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The Effect of Using Problem Based Learning Student Worksheet Model to Build Mathematical Problem Solving Ability for Class VIII Junior High School Students

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A B S T R A C T

This study aims to determine the effect of using student worksheet (LKPD) based on the Problem Based Learning model on the mathematical problem solving abilities of students of class VIII SMP Negeri 2 Pangean. This type of research was a quasi-experimental study with a pretest – posttest control group design. The population was all students of SMP Negeri 2 Pangean Indonesia in the 2019/2020 school year. Sampling method was using random sampling technique. Based on the results of data analysis, the posttest mean score in the experimental class was 85.45 and the average value in the control class was 54.5, meaning that the average value of the experimental class was higher than the control class. The two-mean difference test using the t test was significant (2-tailed) 0.000 <α = 0.05, which means that the posttest score of students 'mathematical problem solving abilities was different from the average posttest score of students' mathematical problem solving abilities. which uses scientific learning. So it can be concluded that there is an effect of the Problem Based Learning model on students' mathematical problem solving abilities.

1. Introduction

The curriculum is a dynamic teaching and learning tool so that it needs to be assessed and developed continuously and continuously in accordance with the needs and developments in society. This is in line with the opinion of Arifatud Dina (2015) that the curriculum plays an important role in education, because basically the curriculum serves as a reference or guideline in improving the quality of education. Therefore the education curriculum in Indonesia has undergone several changes.

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The implementation of the 2013 curriculum will run well without any problems that could have been avoided if changes were made with various preparations, including teacher preparation related to the implementation of the 2013 curriculum. One form of preparation that the teacher makes is preparing learning tools that support the implementation of the 2013 curriculum. The implementation of the curriculum is largely determined by the teacher's ability to develop learning tools (Sad'un Akbar, 2013). Because these learning devices are implemented in daily learning practices in educational units.

One of the importance of mathematics is as a means of solving problems of everyday life (Abdurrahman, 2012). Permendikbud number 22 of 2016 states that the recommended learning in the 2013 curriculum is learning that produces problem-solving based work. Through problems we hone the abilities of students, so that their competencies can be improved (Tina and Sri Sumartini, 2016). In problem solving skills, problems can be resolved and solved. According to Restika and Herni (2017) students can be said to be capable if a problem can be solved, the problem that occurs can be understood, able to choose the right way or strategy to solve it, and can be applied in solving a problem.

Polya (1973) defines four steps that can be taken so that students are more focused in solving math problems. In this study, Polya's steps to be implemented were understanding the problem, making plans, implementing plans and making answers according to the questions asked. The ability to understand problems is the ability of students to determine what is known and asked about the problem. The ability to make plans is the ability of students to write mathematical models and determine appropriate strategies to solve problems. The ability to implement plans is the ability to properly implement strategies and solve problems. The ability to make answers according to question requests is the ability of students to explain the results according to the problem in the form of conclusions.

The low ability of problem solving students can be seen from the work of students. Based on the answers of students, it can be seen that students do not understand well the questions given. The results of the students' work show that: 1) students have made it known and asked; 2) students have not yet completed a strategy to solve the given problem; 3) students do not clearly write down the formula that must be used to solve the questions given; 4) students have not been able to solve the questions properly, from the students' answers it is known that the students were correct in determining the area of the park. However, students have not been able to solve the questions correctly, because students do not understand what is ordered in the questions, so students only make the area of the first circle even though the results of the calculations are correct.

The low ability of students to solve mathematical problems was also obtained from several previous research results. The results of research conducted by Yustianingsih, et al. (2017) on class VIII students of SMPN 3 Sawahlunto, it is known that the mathematical problem solving abilities of students are not optimal and student activities do not support their learning process. Research conducted by Yustianingsih, et al (2017) shows that the low ability of students to solve

mathematical problems is because most of the students have difficulty when given problem solving problems that are applied in real world life. The difficulty of these students is because they are not used to solving non-routine questions. Based on research conducted by Fitri, et al. (2021) students still have low problem-solving abilities and improve it by connecting with the Malay culture of Riau.

Given the low ability of students to solve mathematical problems, it is necessary for the efforts of teachers to improve it. One way that can train and improve the problem-solving abilities of students is by developing learning tools.

Daryanto and Aris Dwicahyono (2014) state that the learning device is a form of preparation made by the teacher before carrying out the learning process. Learning tools used in teaching and learning activities can be in the form of student books, syllabus, lesson plans (RPP), student worksheets (LKPD), as well as learning outcomes instruments. The task of teachers to develop learning tools has been regulated in Permendiknas Number 16 of 2007 concerning Academic Qualification Standards and Teacher Competencies.

Based on the analysis of the RPP mathematics curriculum 2013 teacher at SMP Negeri 2 Pangean, the gaps in teacher activities in learning activities are still dominant so that they do not make students active in learning, the preliminary activities in the apperception section have not been described, the closing activities in the reflection section have not been described, and the learning material is complete in There is no lesson plan prepared by the teacher. In addition, it was also found that most of the junior high school mathematics teachers in Pangean were not yet optimal in preparing their lesson plans.

Teachers have not been optimal in preparing lesson plans, influenced by various factors. The factor causing the gap comes from the quality of Human Resources (HR), especially teachers as educators, they still need joint development, and teacher cooperation is not yet visible. The root cause that affects is that the competence of teachers in the field of learning is still not optimal. This can be seen from the learning planning that has not been systematic and directed, so that the implementation of learning activities has not gone well.

This was also conveyed by Zahira et al. (2020) in their research, namely that the learning tools made by teachers were still not optimal due to the difficulty of teachers in implementing the 2013 curriculum. The obstacle experienced by teachers in preparing lesson plans is in designing learning steps. The results of interviews with several junior high school teachers in Pangean concluded that some of the teachers teaching at SMP 1 Pangean had not applied a scientific approach.

One learning model that is in line with the scientific approach is a problem-based learning model. According to Trianto (2013), problem-based learning is a learning model that is based on many problems that require authentic investigation, namely investigations that require real solutions to real problems. Problem-based learning

can lead students to real problems around them as the beginning of the learning process which is then continued into formal theories of mathematics. Through problem-based learning activities, students will find and construct their knowledge through everyday problems related to the subject matter. Students will find solutions to these problems by linking the material they already have. PBL (Problem-based learning) is a learning model designed to help students develop thinking skills, problem-solving skills, and intellectual skills.

In order for Problem Based Learning to be carried out well, it needs to be supported by the availability of supporting learning resources, one of which is through Student Activity Sheets (LKPD). According to Wijayanti (2019), the LKPD that is compiled can be designed and developed in accordance with the conditions and situations of the learning activities to be faced. The existence of Student Worksheets in order to avoid teacher centered learning. Student Worksheets will train students to learn independently and involve students more in learning. The learning tools used by mathematics teachers are not optimal. This is because the syllabus has been compiled based on the components put forward by the Permendikbud, but has not been combined with a learning model other than scientific. The teacher also only takes an example from the syllabus form on the internet.

As for the Learning Implementation Plan (RPP) that was prepared not yet referring to the RPP component stated by Permendikbud number 22 of 2016. The RPP that was designed still had several weaknesses, among others, the learning objectives did not include ABCD, the core activities had not seen the steps of the model or Learning strategies that will be carried out with a scientific approach and assessment of learning outcomes have not been seen to assess skill abilities. In schools, students have used Worksheets for Students, but LKPD are purchased through publishers who come to school. The LKPD used only contains a summary of the material and a collection of questions that do not suit the needs of students, meaning that the LKPD does not contain learning activities that involve students directly in finding and applying mathematical concepts. Student Worksheets like this do not provide learning experiences for students and do not encourage the development of students' thinking skills, so it is necessary to develop supportive LKPD. Armis, et al (2010) stated that a good LKPD must be prepared based on the principles of effective learning, and meet the construction and technical requirements. Based on the problem identification above, the aim of this study is to see the effect of using the PBL based LKPD on students' mathematical problem solving abilities. The validity and practicality of the LKPD used have been tested.

2. Methodology

This research was a development research, namely a research method used to produce certain products, and to test the effectiveness of these products (Sugiyono, 2013). This type of research was a quasi-experimental research design with a pretest – posttest control group design. This research was conducted in two classes, namely the experimental class and the control class. Before the treatment,

both classes were given a pretest to see their initial ability. The treatment was given to the experimental class using LKPD based on the PBL model and in the control class with scientific learning. After being given treatment, the two classes will be given a posttest to see the final ability of the material that is assessed according to the indicators of mathematical problem solving abilities.

The population of this study was all students of SMP Negeri 2 Pangean in the even semester of the 2020/2021 school year. Sampling in this study was a random sampling technique, which was carried out by randomly taking 41 students. The instrument used in this study was a test. The test used in this study was an essay test of 5 questions. The essay test is prepared based on the indicators of mathematical problem solving abilities that will be observed. One question can have one or more indicators. Several indicators of mathematical problem-solving abilities on the grounds of suitability of the research material, namely Class VIII Junior High School Circle material. The indicators are 1) Understanding the problem; 2) planning problem solving; 3) solve the problem; 4) check the results of problem solving

In this study, data obtained from the pretest and posttest experimental class and control class. The pretest results will be analyzed by looking at the average experimental class and control class. If the average of the two classes is the same or almost the same, then the initial abilities of students are the same. So to see the effect of a treatment by analyzing the posttest results of the experimental class and the control class. However, if the average experimental and control classes differ greatly, the initial abilities of students in the two classes are different. So, to see the effect of a treatment by calculating the difference between the pretest and posttest results in the experimental class.

To see the effect of treatment based on its significance is to use parametric statistical tests or nonparametric statistical tests. If there is a significant difference between the experimental group and the control group, then the treatment given has a significant effect.

3. Results and Discussion

The student worksheets used were LKPD with the PBL learning model. The format of the LKPD content is adjusted to the steps of solving mathematical problems with the PBL model. A problem is given to students to initiate learning activities contained in the LKPD. PBL steps carried out on the content of the LKPD are oriented to the problem, organizing students to learn, and guiding investigations. The other two stages, namely presenting the work cannot be done in the LKPD and reflection or evaluation is carried out by the teacher. Figure 1 shows the appearance of the PBL-based LKPD:

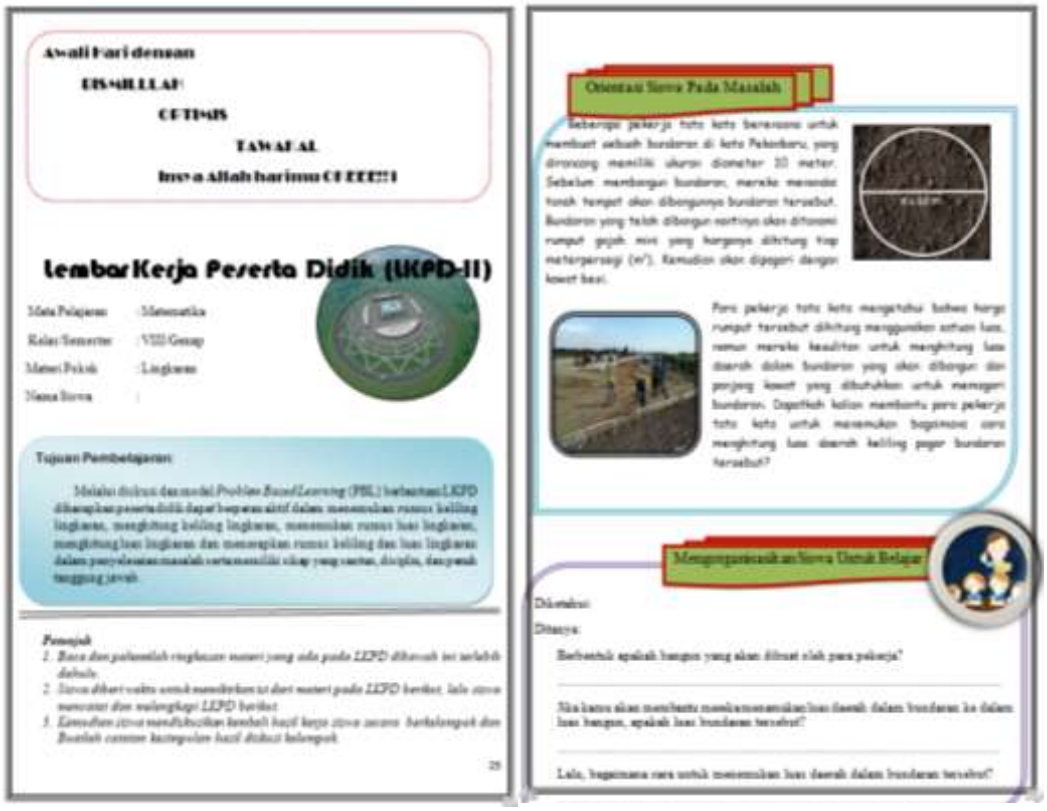

Figure 1. The student worksheet with problem based learning

The LKPD provided has several advantages including PBL is a learning model that starts with problems related to daily life so that students will be more interested in learning because at the beginning of the material they have been given learning experiences that they can encounter in their lives. In addition, in this PBL-based LKPD students can think more actively because they take their own steps so as to find solutions to a given problem. The LKPD above is also carried out in groups so that scientific activities will be created among students. The LKPD provided is designed and structured in such a way as to make it more attractive so that it attracts students' interest to learn.

The results of the pretest descriptive analysis obtained an average of 52.6 in the experimental class while the control class was 44.95. This shows that the pretest average of the two classes is almost the same so that it can be concluded that the initial abilities of the two classes are the same. To see the effect of a treatment, you can analyze the results of the posttest. Before the analysis is carried out to see the effect of the treatment, the prerequisite analysis is first tested which consists of the normality test and the homogeneity test.

1. Normality test results

The post-test data normality test for the experimental and control classes used the Kolmogorov-Smirnov test through SPSS. The results of the normality calculation are presented in Table 1.

Table 1.Normality Test of Posttest Values for Experiment and Control Class

Class	*N*	Mean	SD	Sig.	Conclusion
Experiment	20	85,45	12,5	0,925	Normal
Control	21	54,52	1,21	0,278	Normal

If the significant value of K-S> is at the 5% alpha significance level, it can be concluded that the data is normally distributed. Conversely, if the significant value of K-S <at the 5% alpha significance level, it can be concluded that the data are not normally distributed.

Based on Table 1, the pretest data shows that the significance level P> $\propto$ is 0.925> 0.05 for the experimental class and the significance level P> $\propto$0.278> 0.05 for the control class. It can be concluded that H0 is accepted, meaning that the data variance of the experimental class and control class is normally distributed.

2. Homogeneity test results

The homogeneity test is one of the requirements that must be met before performing the test for the difference between the two means. The homogeneity test was carried out to determine whether the experimental class and the control class had the same variance (homogeneous) or not before getting different treatments. The results of the post-test data homogeneity test for the experimental class and the control class are shown in Table 2.

Table 2. Posttest Value Homogeneity Test for Experiment and Control Classes

Class	*N*	Mean	SD	Sig.	Conclusion
Experiment	20	85,45	12,5	0,722	Homogen
Control	21	54,52	1,21		

Based on Table 2, for the post-test data of the experimental class and the control class, the significance level is obtained p> $\propto$ = 0.05. It can be concluded that H0 is accepted, meaning that the variance of the post-test data for the experimental class and control class is homogeneous.

Because the data for the two classes were normally distributed, to determine whether or not there was a significant difference between the experimental and control classes, it was followed by a statistical test, namely the t test. The results of the t-test calculation of the post-test value are shown in Table 3 below.

Table 3.Test Results of the Two-Mean Difference Test (t-test) Posttest for the experimental and control classes

Class	*N*	Mean	SD	Sig,	Conclusion
Experiment	20	85,45	12,5	0,00	H_0 rejected
Control	21	54,52	1,21		

Based on Table 3, the posttest data for the experimental class and control class obtained a significance level of p <= 0.05. So it can be concluded that H0 is

rejected, meaning that there is a difference in the results of the experimental class posttest and the control class. Thus there is a difference in mathematical problem solving abilities between students who use developed learning tools and students who do not use the developed learning tools.

Discussion

Based on the results of the explanation above, this study produces a valid mathematics learning tool (overall syllabus 86.11%) with the criteria "very valid"; RPP is 98.68% with "very valid" criteria and LKPD is 95.83%). Thus, the learning module developed has met valid qualifications because it has reached the minimum good criteria. Titik Yuniarti, et al (2014) states that learning devices are said to be valid if the theory is rational and the relationship is consistent.

In addition to valid criteria, the device must also meet practical criteria. The results of this study indicate that the mathematics learning tools obtained have practical criteria with an average of 90.93%. which means that the developed mathematics learning model has fulfilled practical aspects. This is in line with previous research conducted by Elmiwati, et al. (2020) which stated that PBL-based mathematics learning tools are practical to improve students' mathematical problem solving abilities.

The existence of learning tools with the PBL model can facilitate teachers and students in developing students' mathematical problem solving abilities. This has been fulfilled in the mathematics learning tool so that it can be continued in the next development process, namely the effectiveness test in learning mathematics using the PBL model. This is in line with research conducted by Pertiwi (2021) that learning tools with a quality PBL model can improve the skills of students.

Based on the completeness of the learning outcomes test (tests of students' mathematical problem solving abilities), it was found that the percentage of students who reached the KKM (75) after using the developed mathematics learning tools was 90%. Thus the learning tools developed are effective for improving student learning outcomes. Based on the description of the results of the validation of the syllabus, RPP and LKPD, as well as student response questionnaires to mathematics learning tools on circle material it can be concluded that it is valid, practical and effective for students to use class VIII SMP.

The problem-based learning model is a learning model with a learning approach in which students work on authentic problems with the intention of compiling their own knowledge, developing inquiry and higher-order thinking skills, developing independence, and self-confidence proposed by Trianto (2013). Related to the development of learning tools based on the PBL model to build mathematical problem solving abilities, it shows that the LKPD developed is valid, practical, effective and can improve the mathematical problem solving abilities of students of class VIII SMP. This is also in line with research

conducted by Elmiwati, et al. (2020) that the development of tools with the PBL model can improve students' problem solving abilities.

Learning tools with the PBL model can facilitate teachers and students in developing students' mathematical problem solving abilities. Students stated that the developed LKPD helped them better understand the circle material, making them more interested in following the learning process because it used an attractive LKPD with nice and attractive covers, pictures and colors. In addition, learning using LKPD trains them to find out for themselves the circumference and area of a circle.

4. Conclusion

Based on the results of the research conducted, it can be concluded that there is an effect of using LKPD based on problem based learning on students' mathematical problem solving abilities. This means that the use of PBL-based LKPD is effective in improving mathematical problem solving abilities. This research resulted in a development product in the form of a PBL-based mathematical learning tool on circular material that is suitable for use. For other researchers, it is hoped that it can become a reference and reference for other researchers in conducting research in the same scope

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