors that are deliberately generated by researchers by eliminating or reducing or setting aside other disturbing factors (Yudhanegara, 2015). The research design used in this research is the one-group pretest-posttest design. This study used one group that was given treatment, then compared before and after being given treatment.

The population is characterized as an object/subject in quantitative research, with the characteristics and attributes that the researcher chooses to study and draw conclusions (Sugiyono, 2013). The population in this study were class VII students of SMP Negeri 29 Sijunjung for the 2022/2023 academic year as shown in Table 2.

Table 2. Number of Class VII Students of SMPN 29 Sijunjung

No	Class	Total Student
1	VII 1	29
2	VII 2	28
3	VII 3	28

Source: Class VII math teacher at SMP Negeri 29 Sijunjung

The sample is part of the number and characteristics possessed by the population (Sugiyono, 2013: 81). Based on the problem to be studied, one sample class is needed as the experimental class. The sampling technique in this study was carried out by means of simple random sampling.

Research Instruments

The instrument is a data collection tool in order to achieve research objectives. The instrument used in this study is a pretest & post test. The test given is in the form of an essay adapted to the subject matter. Pretest & Post-test serves to measure students' mathematics learning outcomes before and after learning. The questions used for the pretest & posttest are the same questions. To get a good pretest & post-test in this study, the following steps were taken:

1. Constructing the Test. Steps taken in compiling the test:
 - a. Determining the purpose of holding the test is to obtain learning outcomes and students' mathematical problem solving abilities
 - b. Make limits on the subject matter to be tested.

- c. Compile a grid of questions
- d. Arrange the questions that will be presented.
- e. Make a trial test answer key
- f. Validating tests

The validity used is content validity or curriculum validity. According to Sudijono (2006), content validity is validity seen in terms of content as a measuring tool for learning outcomes. Content validity is often also called curriculum validity which means that a measuring tool can be said to be valid if it is in accordance with the content of the curriculum to be measured (Utomo, 2019). The questions given were previously validated by lecturers from the Mathematics Education Study Program, Faculty of Science and Technology, PGRI University, West Sumatra and teachers in mathematics class VII, SMP Negeri 29 Sijunjung. (Appendix 9 page 82)

2. Trial Test

In order for the questions prepared to have good criteria, the questions need to be tested first and then analyzed to see which questions have good criteria. The test questions were tried out at schools that were not the subject of the study and had the same academic level and had the same KKM, namely SMP Negeri 16 Sijunjung.

3. Item Analysis

After the tryout was carried out, item analysis was then carried out to see whether a question was good or not. To find out this, the following steps are taken:

a. Item Validity

According to Arikunto (2010) Validity is a statistic that reflects the level of validity or validity of an instrument. Less innovative instruments, on the other hand, have lower validity. Validity checks seek to produce truly valid statements, that is, statements that accurately convey the magnitude of the validity of the variable under consideration.

RESEARCH RESULTS AND DISCUSSION

The research was conducted from 17 November to 2 December 2022 in 5 meetings and was attended by 26 students. Based on the research that has been done in the sample class, data is obtained regarding students' mathematics learning outcomes. The data were obtained from pre-test before treatment and post-treatment. The test questions are in the form of essay questions in the amount of 4 questions. The score of student learning outcomes in this sample class can be calculated by means of the average (\bar{x}), standard deviation (S), highest score (X_{\max}) and lowest score (X_{\min}). The calculation results can be seen in the table:

Table 3. Calculation results of learning mathematics

Test	\bar{x}	S	X_{\max}	X_{\min}
Pretest	16,05385	10,20832	31	0
Posttest	71,96154	20,38133	100	40

Data Analysis

The purpose of data analysis in this study was to determine the effectiveness of the use of Problem Based Learning (PBL) based modules on students' mathematics learning outcomes. The hypothesis in this study is that the use of Problem Based Learning (PBL)-based modules is effective in increasing the learning outcomes of class VII students of SMP Negeri 29 Sijunjung for the 2022/2023 academic year. Before testing the hypothesis with the t test, first gain test, normality test with liliefors test and variance homogeneity test with F test.

Test Gains

The gain test aims to see whether the use of PBL-based modules is effective for use in learning. After the gain test was carried out, the result was that the percentage of N-gain was 68.50 with the criteria being quite effective. So it can be concluded that the use of PBL-based modules is quite effective in learning mathematics.

Normality Test

The normality test aims to see whether the sample comes from a normally distributed population or not. After the normality test was carried out using the Lilifors test, the results were obtained at the pretest $L_0 = 0.156496$ and $L_{table} = 0.173759$. The posttest results obtained $L_0 = 0.129382$ and $L_{table} = 0.173759$. from the two data it can be seen that $L_0 < L_{table}$, then accept H_0 . So it can be concluded that the sample is normally distributed.

Variance Homogeneity Test

Based on the results of the homogeneity test calculations using the F test, it was obtained $F_{count} = 3.98$ and $F_{table} = 4.24$, it can be seen that $F_{count} < F_{table}$, so H_0 is accepted. After that it can be concluded that the two data have a homogeneous variance.

Hypothesis Testing

Based on the results of the normality test, the samples are normally distributed and the results of the sample homogeneity test have a homogeneous variance. Testing is done by t test. The test criteria accept H_0 if $t_{count} < t_{table}$ and reject H_0 if t has other values. Based on the test results obtained $t_{count} = 4.89$ and $t_{table} = 1.708$, because $t_{count} > t_{table}$, then reject H_0 . so it can be concluded that the hypothesis in this study is accepted, namely the use of Problem Based Learning (PBL) based modules effectively improves student learning outcomes at SMP Negeri 29 Sijunjung.

Discussion

Based on the hypothesis testing it was concluded that the use of Problem Based Learning (PBL) based modules was effective in increasing student learning outcomes. This shows that the use of PBL-based modules has a positive impact on student learning outcomes.

Learning Process

The learning process in class VII 3 begins with the teacher dividing students into several groups. Students are divided into 5 groups, each consisting of 4-5 students. Furthermore, the teacher distributes PBL-based modules to each group and asks students to understand the problems in the module to stimulate students to give opinions about the problems given, the teacher asks students to discuss with group mates to solve problems in the module, the teacher walks around to see students discussing and providing assistance if there are students who have difficulty, then the teacher asks students to complete a report on the results of the discussion, the teacher asks each group representative to present the results of the discussion to the front of the class and draw conclusions.

The first meeting begins with giving a pretest for 1 hour of learning to find out the students' initial abilities. Furthermore, the implementation of learning using problem-based learning (PBL)-based modules, learning has not gone well because students are not familiar with the modules provided. The class conditions were noisy when forming groups, when dividing into groups students refused to be in one group with their friends, students still relied on friends who were smarter, therefore the teacher directed students to be able to

work together in their respective groups so that each group member understood and understood the material being taught. studied. The atmosphere during learning is very noisy. When the discussion took place students had difficulty understanding the problems in the module, the teacher guided students in solving the problems in the module.

The second meeting, the learning process has started to run smoothly because students are no longer hesitant in forming groups and dividing tasks. Students become accustomed to solving problems in the modules given by the teacher. When discussing with groups of students, they are still fighting over it so the teacher makes a mutual agreement so that students don't fight anymore.

Furthermore, at the third meeting the learning process ran smoothly, the teacher made an agreement at the beginning of the lesson so that students would not make noise during discussions. Students are used to learning and discussing in groups, solving existing problems in the modules given by the teacher, and are more courageous in giving opinions in discussions. Students have been able to solve the problems in the module well. However, at the third meeting there was not enough time for students to complete the evaluation questions in the module, so the evaluation questions at the third meeting became homework and were collected at the next meeting.

Furthermore, at the fourth meeting the learning process went well, students were used to learning and discussing in groups, solving existing problems in the modules given by the teacher, and were more courageous in giving opinions in discussions and were active in asking questions when there was material that was in doubt. Students are able to present good answers and in accordance with the questions ordered. However, the time at the fourth meeting was insufficient to work on evaluation questions, so the evaluation questions were used. At the fourth meeting, it was seen that the learning process had increased. At the fifth meeting the posttest was carried out to see student learning outcomes after being given learning for 4 meetings using a PBL-based module for one hour, after students finished working on the posttest questions the teacher discussed together with students the posttest questions given until they were finished.

Final Test Results

Based on the final test (posttest) that was carried out in the sample class, it was found that some students were able to solve the questions given properly. When compared with the pretest results, the posttest results are better than the pretest. An overview of the posttest can be seen from the student answer sheets taken randomly with high, medium, and low abilities.

Obstacles

During the research, there were several obstacles, namely at the beginning of the meeting, students needed a long time to form groups because some refused to be in a group with their friends. Conditioning students in group discussions was a little difficult because there were some group members who were silent and did not participate in the discussion. The problem of learning hours is also an obstacle in research, because in discussing students it takes a long time.

CONCLUSION

Based on the hypothesis put forward, it can be concluded that the Problem Based Learning (PBL) based module is effective in improving the learning outcomes of class VII students of SMP Negeri 29 Sijunjung. Based on the discussion that has been described, several suggestions can be put forward, namely: For teachers in the field of mathematics studies,

especially at SMP Negeri 29 Sijunjung, it is necessary to innovate in learning mathematics. The application of Problem Based Learning (PBL) based modules has a good influence on student learning outcomes, for this reason it is expected that mathematics teachers can try using PBL based modules on one variable linear equations and inequalities. For researchers who are interested, it is hoped that they can allocate their time well so that the results achieved in the application of Problem Based Learning (PBL)-based modules are maximized.

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