IMPROVING MATHEMATICS LEARNING OUTCOMES THROUGH THE IMPLEMENTATION OF PROBLEM-BASED LEARNING APPROACH IN ELEMENTARY SCHOOLS PEKANBARU

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Abstract. Students' low interest in learning creates challenges in the learning process, where a lack of motivation reduces students' active participation in teaching and learning activities. Therefore, it is essential to identify strategies that can increase students' interest in learning so that they are enthusiastic about participating in learning. This research aims to overcome the low learning outcomes of the Theme 1 Subtheme "My Daily Tasks at School" by applying the Problem-Based Learning model in class II at SDN 147 Pekanbaru. The research method used is Classroom Action Research with four main stages: planning, action implementation, observation, and reflection, carried out in 2 cycles, each consisting of 2 meetings. Data collection techniques include observation, tests, documentation, and quantitative and qualitative data processing. The research results show that applying the PBL model has improved student learning outcomes. In the pre-cycle, only eight students, or 31%, achieved completeness, then this increased to 18 students, or the equivalent of 69% in cycle I, and in cycle II, it reached 26 students or 100% completion.
Keywords: *Learning Outcomes, Problem-Based Learning*

1. INTRODUCTION

The development of the world has made all aspects of life evolve, including education. Education is essential in facing these global changes because, through education, individuals can develop the skills and knowledge needed to adapt to technological advances and the demands of an increasingly competitive job market [1], [2]. In addition, education also plays a role in shaping the character and critical attitude needed to face various challenges in the future [3]–[5]. Thus, improving the quality of education is a top priority so that people can contribute optimally in this dynamic era of development.

One part of education experiencing rapid development is classroom learning, where many learning models constantly evolve. These learning models, such as project-based learning, collaborative learning, and digital technology, contribute significantly to improving the quality of teaching and learning [6]–[8]. These developments allow educators to create a learning environment that is more dynamic, interactive and relevant to the needs

of today's students [9]–[11]. In addition, innovations in learning methods also encourage students to be more actively engaged, think critically, and develop skills needed in the real world [12]–[14]. Thus, developments in classroom learning not only improve the effectiveness of education, but also better prepare students to face future challenges.

There are four changes in the 2013 Curriculum: graduate competency standards, content standards (core competencies and essential competencies), process standards, and assessment standards [15]–[17]. These four changes are explained as follows. Improving graduate competency standards by paying attention to the integrated development of values, knowledge, and skills, focusing on achieving competency. Educators in class II at SDN 008 Gunung Mulya have used a scientific approach to learning. The scientific approach includes six steps: observing, asking, collecting, processing, and communicating. However, the scientific approach has yet to be implemented optimally. One of the reasons is that educators still use the lecture method in the learning process, so the learning process is centered on the educator. The lecture method also needs to explore students' reasoning abilities. With the lecture method, educators must allow students to ask questions and express their opinions.

Learning outcomes are essential and need serious attention in the education process [18]–[20]. Learning is a process of changing behavior that requires assessment to see how effective the method is [21], [22]. Five aspects of learning outcomes must be considered: intellectual skills, cognitive strategies, attitudes, verbal information, and motor skills [23], [24]. Students' success in learning can be measured by their ability to understand and apply the concepts taught during the learning process [25]. By monitoring and evaluating these five aspects of learning outcomes, educators can provide appropriate feedback and adjust teaching strategies to ensure that each student reaches their full potential and experiences positive changes in their behavior and abilities.

Student learning outcomes can be seen from several cognitive aspects, namely, students' abilities in knowledge (memory), understanding, application, analysis, synthesis, and evaluation [26]–[28]. In other words, student learning outcomes can also be measured by their ability to remember lessons that have been delivered by the teacher, as well as their ability to solve problems that arise during the learning process [29], [30]. In line with this opinion, learning outcomes reflect the basic competencies that have been understood and those that have not been understood by most students [31]–[33]. Thus, learning outcomes reflect not only the extent to which students master the subject matter but also how well they can apply that knowledge in real situations, analyze complex information, synthesize new concepts, and evaluate various solutions or arguments. In conclusion, good learning outcomes include deep understanding and practical application of the material taught and students' ability to continue to develop in higher cognitive aspects.

The learning problems mentioned above hurt students' learning outcomes, which can be seen from their learning outcomes, which are far below the Minimum Completion Criteria (KKM) set by SDN 147 Pekanbaru. The KKM set for Pancasila and Civic Education, Mathematics, and Indonesian Language are all at 65. One of the main reasons behind these low learning outcomes is students' lack of motivation and interest in learning, which results

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in a lack of understanding of the material and active participation in the learning process.

Based on the problems above, improvements need to be made to the learning process and outcomes, one of which is using learning models based on the expected learning objectives. The Problem-based Learning (PBL) model can improve learning processes and outcomes. In problem-based learning, students must face real problems in everyday life [34], [35]. So, the appropriate learning model for this problem is the Problem-Based Learning (PBL) model because this model can develop thinking abilities to solve issues and develop students' intellectual skills.

Based on several experts' opinions, it can be concluded that learning outcomes are an effort to develop one's abilities. The results of developing students' abilities produce changes in behavior for the better.

2. RESEARCH METHOD

This research was carried out in 2 cycles. In one cycle, there are two meetings and one daily review consisting of planning, implementation, observation, and reflection.

Planning

In this classroom action research, educators make action plans that will be carried out. This action involves implementing thematic learning with an environmental theme using the Problem-Based Learning (PBL) model in class II at SDN 147 Pekanbaru. This activity begins by formulating a learning action plan with the following activities. (1) preparing an action plan in the form of a Learning Implementation Plan model, (b) selecting and determining materials, (c) learning and teaching activities, (d) selecting and determining media or learning resources, and (e) evaluation (2) compiling indicators and criteria for Thematic learning with the theme of my daily tasks. (3) compiling data through observation guidelines and field notes.

Implementation of Actions

Implementing this action begins with implementing thematic learning with an environmental theme. This research was planned in 2 cycles; cycle I was held three times, and cycle II was held three times. Activities are carried out by researchers themselves as educators and colleagues as observers. Educators carry out learning activities in the classroom in the form of interaction activities between educators and students, as well as students and students. The activities carried out are as follows: (1) The implementation phase of this action is designed in 2 cycles. Cycle 1 was held three times, and cycle II was held three times. Educators carry out learning with an environmental theme through the learning plan created. (2) The observer makes observations using an observation format and field notes. (3) Educators and observers discuss the actions taken, then reflect. The results are used for further improvements.

Observation

Observers were also involved in carrying out the research. The observer's task was to observe the teacher's and students' activities during the lesson. The aim is to determine the quality of action implementation. The time for observation was carried out

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simultaneously with the implementation of the action involving two observers, namely a colleague as an observer of teacher activities and the class II homeroom teacher as an observer of student activities. Observations were made to see the activities of teachers and students during the learning process. The aim is to provide input or opinions on the implementation of the learning so that suggestions and criticism from observers can be used to improve the teaching at the next meeting.

Reflection

Reflection is carried out every time an action ends. In this stage, the educator and observer discuss the action that has just been taken. The matters discussed are (1) analyzing actions that have just been carried out, (2) reviewing and explaining differences in plans and implementation of actions that have been carried out, and (3) intervening, interpreting, and drawing conclusions from the data obtained. The results of this joint reflection are used as input for subsequent actions and can be used to conclude the results of the cycle that has been implemented.

Data Collection Techniques and Instruments

Data Collection Techniques are Observation, Test, and Documentation. The data collected in this research are: (1) the results of the final test at the end of each action (evaluation), (2) the results of observation notes (observations), which contain notes regarding learning activities both regarding educators and students. This data analysis technique uses descriptive statistical analysis, which starts from collecting data, compiling or arranging data, presenting data, and analyzing numerical data to provide an overview of the aftermath of symptoms, events, or circumstances.

Instrument

Learning Tool Instrument consists of (1) The syllabus is a reference for planning and implementing learning programs. The syllabus can be used as a guide in learning development, starting from creating learning plans and managing learning activities to assessment systems. The syllabus contains competency standards, essential competencies, learning materials, learning activities, indicators, assessments, time allocation, materials/tools, and resources. (2) Learning Implementation Plan (RPP): The learning implementation plan is a guideline or step the teacher will follow in the learning process. The learning implementation plan contains competency standards, essential competencies, learning objectives, teaching materials, learning models and methods, learning steps, learning resources, and learning outcomes assessment. (3) Student Worksheets (LKS), Student worksheets are activity steps that students must complete to understand the material being taught

Learning Outcome Analysis Techniques

This data analysis technique uses descriptive statistical analysis, which starts from collecting data, compiling or arranging data, presenting data, and analyzing numerical data to provide an overview of the aftermath of symptoms, events, or circumstances. After the teacher and student activity data is collected through observation, the data is processed using the percentage formula, which is as follows:

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$$P = \frac{F}{N} x100\%$$

Information:

P = Percentage number

F = Frequency the percentage is being searched for

N = Number of Cases (number of frequencies/number of individuals)

100% = Fixed Number

The categories of student learning outcomes that have been obtained are determined by qualitative values or category values by referring to the theory put forward by Purwanto as follows:

Table 1. Learning outcomes categories

No	Interval (%)	Category
1	91-100	Very Good
2	83-90	Good
3	75-82	Less Good
4	<74	Not Good

3. RESULTS AND DISCUSSION

3.1 Results

Pre-Action to cycle I

Based on data before the implementation of the Problem Based Learning model, it is known that student learning outcomes for theme 1 sub-theme are still lacking, namely with completeness equivalent to 30.8%. This is because so far teachers are still using old methods, and learning is only focused on the teacher while students only take notes, so students feel bored.

Cycle I to Cycle II

In the second cycle, the level of completeness of student learning outcomes was 100%. Or the equivalent of 26 students who have achieved completeness individually. Following are the results of cycles 1 and 2;

Table 2. Cycle I Learning Results

Description of learning outcomes	Total	Percentage
Complete	18	69%
Not Complete	8	31%

From Table 2, we get the score of cycle I results. Students can solve or complete the problem are 18 students and 8 students can not complete or solve the given problem or test.

Table 3. Cycle I Learning Results

Description of learning outcomes	Total	Percentage
Complete	26	**100** %
Not Complete	**0**	**0** %

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The table above shows the results of learning cycle I, where of the 26 students who completed 18 students with a percentage of 69%. Then, eight students did not complete or a rate of 31%. This will then be continued in the next cycle. The table above shows the learning results of cycle II, where of the 26 students who completed it, 26 had a percentage of 100%. Then, the student's other assignments can be said to be successful. With these results, the teacher applied the problem-based learning model well.

Based on the results of the discussion above, it can be concluded that applying the Problem-Based Learning model can improve student learning outcomes in the material Recognizing Fractions, class II SDN 147 Pekanbaru. But, this statement must be proved by statistics to check whether a significant different are happen. This result can be seen from Paired-samples test. This result are started with checking the data normality with One Sample Kolmogorov-Smirnov Test in Table 4.

Table 4. One-Sample Kolmogorov-Smirnov Test

	Parameters	**Cycle1**	**Cycle2**
Normal Parametersa,b	Mean	761.154	845.000
	Std. Deviation	885.585	509.313
Most Extreme Differences	Absolute	.170	.177
	Positive	.118	.140
	Negative	-.170	-.177
Test Statistic		.170	.177
Asymp. Sig. (2-tailed)		0.053c	0.13c

From the results, it is acquired the One Sample Kolmogorov-Smirnov value 0.053 of Cycle 1 and 0.113 of Cycle II. These values are proved that Cycle I and II in normal distributed. Next step, we find the result of statistics descriptive of cycle I and II as in Table 5.

Table 5. Statistics Descriptive of Cycle 1 and Cycle II

	Min	**Max**	**Mean**	**Std**	**Variance**
Cycle1	60.	90	76.1	8.86	78.43
Cycle2	75	90	84.5	5.09	25.94

From table 5, we get of statistics descriptive of Cycle I with minimum of 60, maximum of 90, mean of 76.1, standard deviation of 8.86, and variance of 78.43. Statistics descriptive of Cycle I with minimum of 75, maximum of 90, mean of 84.5, standard deviation of 5.09, and variance of 25.94. The next step, we find the paired samples correlation. From this term, we find the correlation between Cycle 1 and II. This result can be seen in Table 6.

Table 6. Paired Samples Correlations

	Variables	N	Correlation	Sig.
Pair 1	Cycle1 & Cycle2	26	-.146	.477

From Table 6, we get the correlation coefficient of -0,146 with significant value 0.477. This correlation explains that there is no correlation between Cycle I and Cycle II. This mean, the score has acquired form Cycle I didn't affect score from Cycle II. The last step, we find the

paired samples test to know whether there is a significant different between treatment of Cycle I and Cycle II. This result can be seen in Table 7

Table 7. Paired Samples Test

	Paired Differences					t	Sig. (2-tailed)
	Mean	Std	Std. Error Mean	95% Confidence Interval of the Difference		-3.944	.001
				Lower	Upper		
Cycle1 - Cycle2	-83,	1.08	212.608	-1.276.337	-400.586		

From Table 7, we find the t value and Significant Value (Sig. (2-tailed)) of -3.944 and 0.001. In this case, we can conclude significant different will happen if significant value is lower 0.05. so, the result show, score of Cycle II is better from score Cycle II.

3.2 Discussion

The development of education has driven the evolution of learning styles that keep up with the changing times [36], [37]. One of the increasingly popular approaches is Problem-based Learning (PBL). PBL is very helpful in improving the quality of learning because this method puts students at the center of the learning process, requiring them to solve real problems relevant to the subject matter. Through PBL, students not only acquire theoretical knowledge but also develop critical thinking, collaboration and problem-solving skills. In addition, PBL encourages students to become independent learners and take responsibility for their own learning process, which is very important in a changing world that demands high adaptability. Thus, PBL not only improves students' understanding of the subject matter but also prepares them to face real-world challenges more confidently and competently.

The application of the Problem-based Learning (PBL) model is proven to be able to improve student learning outcomes on theme 1 subtheme “Living in Harmony at School” in class II SDN 147 Pekanbaru. The application of PBL in this class showed a significant increase in the completeness of student learning outcomes. In the pre-study cycle, only 8 students or around 31% achieved mastery. However, after the implementation of PBL in cycle I, the number of students who achieved mastery increased to 18 students or around 69%. This increase continued in cycle II, where all students, as many as 26 students or 100%, managed to achieve mastery. These results show that PBL not only increases students' participation and involvement in the learning process, but also significantly increases students' understanding and mastery of the material. PBL allows students to learn actively and contextually, solving real problems relevant to their lives, thus improving their overall motivation and learning outcomes [38], [39]. Thus, the implementation of PBL model can be considered as an effective strategy in improving the quality of learning and students' learning outcomes.

Of course, this research has shortcomings that need to be considered. One of the main shortcomings is the limited sample which only involved grade II students at SDN 147 Pekanbaru, so the results may not be generalizable to a wider population. In addition, this

study did not consider external factors such as students' socio-economic background, family support or the availability of learning resources at home that may affect learning outcomes. The evaluation method used may also be less comprehensive, as it only focuses on the completeness of learning outcomes without evaluating changes in aspects of students' critical thinking skills or collaborative abilities in depth. Therefore, further research with more diverse samples and more holistic evaluation methods is needed to gain a more thorough understanding of the effectiveness of PBL models in improving student learning outcomes.

4. CONCLUSION

Based on the discussion above, it can be concluded that the application of the PBL model is proven to be able to improve student learning outcomes in theme 1, sub-theme of living in harmony at school by implementing the problem-based learning model in class II at SDN 147 Pekanbaru, this can be seen from the completeness of student learning outcomes pre-complete cycle only eight students or 31% then in cycle I it increased to 18 students or the equivalent of 69% and finally in cycle II it became 26 students or 100% completeness. Starting from the discussion of the research results and conclusions above, the researchers put forward several suggestions: To apply the use of the PBL model in learning. Teachers should first understand the stages of learning using PBL, namely: a) the stage of orienting students to problems, b) the stage of organizing students to learn, c) the stage of conducting individual and group investigations, d) the stage of developing and presenting the results of the work, and e) the stage of analyzing and evaluating the problem-solving process. School principals should be able to motivate and develop teachers to use PBL in learning at school and monitor the implementation process. Readers should be able to gain insight into the implementation of PBL, which can be used as an alternative learning model and must be adapted to the material being taught.

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