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The Effect of Problem-Based Learning Model on Student Learning Outcomes in Mathematics Subjects in Grade III of SDN 2 Biskang

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ABSTRACT

This study aims to determine the effect of the Problem-Based Learning model on third-grade students' mathematics learning outcomes at SDN 2 Biskang in the 2024/2025 academic year. This study uses a quantitative method and a pre-experimental research design. The population in this study consists of all third-grade students at SDN 2 Biskang. The sample was taken using non-probability sampling, specifically a convenience sampling, in which the population served as the sample, consisting of 23 third-grade students. To determine the students' initial abilities, the researcher administered a pretest with an average score of 59.69, which was categorized as poor. After the researcher applied the Problem-Based Learning model, students' learning outcomes improved, with an average score of 81.26, indicating good performance. This research can be supported by the correlation coefficient of 0.960, which indicates that rhitung (0.960) ≥ rtabel (0.184), so Ha is accepted. Thus, the Problem-Based Learning model strongly influences the learning outcomes of third-grade students at UPTD SPF SD Negeri 2 Biskan. As seen from the t-test results, 3.783 ≥ 2.080, indicating that Ha is accepted. This shows a significant positive influence of the Problem-Based Learning model on the learning outcomes of third-grade students at SDN 2 Biskang for the 2024/2025 academic year.

Keywords*: *learning model, problem based learning, learning outcomes

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INTRODUCTION

Education is a process that everyone goes through throughout their lives. Education enables an individual to develop their potential and skills and to build a capable, competent personality. Education is the most important aspect of life because it is the source of high-quality human capacity and can keep pace with the accelerating trends of development in our increasingly sophisticated era. The progress of a nation depends on the success of its education system. A country achieves educational success when efforts are made to improve the quality of education within its borders. In today's increasingly globalized world, education is one of the main factors that determine a nation's progress or decline and shape the quality of its future generations.

The purpose of education is to achieve a better and more prosperous life. Education also aims to shape individuals who possess attitudes and character that reflect the values of Pancasila. The National Education System Law No. 20 of 2003, Article 3, states the objectives of education as follows: the development of students to become individuals who are faithful and reverent toward God the Almighty, possess noble character, are healthy and knowledgeable, skilled, creative, independent, and become democratic and responsible citizens. Learning objectives will be achieved if students understand the material presented during the learning process. Therefore, reforms in education must always be carried out to improve its quality, one of which is implementing appropriate learning models for students. A learning model is a guideline in the form of a program or teaching strategy designed to achieve learning objectives. A learning

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model is also referred to as a series of teaching materials that covers all aspects of learning required by teachers to facilitate students' learning. Learning models can be used as a pattern of choice, meaning that teachers select those that are appropriate and efficient for achieving their educational goals. Teachers are facilitators who guide students during the learning process, helping them better understand the material and achieve learning objectives efficiently, thereby improving student learning outcomes. Learning outcomes are indicators of success achieved by students after a learning experience and include cognitive, affective, and psychomotor aspects. Evidence of learning outcomes is typically demonstrated through test scores and teacher evaluations. Teachers' abilities and creativity significantly influence improvements in student learning outcomes in conducting the learning process. Conversely, low learning outcomes may be caused by several factors, including: (1) Internal factors, originating from within the individual, such as interest, readiness to learn, and motivation to learn. Learning motivation is the internal drive within students to achieve learning objectives; (2) External factors, which originate from the individual's external environment, such as monotonous or unvaried learning methods, as well as a lack of creativity on the part of teachers in using learning media and models. This can make the teaching and learning process less engaging, leading students to feel bored and disinterested, which, in turn, negatively impacts learning outcomes, particularly in mathematics education.

Mathematics is the science of numbers, the relationships between numbers, and the operational procedures for solving problems related to numbers. Mathematics can improve thinking and reasoning skills, help solve everyday problems, and support the development of science and technology. Thus, mathematics teaches logical and critical thinking and encourages the expression of opinions that can be applied to problem-solving. However, many students struggle with mathematics, and many learning problems are considered difficult, making learning mathematics a burden. According to the researcher's observations, some of the students' learning outcomes in mathematics at UPTD SPF SD Negeri 2 Biskang remain weak, as evidenced by many students' test scores still below the minimum passing grade. Some believe that mathematics is a complex subject to understand, so many are afraid to learn it, and their lack of enthusiasm results in low learning outcomes. Additionally, the learning process still employs a teacher-centered learning system. It is also common for students to understand the material today but to forget it by tomorrow when it is revisited. The lack of students' interest in learning mathematics makes it difficult to achieve academic success if that interest remains low. Low interest in learning makes students reluctant and unable to accept knowledge and insights, resulting in poor learning outcomes. Conversely, high interest in learning can encourage students to have the will, motivation, and enthusiasm to participate in every lesson.

LITERATURE REVIEW

Learning is a process of behavioral change in individuals resulting from experiences and practice gained through interactions with the environment. Slameto, (2021:2) states that learning is a process undertaken by individuals to achieve comprehensive behavioral change as a result of their own experiences in interacting with their environment. This change encompasses cognitive, affective, and psychomotor aspects, and is characterized by an increase in students' knowledge, skills, and attitudes.

Learning outcomes are the achievements of students after the learning process, demonstrating positive changes in knowledge, skills, and attitudes. According to Sulistiasih, (2023:1), learning outcomes refer to academic achievements and understanding gained by individuals through the learning process. Learning outcomes can be measured through tests, assignments, or other evaluations that describe the extent to which learning objectives have been achieved.

Problem-Based Learning Model

The Problem-Based Learning model is an approach that places real-world problems at the heart of the learning process. In Problem-Based Learning, students are presented with complex situations or challenges that require critical thinking and analysis to find solutions. In this way, students not only learn theory, but also

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develop practical skills that can be applied in everyday life. This process encourages students to actively seek information, collaborate with classmates, and interact with various learning resources. According to Siswanti & Indrajit (2023:2), Problem-Based Learning is a learning method based on the principle of using cases (problems) as a starting point for acquiring and integrating new knowledge. Problem-Based Learning is a learning method in which students are given complex everyday problems that do not have one correct answer.

Characteristics and Steps of Problem Based Learning

The Problem-Based Learning model has several key characteristics that distinguish it from other learning models. Problem-Based Learning emphasizes authentic and real-life problem-solving processes and actively involves students in the learning process and in finding solutions. PBL also involves student-centered learning, small group learning, and teachers acting as facilitators. The main characteristics of Problem-Based Learning according to Adi Asmara, (2023:41) namely: (1) Learning begins with a problem (2) Ensuring that the problem given is related to the real world of students, (3) Organizing lessons around problems, not around disciplines, (4) Giving learners a great deal of responsibility in shaping and directly implementing their own learning processes, (5) Using small groups, (6) Requiring learners to demonstrate what they have learned in the form of a product or performance.

Steps in implementing the Problem Based Learning model

That is, a series of stages designed to help students solve real problems. The steps in applying the Problem-Based Learning model according to Vera, et al. (2022:20) Among others: (1) Learning begins with the presentation of a problem, usually one with a real-world context (2) Learners actively work in groups to formulate the problem and identify gaps in their knowledge (3) They study and independently search for material related to the problem (4) They report on the solution to the problem.

Advantages and Disadvantages of Problem-Based Learning

Every learning model has its advantages and disadvantages, and Problem Based Learning is no exception. It also has advantages and disadvantages that need to be considered for its successful implementation. The following are the advantages and disadvantages of the Problem-Based Learning model in problem-solving. According to Siswandi, (2023:73), the advantages of Problem-Based Learning include: (1) An effective technique for understanding learning material, training critical and creative thinking skills. (2) Stimulating students to discover new knowledge. (3) Increasing student learning activity. (4) Helping students apply knowledge in everyday life. (5) Helping students develop knowledge and evaluate their learning outcomes and processes. (6) Training students to think critically when facing problems. (7) Considered enjoyable and preferred by students. (8) Developing creative thinking skills and the ability to adapt to new knowledge. (9) Providing students with opportunities to apply knowledge in real life. (10) Increasing students' interest in learning.

The weaknesses of PBL are as follows:

The weaknesses of the PBL model are: (1) Many schools do not have the conditions to support the implementation of Problem Based Learning. (2) Problem Based Learning requires facilities that not all schools have. (3) The implementation of Problem Based Learning takes a long time. (4) The Problem-Based Learning model focuses more on problem-solving through investigative activities, which require information from various sources, and the ability to process information is a characteristic of critical thinking skills.

Mathematics in the context of elementary school

According to Isnaina (2022:40-41), the definition of mathematics in KBBI is: Mathematics is the science of numbers, relationships between numbers, and operational procedures for solving problems related to numbers. Mathematics can improve thinking and reasoning skills, help solve everyday

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problems, and support the development of science and technology. Thus, mathematics teaches logical and critical thinking and expresses opinions that can be applied in problem solving. However, many students struggle with mathematics, and many learning challenges are perceived as difficult, making it a burden to learn. One challenging topic is simple fractions, which require conceptual understanding as well as skills in visual and numerical representation. Applying the Problem-Based Learning (PBL) model to this topic can help students understand concepts through real-world contexts and increase their interest in learning mathematics.

METHOD

A research method is a scientific approach used to collect data for specific purposes and uses. In this context, research methods must meet scientific criteria, namely rationality, empiricism, and systematicity. Thus, research methods serve as guidelines for obtaining valid and accountable information in a study. Sugiyono, (2020:2) that "The experimental research method is a quantitative method, used primarily when researchers want to conduct experiments to find the effect of certain independent variables/treatments on dependent variables/results/outputs under controlled conditions." Arikunto, (2023:9) believes that "The experimental method is a way to find the relationship between two factors and see the effects of a treatment." In this study, the researcher intended to test the effect of the problem-based learning model (X) on the dependent variable, namely student learning outcomes (Y). This study used a quantitative method with a pre-experimental approach (one group pretest- post-test). The population in this study was all 23 third-grade students at UPTD SPF SD Negeri 2 Biskang. Data collection techniques were conducted through tests and questionnaires. Tests were used to determine initial ability (pretest) and results after treatment (post-test). Data were analyzed using correlation and t-tests to assess the significance of the PBL model's influence on learning outcomes.

RESULTS AND DISCUSSION

1. School Data Description

This study was conducted in the third grade of UPTD SPF SD Negeri 2 Biskang, located on Jl. Iskandar Muda, Danau Paris District, Aceh Singkil Regency. The study was conducted to determine the extent of the Problem-Based Learning model's influence on student learning outcomes. The study was conducted over three days from June 11 to 13, 2025. The UPTD SPF SD Negeri 2 Biskang school has facilities that support teaching and learning. The school has one principal's office, one administrative office, three school bathrooms (one for teachers and two for students), ten classrooms/student learning rooms, one library, one canteen, and extracurricular equipment. The data collection method used in this study involved tests and questionnaires. Before collecting data from the research sample, the researcher conducted a pilot test at another school, SD Budi Murni 2 Medan, with 30 students, but only 23 participated. Of 50 test questions, 25 were deemed valid, and of 50 questionnaire items, 25 were valid. After obtaining valid results, the questions were then distributed to the research school respondents at UPTD SPF SD Negeri 2 Biskang, third grade, consisting of 23 students for the 2024/2025 academic year.

2. Class II Post-test Results

At the end of the lesson, after all the material had been taught using the problem-based learning model, the researcher administered a post-test to assess the intervention's effectiveness. The students' post-test scores are shown in the table below:

Table 1. Third-Grade Post-test Results

No	Student Name	KKTP	Post-test score	Description
1	Bela	70	89	Fulfilling
2	Bella tgr	70	82	Fulfilling

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3	Bijak Dika	70	79	Fulfilling
4	Efa Yuliani	70	69	Not Compliant
5	Enjelina	70	73	Fulfilling
6	Feri	70	86	Fulfilling
7	Fitri	70	82	Fulfilling
8	Gael	70	79	Fulfilling
9	Gremil	70	76	Fulfilling
10	Habibi	70	86	Fulfilling
11	Hendi	70	79	Fulfilling
12	Immah	70	82	Fulfilling
13	Iskandar	70	79	Fulfilling
14	Juni Yani	70	89	Fulfilling
15	Melina	70	79	Fulfilling
16	Mordekka	70	73	Fulfilling
17	Nami	70	86	Fulfilling
18	Natalia	70	92	Fulfilling
19	Parwis	70	73	Fulfilling
20	Putri	70	89	Fulfilling
21	Riza Andre	70	82	Fulfilling
22	Rona	70	89	Fulfilling
23	Sehat	70	76	Fulfilling
	Total		1.869	
	Average		81.26	

Based on the table above, the average post-test score for third-grade students is 81.26. The post-test results show that 22 students met the KKTP criteria, while 1 student did not. For a clearer picture of the post-test results for third-grade students, the following table shows the frequency distribution of post-test scores for third-grade students:

Table 2. Frequency Distribution of Post-test Data

X	F	FX	X=x-x	X2	FX2
69	1	69	-12.26	150.307	150.307
73	4	219	-8.26	68.227	204.682
76	2	152	-5.26	27.667	55.335
79	5	395	-2,26	5.107	25.538
82	4	328	0.74	0.547	2.190
86	3	258	4.74	22.467	67.402
89	4	356	7.74	59.907	239.630
92	1	92	10.74	1	115.347
Total	**∑23**	**∑FX=1.869**	-	**$\sum X^2$ =449.5808**	**$\sum FX^2$=860.4348**

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From the data above, the mean, standard deviation, and standard error can be calculated as follows:

1. Mean

$M_x = \frac{\Sigma fx}{n}$

$M_x = \frac{1.869}{23}$

$M_x = 81{,}26$

a. Standard Deviation

$SD = \sqrt{\frac{\Sigma fx^2}{n}}$

$SD = \sqrt{\frac{860{,}4348}{23}}$

$SD = \sqrt{37{,}4102}$

$SD = 6.116$

b. Standar Eror

$SE_m = \frac{SD}{\sqrt{N-1}}$

$SE_m = \frac{6.116}{\sqrt{23-1}}$

$SE_m = \frac{6.116}{\sqrt{22}}$

$SE_m = \frac{6.116}{4{,}6}$

$SE_m = 1{,}32$

Table 3. Frequency Distribution of Post-test Results

Value	Frequency	Percentage	Description
69-72	1	4%	Enough
73-76	5	22%	Enough
77-80	5	22%	Good
81-84	4	17%	Good
85-88	3	13%	Very good
89-92	5	13%	Very good

Based on the post-test percentage distribution table above, 1 respondent scored 69-72 (4%), 5 respondents scored 73-76 (22%), 5 respondents scored 77-80 (22%), 4 respondents scored 81-84 (17%), and 3 respondents scored 85-88 (13%). 5 respondents scored 13%. For further clarification, please refer to the following histogram:

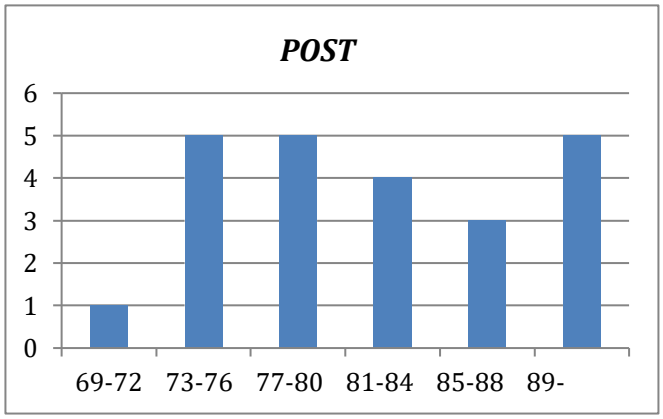

Figure 1. Post-test Frequency Diagram

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Based on the data above, it can be seen that the post-test scores of the students are as follows: 1 respondent scored 62-72 (4%), 5 respondents scored 73-76 (22%), 5 respondents scored 77-80 (22%), 4 respondents scored 81-84 (17%), 3 respondents scored 85-88 (13%), and 5 respondents scored 89-92 (22%). For further details, please refer to the chart below:

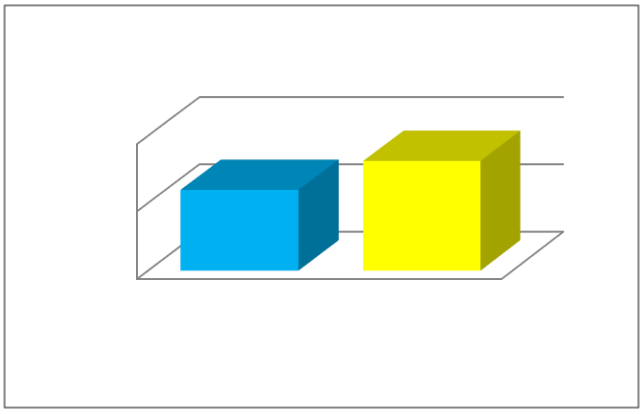

Figure 2. Diagram of Average Pretest and Posttest Values for Class III

Based on Figure 4.3, the average pretest score was 59.69, and after treatment using the Problem-Based Learning model, the average score increased to 81.26.

3. Correlation Coefficient Test

The correlation coefficient test is used to determine whether there is an influence between the independent variable (X) and the dependent variable (Y). The requirement for the correlation coefficient test is to determine whether tcount > ttable using the Product-Moment correlation coefficient formula.

Table 4. Correlation Coefficient Results

X	Y	X^2	Y^2	XY
65	89	4225	7921	5785
85	82	7225	6724	6970
78	79	6084	6241	6162
70	69	4900	4761	4830
64	73	4096	5329	4672
90	86	8100	7396	7740
81	82	6561	6724	6642
78	79	6084	6241	6162
67	76	4489	5776	5092
85	86	7225	7396	7310
80	79	6400	6241	6320
81	82	6561	6724	6642
81	79	6561	6241	6399
92	89	8464	7921	8188
80	79	6400	6241	6320
74	73	5476	5329	5402

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80	86	6400	7396	6880
84	92	7056	8464	7728
74	73	5476	5329	5402
90	89	8100	7921	8010
79	82	6241	6724	6478
92	89	8464	7921	8188
80	76	6400	5776	6080
∑=1830	∑=1869	∑=115,199	∑=152,560	∑=1,530,833

Table 5. Correlation Coefficient Test

		Model	Hasil Belajar
Model	*Pearson Correlation*	1	.960**
	Sig. (2-tailed)		.000
	N	23	23
Hasil Belajar	*Pearson Correlation*	.960**	1
	Sig. (2-tailed)	.000	
	N	23	23

The table above shows that the correlation coefficient ranges from 0.80 to 1.000, indicating a strong relationship between the problem-based learning model and student learning outcomes. The magnitude of the influence of the problem-based learning model variable (X) on student learning outcomes.

3. Discussion of Research Results

This study was conducted at UPTD SPF SD Negeri 2 Biskang, located in Danau Paris Subdistrict, Aceh Singkil Regency, Aceh. The researcher used tests, questionnaires, and documentation as data collection tools with a sample size of 23 students. The purpose of this study was to determine how the learning process using the problem-based learning model was implemented in mathematics lessons and to determine the extent of the influence of using the problem-based learning model on student learning outcomes in mathematics lessons for third-grade students at UPTD SPF SD Negeri 2 Biskang. Based on the research results, the following findings were obtained:

a. **The implementation process using the Problem-Based Learning model on students' learning outcomes in Mathematics, specifically simple fractions.**

The application of the Problem-Based Learning model in this study was carried out through five main steps: (1) presenting contextual problems related to students' daily lives, (2) organizing students into groups, (3) the teacher assists students in organizing learning tasks according to the problem, (4) students gather knowledge and conduct experiments to solve the problem, (5) students develop and present group work results.

Students are actively encouraged to discuss and find solutions to the problems given, making them more enthusiastic and motivated to learn. Survey results indicate that most students enjoy learning with the PBL model because it is more engaging, enjoyable, and easier to understand. Correlation test: r = 0.960 > r_table = 0.413, indicating that the alternative hypothesis (Ha) is accepted. (there is a significant influence of the Problem-Based Learning model on student learning outcomes). This aligns with Syamsidah's (2020) view that problem-based learning can create a meaningful learning environment by enabling students to learn through direct experience and real-life situations. Based on the research findings and discussion, it can be

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concluded that the implementation of Problem-Based Learning is effective and enjoyable, fostering active student engagement through improved mathematics learning outcomes, as evidenced by increased post-test scores and statistically significant results.

b. **Student learning outcomes by applying the Problem Based Learning model in Mathematics lessons on simple fractions**

The research design used was a One-Group Pretest-Posttest Design. The research results showed: Pretest scores: Average score: 59.69; students who achieved learning mastery: 9 out of 23 students (39.13%); students who did not achieve mastery: 14 students (60.86%). Post-test scores: Average score: 81.26, students who achieved learning mastery: 22 out of 23 students (95.65%), students who did not achieve mastery: 1 student (4.34%). Correlation test (r) = 0.960 > r_table = 0.413, indicating a powerful relationship between the learning model and student learning outcomes. t-test t_calculated = 3.783 > t_table = 2.080, meaning Ha is accepted, indicating that there is a significant influence of the Problem-Based Learning model on student learning outcomes.

The Problem-Based Learning model encourages students to be more active, think critically, and collaborate in solving contextual problems. Learning becomes more meaningful when students are directly involved in solving the problems presented. Students no longer merely receive information from teachers; they also construct their own understanding, which significantly improves learning outcomes. This research aligns with Siswanti and Indrajit (2023:2), who state that Problem-Based Learning emphasizes the integration of new knowledge through the resolution of complex problems, thereby encouraging students to develop independent and deep understanding. Based on the data analysis and discussion, the following conclusions were drawn: The Problem-Based Learning model can be effectively applied in mathematics learning in third grade through systematic steps that involve real-world contexts and student experiences. Student learning outcomes improved from 59.62 to 81.26.

c. **The Effect of the Problem-Based Learning Model on Student Learning Outcomes in Mathematics on the Topic of Simple Fractions**

This study used a One-Group Pretest-Posttest Design to measure the effect of the Problem-Based Learning model on student learning outcomes in mathematics, specifically simple fractions. Pretest scores, average: 59.69, only 9 out of 23 students (39.13%) achieved mastery (KKTP). The majority of students were in the categories of needing improvement and sufficiently developed. Post-test scores: average 81.26; 22 out of 23 students (95.65%) achieved mastery. There was a significant increase from the pretest scores.

Statistical analysis, correlation coefficient (r): 0.960, indicating a very strong relationship between the implementation of the Problem-Based Learning model and learning outcomes. t-test: t_calculated = 3.783 > t_table = 2.080, meaning there is a significant effect of the Problem-Based Learning model on student learning outcomes. The results of this study indicate that learning with the Problem Based Learning model increases student interest and learning, facilitates students' understanding of multiplication concepts, and significantly improves learning outcomes. This study aligns with the findings of Ilmiah & Pendidikan (2023:1056), which state that Problem-Based Learning increases students' curiosity and activity, ultimately encouraging higher learning outcomes.

Based on the research results and discussion, it can be concluded that the Problem-Based Learning model can be effectively applied in mathematics learning in Grade III at UPTD SPF SD Negeri 2 Biskang, particularly in the material on simple fractions. The application of the model has a significant effect on student learning outcomes, as evidenced by increases in post-test scores and statistical analysis results.

CONCLUSIONS AND RECOMMENDATION

Based on the results of the analysis and discussion of the research on the effect of the Problem-Based Learning model on student learning outcomes in mathematics for third-grade students at UPTD SPF SD Negeri 1 Danau Paris in the 2024/2025 academic year, the following conclusions were obtained:

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1. The implementation of the Problem-Based Learning model to improve students' learning outcomes in grade III at UPTD SPF SD Negeri 2 Danau Paris, using questionnaires administered to respondents. The test consisted of 25 questions aimed at assessing the learning process using the Problem-Based Learning model. The average score for the questionnaire was 79.56, with the highest score being 92 and the lowest being 65. This indicates that the learning process using the Problem-Based Learning model in mathematics instruction in third grade at UPTD SPF SD Negeri 2 Biskang falls into the "good" category.
2. The application of the Problem-Based Learning model on student learning outcomes in mathematics in grade III at UPTD SPF SD Negeri 2 Biskang in the 2024/2025 academic year by administering a pretest before implementing the treatment on grade III students. The researcher first administered a pretest comprising 20 questions to assess students' initial abilities. The average pretest score for third-grade students was 59.69, with 9 students meeting the KKTP standard and 14 scoring below it. Meanwhile, the average post-test score was 81.26, with 22 students scoring above the KKTP standard and 1 student scoring below it. This indicates an improvement in students' learning outcomes after receiving treatment through the Problem-Based Learning model.
3. Based on the results of the research and data analysis conducted, it can be concluded that there is an influence of the Problem-Based Learning model on students' learning outcomes in the mathematics subject matter "simple fractions" for third-grade students at the UPTD SPF SD Negeri 2 Biskang School for the 2024/2025 academic year. This can be seen from the correlation coefficient value (r = 0.637) and the rtabel value (0.184), where the results are determined by comparing rhitung ≤ rtabel. The results of the hypothesis test (t-test) to determine whether the hypothesis is accepted or rejected based on the criteria thitung ≥ ttabel and significance level (α ≤ 0.05) show a result of 3.782 ≥ 2.080 and a significance level of 0.001 ≤ 0.05, meaning that (Ha) is accepted and (H0) is rejected, thus indicating the influence of the Problem-Based Learning model on student learning outcomes.

Based on the data obtained, it can be concluded that the application of the Problem-Based Learning model has a significant effect on students' learning outcomes in mathematics in grade III at UPTD SPF SD Negeri 2 Biskang. The application of this model not only makes learning effective, but also improves students' basic skills in self-confidence, cooperation, and critical thinking.

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