

The Effect of Applying the Learning Model Problem Based Learning Assisted Method Polya on Reasoning Ability and Solving Mathematics Story Problems in Students Grade IV Kasmaran Primary School

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ABSTRACT

This study aims to determine the effect of PBL model learning assisted by the Polya method on improving mathematical reasoning and problem solving skills of fourth grade students of SD Negeri Kasmaran in the 2023/2024 academic year. This research uses a quantitative research approach, with an associative research type (relationship), and uses quantitative analysis methods (data in the form of numbers). Data on mathematical reasoning and problem solving skills were collected through observation using an assessment instrument in the form of a rubric. The sample in this study totalled 46 students. The research data were processed using simple linear regression test with the results for the effect of PBL model learning assisted by Polya method on mathematical reasoning skills $t_{count} 2.478$ and $t_{tabel} 2.015$ means $t_{count} > t_{tabel}$. For the effect of PBL model learning assisted by Polya method on problem solving skills $t_{count} = 2.902$ and $t_{tabel} = 2.776$, means $t_{count} 2.902 > t_{tabel} 2.015$. Based on the results of this study, it shows that there is an effect of PBL model learning assisted by Polya method on mathematical reasoning ability and problem solving ability of fourth grade students of SD Negeri Kasmaran in the 2022/2023 academic year.

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1. INTRODUCTION

One of the aims of mathematics is for students to have the ability to solve problems which include the ability to understand the problem, design a mathematical model, solve the model and interpret the solution obtained. Learning mathematics that includes problem solving and assignments can help students to develop more creatively in the field of mathematics. The ability to solve mathematical problems in students needs to be emphasised in order to help students develop important aspects in mathematics such as the application of rules to pattern discovery, generalisation, and mathematical communication ¹².

¹ Yunia Astiana, M. Yusuf Setia Wardana, and Ervina Eka Subekti, 'Analisis Kemampuan Pemecahan Masalah Dalam Menyelesaikan Soal Cerita Pecahan', *MENDIDIK: Jurnal Kajian Pendidikan Dan Pengajaran*, 7.1 (2021), 54–59 <<https://doi.org/10.30653/003.202171.143>>.

² Astiana, Wardana, and Subekti.

Problem solving skills must be possessed by students to train so that students can solve problems in other fields of study, be it mathematics or everyday problems that students often encounter ³. For this reason, problem solving skills need to be trained and developed for students so that they can solve problems that students face in the future. Solving mathematical problems in everyday life is usually presented in the form of story problems. According to ⁴, story problems in mathematics are problems made in story form sentences that need to be translated into mathematical sentences or mathematical equations.

In solving story problems, students must understand what is known from the problem, what is asked, and how to convert the story problem into a model so that students can find a way to solve the problem ⁵. In answering story problems, students must have the ability to understand the contents of the problem, because if students misunderstand the problem, the method used to solve the problem will also be wrong. In addition, students also understand mathematical concepts so that students can solve these problem-solving skills. In line with Ermawati & Zuliana's opinion that Mathematical problem-solving ability is a very important ability in mathematics learning because in its learning activities students learn about mathematical concepts while emphasizing the development of students' ways of thinking ⁶.

The problem that often occurs today is that students find mathematics story problems difficult to understand and solve. The obstacles that students often experience are students' weakness in understanding the meaning of the problem and lack of skills. In line with Riswari's opinion that Mathematical problem solving is considered important, however, students often have difficulty in solving math problems ⁷. This can be seen from the way students solve story problems, where the possibility when students take the wrong steps in the initial work can cause errors also in the second step and so on. Seeing the mistakes that often occur, teachers should carry out learning activities by familiarising students to make story problems and solve them with existing steps.

Based on existing empirical conditions, students still have difficulty in solving a problem. If given a problem that is different from the example, students still have difficulty in solving it. There are also some students who are less able to solve story problems on fraction material. For example, students are less able to understand the meaning of the problem in determining what is known and what is asked from the problem. In this case understanding the problem in the story problem students still often feel confused. In the calculation process, students are less careful in calculating fraction operations which greatly affect the completion of the story problems they do. Students often do not double-check the results of their answers on the grounds that they are finished quickly. Students' problem solving skills in mathematics subjects in class IV SDN Kasmaran are still relatively low compared to other subjects. This can be seen from the table of results of the first midterm assessment of class IV SDN Kasmaran which states that the average value of mathematics subjects is the lowest compared to other subjects. Based on observations of empirical conditions, mathematics subjects are less attractive to some grade IV students because they are considered the most difficult. This causes students who dislike mathematics lessons to have an impact on low mathematics learning achievement. This difficulty is due to students' lack of repetition of lessons learned, lack of focus in the learning process and an uninteresting learning process being one of the factors for weak problem solving skills. These difficulties cause a lack of student competence in arithmetic operations. This indicates that students are still lacking in mathematical problem solving skills.

Polya states that problem solving is an attempt to find a way out, and achieve goals that are not intentionally achievable. One of the efforts to train students' ability in mathematical solving is using Polya's theory with the first stage of understanding the problem, the second is developing a plan, the third is implementing the plan, the fourth is checking back ⁸. Solving a problem is not only by reading, but also by understanding the content of the problem. Students here are objects that must master various concepts in mathematics. Polya's four stages of problem solving are very important to develop. The results of empirical observations conducted in grade 4 SDN Kasmaran stated that stages 2 and 3 were the most difficult stages, namely the stages of developing a plan and implementing a plan. This stage is the most difficult because students do not know the stages of developing a problem solving plan for the problem and are still confused about solving the problem and students still cannot

³ Reny Reski, Nahor Hutapea, and Sehatta Saragih, 'Peranan Model Problem Based Learning (PBL) Terhadap Kemampuan Pemecahan Masalah Matematis Dan Kemandirian Belajar Siswa', *JURING (Journal for Research in Mathematics Learning)*, 2.1 (2019), 049 <<https://doi.org/10.24014/juring.v2i1.5360>>.

⁴ Ufi Dwidarti, Helti Lygia Mampouw, and Danang Setyadi, 'Analisis Kesulitan Siswa Dalam Menyelesaikan Soal Cerita Pada Materi Himpunan', *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 3.2 (2019), 315–22 <<https://doi.org/10.31004/cendekia.v3i2.110>>.

⁵ Dian Rizky Utari, M. Yusuf Setia Wardana, and Aries Tika Damayani, 'Analisis Kesulitan Belajar Matematika Dalam Menyelesaikan Soal Cerita', *Jurnal Ilmiah Sekolah Dasar*, 3.4 (2019), 545 <<https://doi.org/10.23887/jisd.v3i4.22311>>.

⁶ Diana Ermawati and Eka Zuliana, 'Implementation Of Open-Ended Problems On Mathematical Problem-Solving Skill Of Elementary School Students', *Jpsd*, 6.2 (2020), 145–57.

⁷ Firda Afita Jihanifa, Sumaji Sumaji, and Lovika Ardana Riswari, 'Peningkatan Kemampuan Pemecahan Masalah Matematis Siswa Melalui Model Problem Based Learning Berbasis STEAM Berbantuan Media MONKABICO', *EQUALS: Jurnal Ilmiah Pendidikan Matematika*, 6.2 (2023), 116–28 <<https://doi.org/10.46918/equals.v6i2.1936>>.

⁸ G. Polya, 'How to Solve It: A New Aspect of Mathematical Method Second Edition', *Princeton University Press: United States of America*, 1957, 253 <<http://www.jstor.org/stable/3609122?origin=crossref>>.

relate to previous material that has been learned. Students' weakness in problem solving lies in their weakness in analysing problems and revisiting questions that have been discussed. In story problems, students need to solve problems through their ability to understand, design, and solve problems in story problems. Story problems are a subject matter that is difficult for students to master, this can be seen from students' mistakes when solving story problems or being fooled by the answers to multiple choice questions. This requires a good and more thorough problem-solving strategy, especially in story problems.

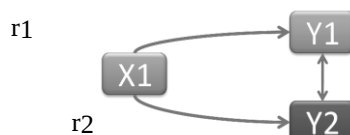
Based on research conducted that there are still many students who make mistakes in working on fraction story problems starting from understanding the problem, finding ways to solve, to writing answers⁹. The mastery of students' concepts in working on story problems of fraction material is low due to the lack of students' understanding of story problems. The same problem was also found in research conducted by Nurkaeti¹⁰ stated that students' problem solving skills were still low. This happens because students do not understand the meaning of the story problems they are working on and students experience procedural errors in working on problems. Therefore, systematic correct steps are needed to be able to solve problems, especially regarding story problems, namely by applying the four stages of problem solving according to Polya. From the review of previous research studies, it can be proven that students' problem solving skills need to be studied. Based on the above background, this study aims to describe the mathematical problem solving ability of elementary school students on fraction material story problems.

2. METHOD OF THE RESEARCH

The purpose of this study was to analyse the effect of the application of the PBL learning model assisted by the Polya method on mathematical reasoning and the ability to solve mathematical story problems of grade IV elementary school students. The research was conducted in class IV of SD Negeri Kasmaran, 2023/2024 academic year located in Kasmaran Village, Pagentan District, Banjarnegara Regency. The research was conducted in May 2024. This research is a quantitative approach, which is associative research, or is research that aims to determine the relationship between two or more variables¹¹. Researchers try to describe the current conditions in a quantitative context that is reflected in the variables. This research uses *Quasi Experimental Design* or pseudo experimental design.

The type of research used is in accordance with the objectives to be achieved, namely to analyse the effect of the application of the PBL learning model assisted by the Polya method on mathematical reasoning and the ability to solve mathematical story problems of grade IV elementary school students. The following is the research paradigm used, which is a double paradigm with two dependent variables. The picture is as follows.

Figure 1: Multiple Research Paradigm



Description:

X1 : Independent variable

Y1 : Dependent/relative variable 1

Y2 : Dependent/relative variable 2

r1 , r2 : Simple correlation

The population of this study were all fourth grade students in Gugus Dipanegara, a total of 10 schools in the 2023/2024 school year. The sampling technique used was *purposive sampling* technique. The *purposive sampling* technique is the determination of samples from the entire population with certain considerations, and to determine the sample, namely based on recommendations from teachers. The sample is a part or representative of the population under study. The sample in this study was 36 students, namely class IV SD Negeri Kasmaran with 24 students as the experimental class and class IV SD Negeri 3 Pagentan with 22 students as the control class.

In order to obtain data related to this study, the researchers used data collection techniques consisting of the documentation method, the test method, and the observation assessment rubric method. Instrument is a measuring tool used in a study. Research instruments are useful as a measuring tool in and as a support in data

⁹ Ilham Ali Fikri, Khamdun Khamdun, and Himmatul Ulya, 'Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Materi Pecahan Ditinjau Dari Kemampuan Matematis', *Jurnal Educatio FKIP UNMA*, 8.1 (2022), 139–43 <<https://doi.org/10.31949/educatio.v8i1.1796>>.

¹⁰ Nunuy Nurkaeti, 'Polya'S Strategy: An Analysis of Mathematical Problem Solving Difficulty in 5Th Grade Elementary School', *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, 10.2 (2018), 140 <<https://doi.org/10.17509/eh.v10i2.10868>>.

¹¹ Prof. Dr Sugiyono, *Metodologi Penelitian Kuantitatif, Kualitatif Dan R & D*, Cetakan ke (Bandung: CV Alfabeta, 2014).

collection techniques in this study. The research instrument used in the study was a test. The instruments used by researchers in conducting research are described as follows:

1. The 5-item mathematical reasoning ability test questions are equipped with 1-5 scoring guidelines for each variable measured and are arranged based on the indicators of each variable studied.
2. Written test questions in the form of description questions to measure students' mathematical problem solving skills totalling 3 questions equipped with scoring guidelines with a score of 1-5 for each variable measured and compiled based on indicators of each variable studied.

Before the research instrument was used for data collection, the researcher first tested the validity and reliability of the instrument. To test items, test questions must have requirements in the form of validity and reliability so that the instruments in the form of description questions and observation assessment rubrics that will be given are valid and reliable. Researchers conducted validity and reliability tests using the *SPSS 27 for windows* application. The instrument test is declared valid if $r_{count} > r_{table}$, and vice versa $r_{count} < r_{table}$ then it is declared invalid or invalid. The results of the instrument reliability test were consulted with the price of $r_{product moment}$ at the 5% significance level. If the price of $r_{count} > r_{table}$, then the research instrument is said to be reliable, but if on the contrary the price of $r_{count} < r_{table}$, then the instrument is said to be unreliable.

Before analysing the effect of the independent variable on the dependent variable, it is necessary to conduct a prerequisite test. The pre-requisite test consists of normality test and linearity test. The data normality test is used as a reference to be able to see that the sample data comes from a normally distributed population. Normality testing using *SPSS 27 for windows* based on the *Kolmogorov-Smirnov test*. To determine the normality of the data, the test significance level uses $\alpha = 0.05$. If the significance obtained $> \alpha$, then the sample comes from a normally distributed population. Meanwhile, the linearity test is a procedure used to determine the linear status or not of research data. Testing on *SPSS 27 for windows* using *Test for Linearity* the basis for decision making uses ANOVA output at a significance level of 0.05. If $sign > 0.05$ then the relationship between the two variables is linear.

After the instrument test and prerequisite test were carried out, then the researcher took data using the instrument. The data obtained was then analysed. Researchers used simple linear regression analysis to determine the effect between the independent variable and the dependent variable. The choice of simple regression is because researchers want to analyse the effect of *Problem Based Learning learning* assisted by Polya's method (X) on mathematical reasoning skills (Y_1) and the effect of *Problem Based Learning learning* assisted by Polya's method (X) on problem solving skills (Y_2).

The simple linear regression formula used in this study is:

$$Y = a + bX$$

Description:

Y : dependent variable

X : independent variable

a and b : constants

To find the price of a and b, the following formula is used:

$$a = \frac{\sum y \sum x^2 - \sum x \sum xy}{N \sum x^2 - (\sum x)^2}$$

$$b = \frac{N \sum xy - \sum x \sum y}{N \sum x^2 - (\sum x)^2}$$

However, in this study the calculation of the simple linear regression test was analysed using *SPSS 27 for windows*. The criteria for acceptance and rejection of the hypothesis is:

1. $t_{table} < t_{count}$, or significant ≤ 0.05 then the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This means that there is a significant influence between one independent variable on the dependent variable.
2. $t_{table} > t_{count}$, or significant ≥ 0.05 then the null hypothesis (H_0) is accepted and the alternative hypothesis (H_a) is rejected. This means that there is no significant influence between one independent variable on the dependent variable.

3. RESULTS AND DISCUSSION

The purpose of this study was to determine the effect of *Problem Based Learning learning* assisted by Polya's method on mathematical reasoning and problem solving skills in class IV at SD Negeri Kasmaran. This research is included in associative research using quantitative analysis methods (data in the form of numbers)

which aims to determine the relationship or influence between two or more variables. The population in this study were all fourth grade students in the Dipanegara cluster of 10 schools. For the sample, the researcher took 36 fourth grade students with details of 24 students at SD Negeri Kasmaran and 22 students at SD Negeri 3 Pagentan.

The data in this study were obtained through two methods, namely the written test method in the form of descriptions and observation rubrics. The test method used by researchers is a written test of students' critical thinking skills, this written test aims to determine the effect of *Problem Based Learning* learning assisted by the Polya method on improving problem solving skills. The written test used is in the form of a description with 5 assessment questions with scoring answers on a scale of 1 to 4 for each question. The next test uses an observation assessment rubric, which aims to analyse the effect of *Problem Based Learning* learning assisted by Polya's method on improving problem solving skills. This assessment is carried out to students when carrying out learning activities. The assessment rubric used was developed from indicators of mathematical reasoning ability with 4 rating scales.

Based on the instrument validity test, the value of each item for the research instrument variable obtained $r_{count} > r_{table}$ 0.2455, and the Sig value $< \alpha$ 0.05 in each question item so that it is declared valid. The following is a table of the results of the validity test of each research instrument to be used.

Table 1. Validity test results of mathematical reasoning instrument

Question No.	Sig. (0.05)	r count (0.2455)	Description
1	<0,001	0,771	Valid
2	<0,001	0,586	Valid
3	<0,001	0,658	Valid
4	<0,001	0,696	Valid
5	<0,001	0,506	Valid

Table 2. Results of the Validity Test of the problem solving instrument

Question No.	Sig. (0.05)	r count (0.2455)	Description
1	<0,001	0,739	Valid
2	<0,001	0,734	Valid
3	<0,001	0,745	Valid

The results of the reliability test calculation, a variable is said to be reliable if it has a Cronbach Alpha (α) value > 0.6 . The value of Cronbach Alpha for each variable in this study is > 0.6 , which means that the instrument in this study is reliable and can be used for further research.

Reliability Statistics

Table 3. Reliability test results of mathematical reasoning instrument

Cronbach's Alpha	N of Items
.619	5

Reliability Statistics

Table 4. Reliability Test Results of Problem Solving Instrument

Cronbach's Alpha	N of Items
.612	3

The normality test used in this study is the *One-Sample Kolmogrov-Smirnov* test using a significance level of 0.05. Data is declared normally distributed if the significance is greater than 5% or 0.05. Each variable obtained $\text{Sig} > 0.05$. So in this study these two variables can be said to be normally distributed. For more details, it is in the following table:

Table 5. 1-KS Normality Test Result

	Asymp. Sig. (2-tailed)
PBL Learning Model Assisted by Polya Method	0,200
Mathematical Reasoning	0,064
Problem Solving	0,110
a. Test distribution is Normal.	

Table 6: Homogeneity Test Results

The distribution of data homogeneity can be seen in the following table:

Mathematical Reasoning	0,233
Problem Solving	0,055

Table 6 shows that the *Sig.* value of student interaction in the PBL model assisted by the Polya method on improving mathematical reasoning ability is 0.233 and on improving problem solving ability is 0.055. This shows that the research data has homogeneous variance because all *Sig values* > 0.05 .

Test for linearity with the basis for decision making using ANOVA output at the 0.05 significance level. If *Sig. deviation from linearity* > 0.05 , it can be determined that there is a linear relationship between the independent variable (X) and the dependent variable (Y1 and Y2) The results of the linearity test calculation in this study show the significance value of the product > 0.05 , which means that the *Problem Based Learning learning* variable assisted by the Polya method and the variables of mathematical reasoning ability and problem solving ability are linear, explained through the following table:

Table 7. Linearity Test Results

ANOVA Table		Sum of Squares	df	Mean Square	F	Sig.
Mathematical Reasoning * PBL Model Assisted by Polya Method	Between Groups	147.625	11	13.420	2.196	.096
	Linearity	48.225	1	48.225	7.891	.016
	Deviation from Linearity	99.400	10	9.940	1.627	.210
	Within Groups	73.333	12	6.111		
	Total	220.958	23			
Problem Solving * PBL Model Assisted with Polya Method	Between Groups	73.958	11	6.723	1.647	.202
	Linearity	34.042	1	34.042	8.337	.014
	Deviation from Linearity	39.916	10	3.992	.978	.507
	Within Groups	49.000	12	4.083		
	Total	122.958	23			

Hypothesis testing in this study uses simple linear regression to determine the effect of the independent variable on the dependent variable with the following equation $Y = a + bx$. The criteria for accepting the hypothesis is if $t_{\text{table}} < t_{\text{count}}$, or significant ≤ 0.05 then the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This means that there is a significant influence between one independent variable on the dependent variable.

A. Hypothesis 1 Analysis

Hypothesis 1 in this study is as follows.

- $H_0 : \mu_1 = \mu_2$ There is no effect of *Problem Based Learning learning* assisted by Polya's method on improving mathematical reasoning ability of fourth grade students.
- $H_1 : \mu_1 \neq \mu_2$ There is an effect of *Problem Based Learning learning* assisted by the Polya method on improving the mathematical reasoning ability of fourth grade students.

Through simple regression tests, the results are presented in the following table.

Table 8. Regression Test Output (Model Summary) Mathematical Reasoning Variable

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.467 ^a	.218	.183	3.496
a. Predictors: (Constant), Mathematical Reasoning				

The table above shows the magnitude of the correlation / relationship value (R) which is 0.467. From the output, the coefficient of determination (R Square) is 0.218 which implies that the effect of the independent variable (PBL model assisted by Polya method) on the dependent variable (mathematical reasoning ability) is 21.8%.

Table 9. Regression Test Output (Coefficients)

Coefficients ^a						
Model		Unstandardised Coefficients		Standardised Coefficients Beta	t	Sig.
		B	Std. Error			
1	(Constant)	10.656	3.360		3.172	.004
	Mathematical Reasoning	.583	.235	.467	2.478	.021
a. Dependent Variable: PBL Model Assisted with Polya Method						

Based on the significance value of the Coefficients table, the significance value is $0.021 < 0.05$ so it can be concluded that the PBL model variable assisted by the Polya method (X) has an effect on the Mathematical Reasoning variable (Y1). Based on the t value of $t_{count} 2.478 > t_{count} 2.015$, it can be concluded that the PBL model variable assisted by the Polya method (X) has an effect on the Mathematical Reasoning variable (Y1). Based on the *Constant* value and the regression equation on the effect of PBL model learning assisted by Polya method on improving mathematical reasoning ability is $Y = a + bX$, namely $Y = 10.656 + (0.581X)$, which means that every addition of one value of PBL model learning assisted by Polya method on mathematical reasoning ability by 0.581.

B. Hypothesis II Analysis

Hypothesis 1 in this study is as follows:

- $H_0 : \mu_1 = \mu_2$ There is no effect of PBL learning assisted by Polya method on problem solving ability of fourth grade students.
- $H_1 : \mu_1 \neq \mu_2$ there is an effect of PBL learning assisted by the Polya method on the problem solving ability of fourth grade elementary school students.

Through a simple linear test, the results are presented in the following table

Table 10. Regression Test Output (Model Summary)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.526 ^a	.277	.244	3.362
a. Predictors: (Constant), Problem Solving				

The table above shows the value of the correlation / relationship (R) which is 0.526. From the output, the coefficient of determination (R Square) is 0.277 which implies that the effect of the independent variable (PBL model assisted by Polya method) on the dependent variable (problem solving ability) is 27.7%.

Table 11. Regression Test Output (Coefficients)

Coefficients ^a						
		Unstandardised Coefficients		Standardised Coefficients Beta	t	Sig.
Model		B	Std. Error			
1	(Constant)	11.715	2.533		4.624	.000

Problem Solving	.880	.303	.526	2.902	.008
a. Dependent Variable: PBL Model Assisted with Polya Method					

Based on the significance value of the Coefficients table, the significance value is $0.008 < 0.05$ so it can be concluded that the PBL model variable assisted by the Polya method (X) has an effect on the problem solving variable (Y2). Based on the t value of the t value of $2.902 > t_{table} 2.015$ so it can be concluded that the PBL model variable assisted by the Polya method (X) affects the problem solving variable (Y2). Based on the *Constant* value and the regression equation on the effect of PBL model learning assisted by the Polya method on problem solving is $Y = a + bX$, namely $Y = 11.715 + (2.533X)$, which means that every addition of one value of PBL model learning assisted by the Polya method on problem solving is 1.750.

C. Implementation of STEM-PjBL Based Learning

The implementation of the PBL learning model assisted by the Polya method in grade IV Mathematics learning, based on the assessment conducted by the grade IV teacher, stated that the implementation of the learning process obtained a score of 75.2% in the two meetings that had been carried out, where each learning syntax was carried out well by students and researchers. The implementation of the learning process with the PBL model assisted by the Polya method is presented in Figure 2 below.

Implementation of PBL model assisted by Polya method

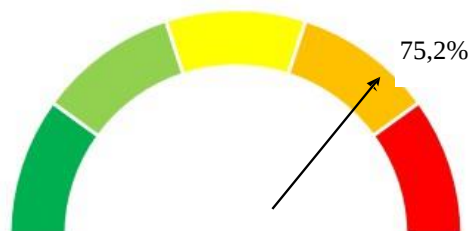


Figure 2: Average score of Implementation of PBL Learning

D. Mathematical Reasoning Outcome

Assessment of students' mathematical reasoning skills was carried out on the second meeting at the end of learning. Indicators used to measure critical thinking skills, namely according to Silmi et al. (2023), namely Analyse mathematical situations, plan the solution process, solve problems with systematic steps, and draw logical conclusions with a scoring process from a range of 1-5. The acquisition of students' mathematical reasoning is calculated with the following formula:

$$rata - rata = \frac{Score\ Obtained}{Total\ Score}$$

The average score of 51.2 is presented in Figure 3 below.

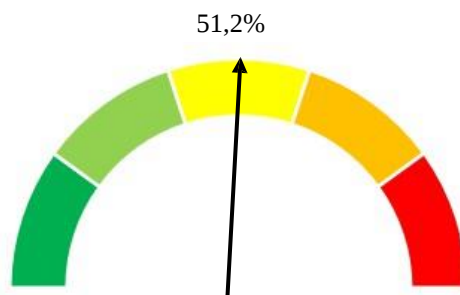


Figure 3: Average score of critical thinking skills

After obtaining the average score, it can be categorised according to table 8 below.

Table 12. Criteria for critical thinking skills

Category	Interval (%)
Very High	81 - 100
High	61 - 80

Category	Interval (%)
Simply	41 - 60
Less	21 - 40
Very Less	≤ 20

Source: Adaptation of Suyitno (2004:73)

Based on the criteria of mathematical reasoning, the average score obtained shows that the mathematical reasoning skills of fourth grade students of SD Negeri Kasmaran are in the sufficient category.

E. Problem Solving Results

Assessment of students' problem solving is carried out at each meeting during the learning process. Indicators of collaboration skills used according to Trilling (2009), namely proposing mathematical statements orally written pictures and diagrams, making conjectures, performing mathematical manipulations, drawing conclusions Composing evidence providing reasons or evidence for several solutions and drawing conclusions from statements.

The acquisition of students' collaboration skills is calculated using the following formula:

$$rata - rata = \frac{Score\ Obtained}{Total\ Score}$$

The average score of 45 is presented in Figure 3 below.

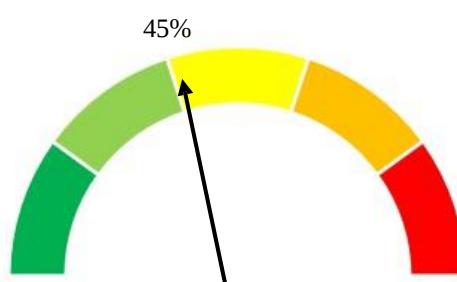


Figure 4. Average score of collaboration skills

After obtaining the average score, it can be categorised according to table 9 below.

Table 13. Criteria for problem-solving ability

Category	Interval (%)
Very good	81 - 100
Good	61 - 80
Simply	41 - 60
Less	21 - 40
Very Less	≤ 20

Source: Adaptation of Suyitno (2004:73)

Based on the criteria for problem solving ability above, the average score obtained shows that the problem solving ability of fourth grade students of SD Negeri Kasmaran is in the sufficient category

F. Discussion

The discussion of the research discusses how the results of the research that have been tested are then reanalysed and seen how the effect is given by the PBL learning model variable assisted by the Polya method on Mathematical reasoning ability and problem solving ability of fourth grade students of SD Negeri Kasmaran.

1) The Effect of PBL Model Learning assisted by Polya Method on Mathematical Reasoning Ability

The results of statistical testing between the PBL Model Learning indicators assisted by the Polya Method (X) on the Mathematical Reasoning variable (Y1) have a regression of 0.581, while the amount of influence is 21.8%, From the data also obtained $t_{count} 2.478 > t_{tabel} 2.015$. So that the results of hypothesis testing that have been carried out can be seen that H_0 is rejected and H_a is accepted, meaning that there is a significant influence of the PBL model variable assisted by the Polya method (X) on the Mathematical Reasoning variable (Y1).

Students' mathematical reasoning ability is generated from test scores at the end of learning. The test questions given measure it, according to mathematical reasoning, while the test material is adjusted to the learning activities of students who apply the PBL model assisted by the Polya method.

After the implementation of the PBL model assisted by the Polya method, the students' mathematical reasoning value increased by 16.7% compared to before the implementation of the PBL model assisted by the Polya method. This is in accordance with the research of Lica Perta Juliyas Muharni in 2024, which confirms that the Polya method in learning provides challenges and motivates students because students' mathematical reasoning, analysis and improve higher-level thinking skills.

2) The Effect of PBL Model Learning assisted by Polya Method on Problem Solving Ability

The results of statistical testing between the PBL model learning indicators assisted by the Polya method (X) on the Problem Solving ability variable (Y2) have a regression of 0.566 while the magnitude of the influence is 27.7%. From the data also obtained $t_{count} 2.902 > t_{tabel} 2.015$. So that the results of hypothesis testing that has been done can be known that H_0 is rejected and H_a is accepted, meaning that there is a significant influence of the PBL model variable assisted by the Polya method (X) on the Problem Solving variable (Y2).

The problem solving ability of students is generated from test scores at the end of learning. The test questions given measure it, according to mathematical reasoning, while the test material is adjusted to the learning activities of students who apply the PBL model assisted by the Polya method.

After the implementation of the PBL model assisted by the Polya method, the students' solution value increased by 27% compared to before the implementation of the PBL model assisted by the Polya method. This is in accordance with the research of Ernawati and Pertiwi Indah Lestari in 2020, which confirms that the Polya method in solving mathematics story problems can generally be said to be effective which can be seen from four aspects, namely increased student activity, student responses during learning, class management and learning completeness.

4. CONCLUSIONS

Based on the results of statistical testing between the PBL Model Learning indicators assisted by the Polya Method (X) on the Mathematical Reasoning variable (Y1) has a regression of 0.581, while the amount of influence is 21.8%, From the data also obtained $t_{count} 2.478 > t_{tabel} 2.015$. So that the results of hypothesis testing that have been carried out can be seen that H_0 is rejected and H_a is accepted, meaning that there is a significant influence of the PBL model variable assisted by the Polya method (X) on the Mathematical Reasoning variable (Y1).

And, the results of statistical testing between the PBL model learning indicators assisted by the Polya method (X) on the Problem Solving ability variable (Y2) have a regression of 0.566 while the magnitude of the influence is 27.7%. From the data also obtained $t_{count} 2.902 > t_{tabel} 2.015$. So that the results of hypothesis testing that has been done can be known that H_0 is rejected and H_a is accepted, meaning that there is a significant influence of the PBL model variable assisted by the Polya method (X) on the Problem Solving variable (Y2).

This is because the PBL model assisted by the Polya method together can be an innovation or novelty in learning that can provide new learning experiences, strengthen mathematical reasoning skills and bring up critical solutions to the problem solving process that are sequential and clear in accordance with the Polya method problem solving. Therefore, it is highly recommended for educators to be able to integrate PBL assisted by Polya's method as an innovation in learning mathematics in schools.

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