

IMPROVING STUDENT LEARNING OUTCOMES THROUGH THE IMPLEMENTATION OF THE POLYA MODEL PROBLEM-SOLVING METHOD

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ABSTRACT

The aim of this research is to determine the effectiveness of learning and differences in student learning outcomes using the polya model problem-solving method. The type of research is quantitative research. The population is all students of class VII SMP Negeri 1 Banyuputih totaling 152 students. The sample is class VII A as the control class and VII B as the experimental class. Data collection techniques using observation, tests, and questionnaires. Data analysis techniques using descriptive analysis and inferential analysis. The results of research through observation sheets show that the application of the Polya model problem-solving method is very effective, namely 88.8%. While the results of the results of the control class students have an average value of 52.36 pretest and 52.56 posttest. The control class experienced an average increase of 0.20. The experimental class that used the Polya model problem-solving method had an average pretest score of 49.28, and a posttest of 69.32. The experimental class experienced an average increase of 20.04.

Keywords: Learning Outcomes, Problem-Solving Methods, Polya Models.

1. Introduction

Learning activities require a method or steps for effective and efficient learning activities, this method is usually known as a learning method. One of them is the problem-solving method. The use of appropriate methods in learning activities plays a very important role because learning can be said to be effective if the learning process is student-centered and equipped with methods that require students to play an active role. The Polya model-based problem-solving method is very appropriate to use to improve student learning outcomes. In this learning process, a structured polya model-based problem-solving method will be applied, this makes it possible to improve student learning outcomes.

Learning outcomes are a form of change in skills, habits, attitudes, mastery, and appreciation for each individual involved in the learning process, not only that, learning outcomes are also a form of change in knowledge for each individual who learns (Nurrita, 2018). In learning activities,

it is very important to find out the learning outcomes obtained by students for evaluation if the learning activities are still considered lacking in student learning outcomes, one of which is in mathematics learning because the learning outcomes themselves are related to memory and thinking abilities which are different for each student. Several factors cause low student learning outcomes, namely: 1) the learning process in schools still uses varied lectures so that they are less able to develop students' potential, namely thinking abilities including the ability to solve problems which results in low learning outcomes, 2) students tend to be passive and teachers only provide information and learning methods that are still inappropriate in the learning process (Markus Iyus Supiyadi, 2016).

The problem-solving method is a method as a series of activities in learning that emphasizes the process of solving problems faced scientifically such as problems faced in real life. The problem-solving method often also called the problem-solving method is a way of teaching that stimulates someone to analyze and synthesize in a structured unity or situation where the problem is on their initiative (In and Pulau, 2022). The use of this problem-solving method is highly recommended to stimulate the ability to think in

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complex problem situations and its use in learning is highly prioritized to create passion for learning, motivation to learn, and stimulate students to play an active role in the learning process. The main objectives of using the problem-solving method are: 1) Developing thinking skills, especially in finding the causes and goals of a problem. 2) Providing students with practical knowledge and skills that are valuable or useful for everyday needs (Ketut and MD, 2017). With this problem-solving method, it is hoped that it will make it easier for students to face problems that occur in real life. There are several stages in learning problem-solving methods including: 1) understanding an existing problem to obtain information, 2) looking for data or information in the form of things that are known and asked in the question, 3) determining a temporary answer, 4) calculating and determining a temporary answer, 5) test the answers obtained (Irawana, 2020). According to (Dasar, 2020) in the learning process using the problem-solving method there are several stages that must be fulfilled as follows: a) there is a problem, b) looking for data or information, c) determining a temporary answer, d) testing the correctness of the student's answer.

Polya model problem solving is an attempt to find a way out of a difficulty and achieve a goal that cannot be achieved immediately. When someone solves a problem, he not only learns to apply the various knowledge and rules he already has but also finds the right combination of various concepts and rules and controls his thinking process (Widahyu and Amry, 2022). The Polya model is a learning model that is suitable for solving problems in mathematics learning in the form of story problems. The learning steps using the polya model problem-solving method that must be achieved to solve the problem are: 1) understanding the problem, including: identifying known elements, and elements in question, checking the adequacy of the elements to solve the problem, 2) determining or choosing a problem-solving strategy, 3) solving problems or carrying out mathematical model calculations, and 4) checking the answers obtained again (Madubun, Laurens, and Gaspersz, 2022). According to M. Tohir, et.al., polya model problem solving is problem-solving that has four characteristics with gradual stages of completion. The four stages are: Understanding the Problem, Devising a plan, Carrying Out the Plan, and looking Back (Moh. Tohir, et.al., 2020) Learning using the Polya model requires students' ability to solve problems

related to students' knowledge, experience, attitudes and personal abilities which can develop thinking and problem-solving abilities.

Current learning conditions vary, but innovation is needed for good learning outcomes. During this time, the learning process of some students is just silent, because the teacher does not direct students to the steps that are appropriate to the learning they are learning. Learning that still uses the lecture method is often uninteresting, and boring, and tends to be considered difficult by students. Proving research conducted by (I Pt Eka Sugiantara, 2021) resulted in the conclusion that there are significant differences regarding learning outcomes that follow the learning process using the problem-solving method and students who follow the learning process directly. Based on the results of previous studies, the researcher has a distinct advantage because this research places more emphasis on student learning outcomes by using a problem-solving method based on a supportive polya model, as well as using more detailed and directed stages, so that later it will be easier to find students who are still have low learning outcomes seen from the way they solve the problems given.

The importance of this research will explain in detail about learning problem-solving methods based on the Polya model which can later improve student learning outcomes and student activity in learning and is by the current curriculum. Meanwhile, this research aims to analyze the effectiveness of learning problem-solving methods based on the Polya model in improving student learning outcomes and to analyze the differences in learning outcomes obtained by students between the Polya model problem-solving and conventional models.

2. Research Methods

The type of research used is quantitative research. Quantitative research is systematic scientific research into parts and phenomena and their relationships (Ahyar et al., 2020). This research was conducted to look for relationships between variables. There are two classes used, namely the experimental class and the control class. The experimental class uses problem-solving methods based on the polya model and the control class uses conventional model problem-solving. The population used was all class VII students at SMP Negeri 1 Banyuputih. Meanwhile, the samples were class VII.A students as the control class and class VII.B students as the

experimental class. All students in the class are given a problem-solving test in the form of questions. The pretest was given to the experimental class and control class, to obtain information about students' initial abilities before receiving learning material. After being given treatment, the experimental and control groups will be given the same posttest to determine differences in learning outcomes.

Data collection techniques include observation sheets, tests, and questionnaires. Observation sheets are used to determine the effectiveness of learning. Meanwhile, tests and questionnaires are used to determine differences in student learning outcomes. Data analysis techniques include prerequisite tests, namely normality tests, homogeneity tests, and hypothesis analysis.

3. Results and Discussion

The effectiveness of learning using the polya model-based problem-solving method is measured by observation sheets during the learning process. The following are the results of observations.

INSTRUMEN OBSERVASI

Nama Sekolah : SMP Negeri 1 Banyuwangi
Mata Pelajaran : Matematika
Pokok Bahasan : Bangun Datar
Kelas/Semester : VII/II

Petunjuk Pengisian

1. Melon kesediaan Bapak/Ibu untuk memberikan penilaian dengan memberi tanda centang (✓) pada lajur yang tersedia berdasarkan beberapa aspek yang diberikan.
2. Bapak/Ibu juga dapat memberikan komentar dan saran pada tempat yang telah disediakan.
3. Model pembelajaran yang digunakan ini menggunakan metode problem solving berbasis model polya

No	Pertanyaan	Jawaban	
		Ya	Tidak
A. Kegiatan Pendahuluan			
1.	Apakah siswa antusias di awal kegiatan pembelajaran?	✓	
2.	Apakah siswa dapat menjawab secara tepat pada persoalan yang diberikan?	✓	
B. Kegiatan Inti			
1.	Apakah siswa dapat memahami pada materi yang sedang dipelajari?	✓	
2.	Apakah siswa mampu mengidentifikasi suatu masalah?	✓	
3.	Apakah siswa mampu mencari suatu data atau keterangan yang ada pada suatu permasalahan?	✓	
4.	Apakah siswa mampu menemukan jawaban sementara yang ada pada soal?		✓
5.	Apakah jalannya proses belajar siswa berjalan dengan baik?	✓	
C. Kegiatan Penutup			
1.	Apakah siswa merespon dengan baik ketika guru bersama-sama menyimpulkan materi yang dipelajari?	✓	
2.	Apakah pembelajaran hari ini mampu meningkatkan hasil belajar siswa?	✓	

Kesimpulan dan saran

Situbondo, 3 Mei 2023
Peneliti,
Irena Jafitri

Figure 1. Observation Sheet Results

Based on the data above, data from observations of the effectiveness of learning problem-solving methods based on the Polya model can be calculated using the formula:

$$P = \frac{f}{N} \times 100\%$$

$$P = \frac{8}{9} \times 100\%$$

$$= 88,8 \%$$

Based on the percentage results obtained, namely 88.8%, it is clear that learning problem-solving methods based on the Polya model can increase the effectiveness of student learning.

The pretest-posttest results show differences in learning outcomes obtained by students.

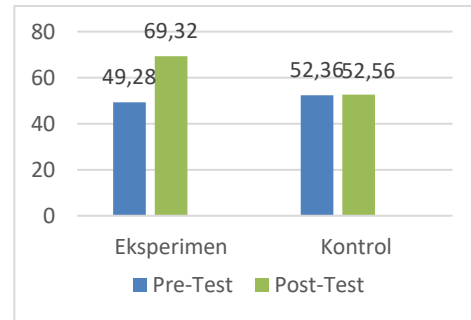


Figure 2. Pre-test and Post-test results

The results of the analysis of the experimental class and control class were given 4 question items in the pre-test and post-test. Based on the pre-test results, the lowest score obtained in the control class was 36 and the highest score obtained was 63, while the average score was 52.36 with a standard deviation of 9.205. Based on the post-test results, the lowest score obtained was 42, while the highest score was 63, the average score was 52.56 and the standard deviation was 8.461. So in this control class, there was an increase in the average pretest-posttest of 0.20. Meanwhile, in the experimental class, there was an increase in the average pretest-posttest of 20.04

Table 1. Normality Test Results

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-Test Eksperimen	.137	25	.200 [*]	.942	25	.167
Pos-Test Eksperimen	.093	25	.200 [*]	.969	25	.612
Pre-Test Kontrol	.214	25	.005	.903	25	.021
Post-Test Kontrol	.178	25	.040	.890	25	.011

From the data above, the pre-test sig value for the control class is 0.021 and the experimental class is 0.167. So the two sig values from the pre-test results are > 0.05 so it can be concluded that the data is normally distributed. The post-test value for the control class is 0.011 and the experimental class is 0.612, so the sig value for both is > 0.05 , so it can be concluded that the data is normally distributed.

Table 2. Pre-test Homogeneity Test Results

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	7.462	1	48	.009
	Based on Median	3.149	1	48	.082
	Based on Median and with adjusted df	3.149	1	43.329	.083
	Based on trimmed mean	7.171	1	48	.010

From the data above, the pretest sig for the control and experimental classes is $0.009 < 0.005$, so. From the data, the sig value from the pre-test was $0.166 > 0.05$ so the data had the same or homogeneous variance.

Table 3. Pre-test Homogeneity Test Results

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	1.979	1	48	.166
	Based on Median	2.025	1	48	.161
	Based on Median and with adjusted df	2.025	1	47.260	.161
	Based on trimmed mean	2.003	1	48	.163

Based on the results of the normality and homogeneity tests, it show that both control class and experimental class samples are normally distributed and have the same variance.

Next, a hypothesis test will be carried out. Hypothesis testing is carried out using a t-test using the independent sample test and paired sample t-test formulas.

Table 4. Control Class Paired Samples Test Results

		Paired Samples Test							
		Paired Differences							
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference	t	df	Sig. (2-tailed)	
					Lower	Upper			
Pair 1	Hasil Belajar Siswa - Kelas kontrol	50.9600	8.75974	1.23881	48.47051	53.44949	41.14936	49	.000

Based on the output obtained from the significance value (2-tailed) of $0.000 < 0.05$, it can be concluded that there is an increase in learning

outcomes between the pre-test and post-test in conventional learning models.

Table 5. Experimental Class Paired Samples Test Results

		Paired Samples Test							
		Paired Differences							
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference	t	df	Sig. (2-tailed)	
					Lower	Upper			
Pair 1	Hasil Belajar Siswa - Kelas Eksperimen	57.80000	13.41032	1.89651	53.98883	61.61117	30.47749	49	.000

Based on the output that has been obtained from the significance value (2-tailed) of $0.000 < 0.05$, it can be concluded that there is an increase in learning outcomes between the pre-test and post-test in learning using the polya model-based problem-solving method.

Table 6. Results of Independent Sample-test post-test control and experimental classes

		Independent Samples Test									
		Levene's Test for Equality of Variances				t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	Lower	Upper
Hasil Belajar Siswa	Equal variances assumed	1.979	.166	5.840	48	.000	16.76000	2.86984	10.98979	22.53021	
	Equal variances not assumed			5.840	43.924	.000	16.76000	2.86984	10.97593	22.54407	

Table 7. Independent Sample-test questionnaire results

		Independent Samples Test									
		Levene's Test for Equality of Variances				t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	Lower	Upper
Hasil Belajar Siswa	Equal variances assumed	1.962	.168	8.995	48	.000	6.04000	.67152	4.68983	7.39017	
	Equal variances not assumed			8.995	45.648	.000	6.04000	.67152	4.68803	7.39197	

Based on the results of the Independent Sample Test carried out by researchers in the posttest and distribution of questionnaires in the control class and experimental class with a significant level of α of 0.05 using SPSS 26 calculations, a significant value of 0.00 was obtained so it can be concluded that H_0 is rejected and H_1 is accepted because sig value $< \alpha$

($0.00 < 0.05$). Therefore, the average value of the experimental class is higher than the average value of the control class. So it can be concluded that there are differences in student learning outcomes who use problem-solving methods based on the Polya model and those who use problem-solving using conventional models. So learning using problem-solving methods based on the polya model can improve student learning outcomes.

Research conducted by (Kristen and Wacana, 2013) proves that "there is a significant difference in levels of mathematical problem-solving ability with the polya problem solving model. Learning outcomes or pretest mathematics problem-solving scores in the control group are lower than those in the experimental group." In this case, it is by research conducted by I Pt Eka Sugiantara, Ni Wyn Arini and I Dw Kade Tastra, proving that "there is a significant difference in mathematics learning outcomes between students who take part in learning using the Polya model of problem-solving and students who take part in learning using learning strategies. direct. "The average calculation results of the two results show that Polya theory-based problem-solving strategies affect students' mathematics learning outcomes" (Widahyu and Amry 2022)

4. Conclusions

The results of the research show that the problem-solving method based on the Polya model is very effective for application in mathematics learning in the form of story questions about applications in daily life. The results of the pre-test, post-test, and questionnaire show that learning using the polya model-based problem-solving method with learning using the conventional model shows an increase in different learning outcomes. This can be seen from the average increase in the pre-test and post-test of the control class and experimental class. In the control class, there was an average increase of 0.20. Meanwhile, in the experimental class, the average value experienced a greater increase compared to the control class, namely 20.04.

Learning using the polya model-based problem-solving method can improve student learning outcomes because, in the pre-test and post-test results in the experimental class, there is an increase in learning outcomes. The results of hypothesis testing show that the effectiveness of learning problem-solving methods based on the Polya model can improve student learning outcomes.

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