

Pengaruh Penerapan Model PBL Terhadap Kemampuan Pemecahan Masalah Siswa di Sekolah Menengah

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Abstract

Kemampuan pemecahan masalah merupakan kemampuan yang penting dimiliki oleh semua peserta didik. Namun, peserta didik masih mengalami kesulitan dalam memecahkan masalah, sehingga diperlukan model pembelajaran yang dapat mendukung kemampuan pemecahan masalah. Penelitian ini bertujuan untuk mengetahui pengaruh penerapan model pembelajaran *Problem Based Learning (PBL)* terhadap kemampuan pemecahan masalah peserta didik. Metode penelitian yang digunakan adalah metode kuantitatif dengan desain *posttest-only control design*. Populasi penelitian ini adalah seluruh peserta didik kelas VIII berjumlah 3 kelas dengan total 69 peserta didik. Sampel yang digunakan 2 kelas dengan jumlah 46 peserta didik. Penelitian ini dilaksanakan di SMP IT An-Nuriyah Sekayu, 12 September – 04 Oktober 2023, dengan teknik *quota sampling* yang mana kelas yang sudah ditentukan dari sekolah yang digunakan sebagai sampel. Teknik pengumpulan data yang digunakan adalah dengan menggunakan tes. Berdasarkan hasil analisis data, diperoleh nilai $t_{hitung} = 1.194965$ dan nilai $t_{tabel} = 2.015367574$ sehingga diperoleh $t_{hitung} < t_{tabel}$ maka menyebabkan H_0 ditolak dan H_1 diterima. Kesimpulan dari penelitian ini adalah terdapat pengaruh model pembelajaran *Problem Base Learning* terhadap kemampuan pemecahan masalah matematis siswa kelas VIII SMP IT An-Nuriyah Sekayu.

Kata Kunci: kemampuan pemecahan masalah, pola bilangan, *Problem Based Learning (PBL)*

The Effect of Implementing the PBL Model on Students' Problem-Solving Abilities in Middle School

Abstract

Problem-solving ability is an essential ability for all students to have. However, students still experience difficulties solving problems, so a learning model is needed to support students' problem-solving abilities. This research aims to determine the influence of applying the Problem-Based Learning (PBL) learning model on students' problem-solving abilities. The research method used is a quantitative method with a Posttest-Only Control Design. The population of this research is all 3 class VIII students, with a total of 69 students. The sample used was 2 classes with a total of 46 students. This research was carried out at An-Nuriyah Sekayu IT Middle School, September 12 – October 04, 2023, using a quota sampling technique in which predetermined classes from the school were used as samples. The data collection technique used is test questions. Based on data analysis, a value of $t_{count} = 1.194965$ and a value of $t_{table} = 2.015367574$ so that it was obtained $t_{count} < t_{table}$, then it causes it to be H_0 rejected and H_1 accepted. So, the conclusion is that the Problem Based Learning model influences the mathematical problem-solving abilities of class VIII students at SMP IT An-Nuriyah Sekayu.

Keywords: number patterns; *Problem-Based Learning (PBL)*; problem-solving ability

INTRODUCTION

Problem-solving ability is a learning process that awakens students to play an active role so that they can receive and respond to questions submitted well and overcome difficulties in solving a problem (Prasetyo & Ramlah, 2021). Mathematical problem-solving ability is one of the most important things students must do to provide positive value to their intellectual abilities in developing mathematical problem-solving, an essential requirement that students must master (Harefa & Laia, 2021). The general goal of teaching mathematics is the importance of mathematical problem-solving abilities, namely, problem-solving ability. Problem-solving includes methods, procedures, and strategies. Problem-solving is the core and primary process in the mathematics curriculum, and problem-solving is essential in learning mathematics (Astutiani et al., 2019). Based on the Trends in International Mathematics and Science Study commonly called TIMSS, the results show that in Indonesia, students' ability to solve problems is in the low category when solving high-level problems (TIMSS., 2015). One of the biggest problems an educator faces is students' low problem-solving abilities. The low ability to solve mathematical problems is because students only focus on memorizing formulas, while their application to problems is still lacking (Yerizon et al., 2021). Apart from that, several studies reveal the same thing regarding students' problem-solving abilities, which are low and challenging for students to master (Fadillah & Ardiawan, 2021; Fatmala et al., 2020; Hindriyanto, 2019; Khasanah et al., 2021).

In an interview conducted by researchers with one of the Mathematics Teachers at SMP IT An-Nuriyah Sekayu, named Mrs. Pipin, S.Pd, she stated that in the process of learning mathematics, students still experience difficulties in solving problems, namely the students' ability to work on problems. Mathematics still needs to be improved; that is, only the majority of students can work on non-routine questions of different types.

Based on the information provided by the researcher, to overcome the problem of problem-solving abilities above, a learning model is needed to develop problem-solving abilities. One type of learning that can improve problem-solving abilities is problem-based learning (Setyaningrum et al., 2019). Problem-based learning (PBL) is a teaching method characterized by real problems as a context for students to learn critical thinking and problem-solving skills and gain knowledge to achieve learning goals (Sofyan et al., 2017). Furthermore, problem-based learning is a teaching and learning model that confronts students with various problems in their reality or where learning begins with problem-solving and contextualization of the real world. This statement aligns with research conducted (Albab et al., 2021) that shows that the results of research using the problem-based learning model are said to have a better impact or influence on problem-solving abilities by applying conventional models to mathematics learning.

Using the problem-based learning model when teaching and learning activities positively impacts or influences students' mathematical problem-solving abilities. Problem-based learning is problem-based, which can help improve students' problem-solving abilities. Evidence that the problem-based learning model can improve students' mathematical problem-solving abilities can be seen from research conducted by Putri et al. (2019), which states that this problem-based learning model affects improving mathematical problem-solving abilities. Based on the results of the overall data analysis, the PBL model has a positive influence on students' mathematical problem-solving abilities. This can be seen from the centrality measure, where the average for students in the medium category is 52.86%, with a standard deviation of 11.31. Next, based on the results of the research conducted Elita (2019) where from the results of data analysis that been carried out in the experimental class and control class, with an average value of 72.58 for the experimental class and 65.00 for the control class, it can be concluded that there is an influence of the problem-based learning model on students' problem-solving abilities. So, from several previous research results, problem-based learning can improve students' problem-solving abilities.

METHOD

This type of research uses quantitative experimental research. The design used in this research is truly experimental. In true-experimental design with post-test only control design. To see how implementing the Problem-Based Learning (PBL) learning model affects students' problem-solving abilities. Quantitative research is a research method based on the philosophy of positivism, used to research specific populations or samples; sampling techniques are generally carried out randomly, data collection uses research instruments, and data analysis is quantitative/statistical with the aim of testing predetermined hypotheses (Sugiyono, 2019).

The design used in this research is a proper experimental design. In true-experimental design in the form of post-test only control design. Random data collection technique: random sampling. In this design, there are 2 class groups as research samples, namely the experimental group class and the control group class. The experimental class was given treatment using the problem-based learning (PBL) learning model, and the control class was not given treatment. The population in this study was all students in class VIII, totaling 3 classes with a total of 69 students; the sample used was 2 classes with a total of 46 students at SMP IT An-Nuriyah Sekayu. This research was conducted at SMP IT An-Nuriyah Sekayu from September 12 to October 04, 2023.

The procedure in this research is the preparatory stage, where the researcher makes observations, goes to school, and makes lesson plan instruments, LKPD, and tests in the form of descriptions and tests of research instruments. The implementation stage involves learning in the two experimental classes using the PBL model and the control class using the conventional model. Learning was carried out in 3 meetings, and 1 post-test was given in both classes. Finally, the reporting stage carries out data processing and analysis of the data results using the techniques used in this research.

The data collection technique in this research consisted of A written test in the form of essay questions on number pattern material. The research instruments used in this research were RPP, LKPD, and tests in the form of descriptions. The indicators used in this research refer to Polya's problem-solving abilities: understanding the problem, planning a problem solution, implementing the solution plan, and checking again. Data on students' problem-solving abilities was obtained from the results of tests concerning scoring guidelines. It can be seen in Table 1.

Table 1. Guidelines for Student KPMM Scoring

Rated aspect	Reaction to questions/problems	Maximum score
Understand the problem	a. Not writing down what is known and what is asked clearly and precisely.	0
	b. Write what is known, but do not write what is asked / vice versa.	1
	c. Can write down what is known and asked clearly and precisely.	2
Plan a solution	a. Did not write down the formula	0
	b. Please write down the formula, but it is not quite right	1
	c. Can write formulas correctly.	2
Resolve problems according to plan	a. I need help to write the solution correctly.	0
	b. You can write down the solution to the problem, but it needs to be corrected.	1
	c. Can write solutions correctly.	2
Recheck all steps taken.	a. Unable to write a final answer conclusion	0
	b. Write a conclusion to the final answer, but it needs to be corrected.	1
	c. You can write a summary of the answer at the end.	2

Quantitative data from this research was obtained by calculating the percentage of each indicator of mathematical problem-solving ability; the percentage of problem-solving ability obtained from the calculations was then qualified according to Table 1.

The data analysis technique used is the quantitative data analysis technique. The student test result data was analyzed for normality using the Kolmogorov-Smirnov test to analyze the homogeneity of the data using the f test and to draw hypotheses using the two-tailed t-test. The tool used to analyze this data is the Excel application.

RESULTS

This study involved two classes, with Class VIII.1 as the experimental group and Class VIII.3 as the control group. Post-test data were gathered to assess students' overall scores, aiming to evaluate the impact of the learning model on their problem-solving abilities. The questions were formulated based on problem-solving ability indicators, each addressing specific aspects of this skill. A total of 23 students, distributed between the experimental and control classes, participated in answering the questions. Upon analyzing the recapitulation of post-test scores, it was evident that the experimental class had a higher highest score and a lower lowest score compared to the control class. This observation indicates a superior problem-solving ability among students in the experimental group. Examining the post-test data summary, the average values for each indicator were determined.

The research aimed to investigate the influence of the problem-based learning model on students' problem-solving abilities in mathematics. The experimental class received treatment using the PBL learning model, while the control class underwent conventional learning. The study comprised four meetings, three learning sessions, and one post-test assessment. During the initial meeting, the disparity in problem-solving abilities between the experimental and control classes was not immediately apparent due to the novelty of the PBL learning model. However, certain groups in the experimental class exhibited early indicators of improved problem-solving abilities, while only a few students in the control class showed such indicators. Subsequent meetings showed progress, with students in both classes demonstrating an enhanced understanding of problems and the ability to plan solutions. By the third meeting, students in both groups displayed clear indicators of improved problem-solving abilities, showcasing a discernible difference between the experimental and control classes. The attainment of these indicators translated into variations in the post-test results, with very few students in the control class reaching high problem-solving abilities. A visual representation of explanatory indicators for students' problem-solving abilities in both classes is depicted in Figure 1.

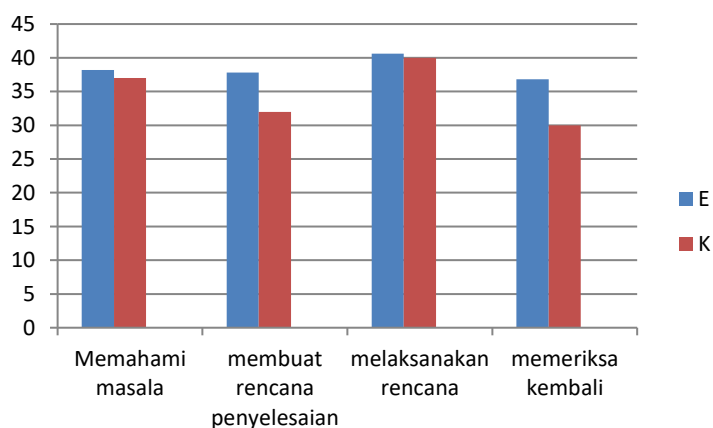


Figure 1. The average value of each indicator

According to Figure 1, it is evident that the experimental class predominantly holds the highest mean score for each indicator. The experimental class exhibits more excellent proficiency in generating indicators of problem-solving ability than the control class. This observation is supported by the final

calculation results, as illustrated in Table 2, which displays the post-test scores obtained for the experimental and control classes.

Table 2. Final Test Scores

Class	The highest score	Lowest value	Mean
Experiment	95	45	75
Control	80	42.5	72

The final post-test score calculation reveals that the experimental class achieved the highest score, surpassing the maximum score in the control class. In contrast, the control class recorded the lowest score compared to the experimental class. This discrepancy indicates that the problem-solving abilities of students in the experimental class outperform those in the control class.

Following acquiring test result data, the researcher proceeded with a hypothesis test, preceded by a normality test for each group. The Kolmogorov-Smirnov normality test conducted using the Excel application indicates that the data for the experimental class is usually distributed, as the significance value exceeds 0.05. Similarly, the data for the control class is also normally distributed, with a significance value greater than 0.05.

In addition to normality, data homogeneity is essential. Therefore, the research included a homogeneity test for both groups, conducted using the Excel application, which revealed a homogeneous distribution of data, as indicated by a significance value of 1.954, where significance > 0.05.

Upon completing the regular and homogeneous post-test analyses, the researcher conducted a hypothesis test to discern differences in post-test outcomes throughout the research. The hypothesis test results, as detailed in Table 3, provide insights into the significance of these differences.

Table 3. Calculation of the t-test hypothesis test

	Experiment	Control
Mean	75,32608696	71,73913043
Variance	137,1047431	70,13339921
Observations	23	23
Pooled Variance	103,6190711	
Hypothesized Mean Difference	0	
Df	44	
t Stat	1,194965	
P(T<=t) one-tail	0,119251072	
t Critical one-tail	1,680229977	
P(T<=t) two-tail	0,238502144	
t Critical two-tail	2,015367574	

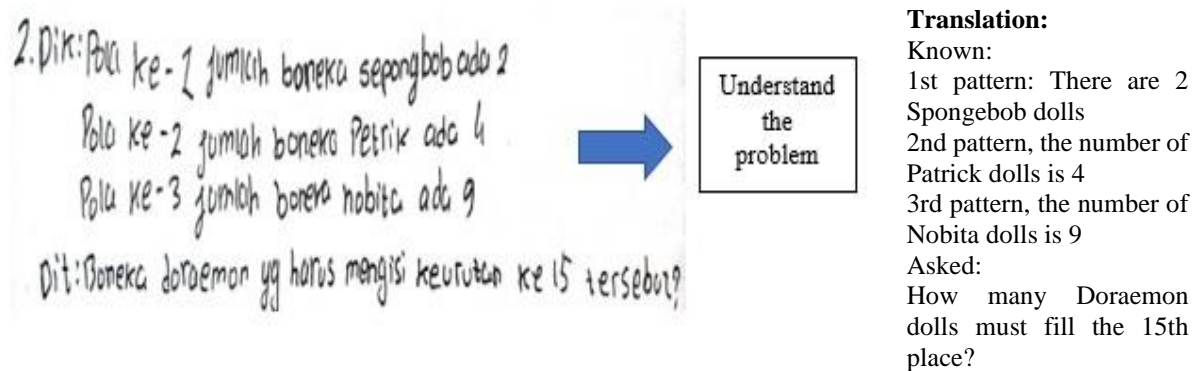
From Table 3, it can be seen that the conclusion from the results of the hypothesis test calculation above is because $t_{hitung} < t_{tabel}$ then it is H_0 rejected and H_1 accepted, meaning that there is an influence of the application of the Problem-Based Learning (PBL) learning model on the problem-solving abilities of class VII students at SMP IT An-Nuriyah Sekayu.

DISCUSSION

Based on the research results obtained, the success of the PBL learning model in the learning process can be seen by the difference between the experimental and control class values, where the questions used contain all indicators of students' mathematical problem-solving abilities. The following are several indicators of problem-solving abilities in number pattern questions that researchers use to determine students' mathematical problem-solving abilities in the question instruments that researchers use to conduct post-tests.

Indicator 1: Understanding the problem

To indicate understanding of the problem, students must write down all the information they know and ask the question. In this indicator, 11 students made mistakes by not writing down information as a bridge to solving problems, some of which can be seen in Figure 2.



Translation:
Known:
1st pattern: There are 2 Spongebob dolls
2nd pattern, the number of Patrick dolls is 4
3rd pattern, the number of Nobita dolls is 9
Asked:
How many Doraemon dolls must fill the 15th place?

Figure 2. The student writes down known information

In Figure 2 above, it can be seen that in Figure 2, students cannot write what information they know and are asked about from the questions that have been given, whereas in Figure 2, students write what information they know and ask about from the questions. Students wait to write down the information in the question but immediately carry out solutions to obtain answers. In line with the research conducted Fadilah & Hakim (2022), which stated that some students still needed to write down the known and asked elements, this was due to the students' habit of answering directly. In this indicator, students are expected to write down what information they know and ask the questions given. The questions show that the first pattern consists of 2 pears, and the next pattern is a multiple of 2. Meanwhile, what is asked in the question is to determine the number of pears to form the following pattern. -20.

Indicator 2: Make a resolution plan

In this indicator of planning a problem solution, students are asked to write down the steps and formulas that will be used to solve the problem. In general, students can create a mathematical model of the problem given, but some students still need to work on problem-solving planning. Appropriate. Some students could have done better on the indicators of planning problem-solving. In this indicator, several mistakes were made by students, some of which can be seen in Figure 3.

In Figure 3, students can write a solution plan and the formula used in the solution correctly. In line with the research conducted Kamila & Adirakasiwi (2021), the factor that causes errors at this stage is the need for students' ability to prepare plans and construct existing data into formulas or mathematical models. The reason why students make this type of error is that students only answer questions by making things up (Lintang et al., 2022). Without making a solution plan, students immediately solve the problem by writing down the answer to the problem given. Write down what formula is used, i.e., $Un = a + (n - 1)b$

Penyelesaian :

1. Mencari jumlah penjualan seblak dengan menggunakan rumus : $a + (n-1) \cdot b$ (jumlah porsi seblak dengan jumlah peningkatan penjualan seblak tiap bulan).
2. Kemudian mengetahui pendapatan pak Ahmad pada bulan Oktober dengan mengalikani Harga porsi seblak dengan jumlah porsi seblak pd bulan Oktober

$U_n = a + (n-1) \cdot b$ Kenaikan porsi tiap bulan.

Jawab :

Januari	300
Februari	$300 + 30 = 330$
Maret	$330 + 30 = 360$
April	$360 + 30 = 390$
Mei	$390 + 30 = 420$
Juni	$420 + 30 = 450$
Juli	$450 + 30 = 480$
Agustus	$480 + 30 = 510$
September	$510 + 30 = 540$
Oktober	$540 + 30 = 570$

atau $U_n = a + (n-1) \cdot b$
 $U_{10} = 300 + (10-1) \cdot 30$
 $U_{10} = 300 + 9(30)$
 $= 300 + 270$
 $U_{10} = 570$

$2 = 570 \times \text{Rp. } 18.000,00$
 $= 10.260.000,00$

Create a resolution plan

Translation:

Solution:

1. Find the number of *seblak* sales using the formula: $a + (n - 1) \cdot b$ (number of *seblak* portions with the increase in *seblak* sales each month
2. Then find out Mr Ahmad's income in October by multiplying the price of *seblak* portions by the number of *black* portions in October

answer :

$$U_n = a + (n-1) \cdot b$$

$$U_{10} = 300 + (10-1) \cdot 30$$

$$U_{10} = 300 + 9(30)$$

$$U_{10} = 570$$

$$= 570 \times \text{Rp. } 18,000.00$$

$$= 10.260,000.00$$

Figure 3. Students write a resolution plan

Indicator 3: Implementing the resolution plan

In indicator 3, students solve problems that have been previously planned based on plans that have been made previously. Most students make many mistakes in completing problem-solving plans, some of which can be seen in Figure 4.

3. Dik: Ilustrasi Sebuah Pohon digambarkan tumbuh 2 ranting Pada Setiap dahan

Dit: Berp banyak ranting yg dapat tumbuh ketika ~~12~~ tumbuh dahan

$U_n = a + (n-1) \cdot b$
 $U_{12} = 2 + (12-1) \cdot 2$ | Kesimpulan: Dapat diketahui dahan yg tumbuh Pada dahan ke 12 adalah : 24,,
 $U_{12} = 2 + 11 \cdot 2$
 $U_{12} = 2 + 22$
 $U_{12} = 24$,,

Implement the resolution plan

Translation:

Known:

Illustration of a tree depicted growing 2 twigs on each branch

Asked:

How many twigs can grow until 12 branches grow

Answer:

$$U_n = a + (n-1) \cdot b$$

$$U_{12} = 2 + (12-1) \cdot 2$$

$$U_{12} = 2 + 11(2)$$

$$U_{12} = 24$$

Conclusion: It can be seen that the twigs that grow on the 12th branch are 24 twigs

Figure 4. Students write a resolution plan

Figure 4 is an example of mistakes made by students in completing problem number 3; it can be seen that students made errors in operating. This aligns with previous research, which stated that sometimes most students need clarification when connecting known information and planning, so students often need help solving questions (Arifin et al., 2021). In line with research conducted Efriani (2021), researchers stated that they found several factors that triggered students' errors in solving problems, namely the lack of basic skills possessed by students, students not understanding the concepts of addition, multiplication, and division, and students being in a hurry and not concentration in solving problems. This makes students need to improve operating solutions, whereas, in Figure 4, students prioritize addition operations over multiplication. Students prioritize addition operations, whereas in

mathematics rules operations, the first thing to do is the multiplication operation, so you get the wrong one. It should be $300 + 9 \times 30$, that is, 9×30 . first, add 300. However, in Figure 3, the students add $300 + 9$, and then the new addition results are multiplied by 30, so the answer should be 570 to 9270.

Indicator 4: Checking the answer results again

In the rechecking indicator, students are asked to describe the results obtained by writing the correct conclusions. The conclusion depends on what is asked or requested by the question. Some students needed to improve in writing correctly. This can be seen in Figure 5.

Januari	300
Februari	$300 + 30 = 330$
Maret	$330 + 30 = 360$
April	$360 + 30 = 390$
Mei	$390 + 30 = 420$
Juni	$420 + 30 = 450$
Juli	$450 + 30 = 480$
Agustus	$480 + 30 = 510$
September	$510 + 30 = 540$
Oktober	$540 + 30 = 570$

atau $U_n = a + (n-1) \cdot b$
 $U_{10} = 300 + (10-1) \cdot 30$
 $U_{10} = 300 + 9(30)$
 $= 300 + 270$
 $U_{10} = 570$
 $= 570 \times \text{Rp. } 18.000,00$
 $= \text{Rp. } 10.260.000,00$

Check again

Translation:
 Answer:
 $U_n = a + (n-1) \cdot b$
 $U_{10} = 300 + (10-1) \cdot 30$
 $U_{10} = 300 + 9(30)$
 $U_{10} = 570$
 $= 570 \times \text{Rp. } 18,000.00$
 $= \text{Rp. } 10,260,000.00$
 The solution above shows that the number of sales of "seblak" portions in October was 570 "seblak" portions and the income in October was Rp. 10,260,000.00

Dari penyelesaian diatas dapat diketahui banyaknya penjualan porsi seblak bulan oktober 570 porsi seblak, dan pendapatan pada bulan Oktober 2023 Rp. 10.260.000,00.

Figure 5. Students write the conclusion

In Figure 5, students have implemented the plan correctly so that the solution to the correct answer is obtained. However, students do not write conclusions about the correct results for solving the questions they have worked on. Not writing down the conclusion from the results of solving the problem sometimes causes students to make mistakes in finding solutions. Many students have completed the problem-solving process and found a solution, but the solution obtained is different from the right solution Rini et al., (2020). This is in line with Agumuharram & Soro (2021), which states that students make mistakes by not writing conclusions or writing conclusions but are wrong to make conclusions.

The difference in student scores in the experimental class and control class is because in the experimental class, the learning process uses the PBL model, and students are directly involved in the learning process using the PBL model, where the material is linked to everyday life so that it will build students' knowledge in his life. This is in line with the research conducted by Oktaviana & Haryadi (2020) that in learning using the PBL model, there is a significantly better increase in problem-solving abilities compared to students who are given direct learning. This is also evident from several previous studies, such as research conducted by Yerizon et al. (2021), which states that the mathematical problem-solving abilities of students who study with the PBL model are higher than those who study with the conventional model in high, medium, and low-level schools.

Research conducted Ulva et al. (2020) shows that the results are significant $0.000 < 0.05$, which means that there is an influence of the application of PBL on students' Mathematical Problem-Solving Ability in terms of all students, where the Mathematical Problem-Solving Ability of students using PBL mode is better than students who use conventional learning models. Furthermore, research conducted by Setyaningsih & Rahman (2022) from the results of research and discussions that have been carried out, found the fact that in learning that applies the learning model from problem-based learning, there has been an increase in the ability to solve mathematical problems faced by students compared to those in other classes. Apply conventional teaching and learning activities. So, the problem-based learning model influences students' problem-solving abilities. So, from several previous research results above, Problem-Based Learning can improve students' problem-solving abilities compared to the teaching and learning process using conventional learning.

CONCLUSION

The results of the analysis carried out on the post-test data used to test the research hypothesis showed that the results of calculations using the t-test carried out in class VIII of SMP IT An-Nuriyah Sekayu obtained a value of $t_{count} = 1.194965$ and a value of $t_{table} = 2.015367574$ so that it was obtained $t_{count} < t_{table}$, then it causes it to be H_0 rejected and H_1 accepted and it can be concluded that there is an influence of the Problem Bases Learning learning model on the mathematical problem-solving abilities of class VIII students at SMP IT An-Nuriyah Sekayu.

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