Increasing Activeness and Learning Outcomes of Mathematics Using Problem-Based

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A R T I C L E I N F O	A B S T R A C T
	The lecture style still dominates and the content does not match the actual situation, so the activity and learning outcomes of the 2nd-grade students of Yos Sudarso Elementary School for the 2022/2023 academic year are still not good. The aim of this study is to outline how to introduce a Problem-Based Learning pedagogical framework to enhance student engagement and knowledge retention. This study followed the format of Classroom Action Research in two cycles. This research involved 28 students from SD Yos Sudarso Purwakarta. Data collection methods, including test and nontest methods. Quantitative and qualitative descriptive analyzes were applied to the data. The results showed that the proportion of active students increased from 21.42 percent or as many as six students in the pre-cycle to 53.57 percent or as many as fifteen students in cycle I and to 78.57 percent or as many as twenty-two students, in the second cycle. The pre-cycle KKM achievement level was 53.57 percent (15 students), the first cycle achievement level was 78.57 percent (22 students), and at the second cycle achievement level all students achieved KKM scores of 28 students

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1. INTRODUCTION

To be successful in mathematics, students need a solid foundation in reasoning, attitudes, and abilities, and this must start in elementary school (Kartikasari & Widjajanti, 2017). Teaching and learning activities in mathematics that allow students to apply their skills to real-world challenges are important to the discipline (Marie Apostol, 2017). Despite the abstract nature of mathematical concepts, many educators continue to rely on a lecture style of instruction. Cockroft (Siagian, 2016) also revealed the important role of mathematics, namely *"It would be very difficult-perhaps impossible-to live a normal life in very many parts of the world in the twentieth century without making use of mathematics of some kind"*. Learning mathematics in elementary schools is quite challenging because the lecture method used by the teacher to convey abstract concepts makes it difficult for students who still think concretely to understand the material, and also makes learning boring (Urhan & Bülbül, 2022), (Jatisunda & Nahdi, 2020). Using a lecture format limits participation in the learning process to only the instructor and a select few students. However,

students who are not active are not actively involved in the class and the contents of the paper including.

Active learning, as described by Hartono et al. (2014: 100), has the potential to have a positive influence on each learner. Interaction between teachers and students or between peers will increase as a result of student involvement in the learning process. This creates an environment in which students feel comfortable contributing to their full potential in the classroom. Authors Kristin and Astuti (2017: 157) The term "active learning" refers to the extent to which students are involved and contribute to the learning process in class, either through direct work or participation in discussions and activities designed to deepen their understanding. material of course. In the classroom, learning occurs when instructors and students work together in groups. Learning outcomes will increase because increased activity will lead to the development of knowledge and skills.

The results of observations of mathematics learning for second-grade students at SD Yos Sudarso Purwakarta show that the level of activity is still low. This is supported by student data from 28 students at SD Yos Sudarso Purwakarta grade 2, only 1 student (3.57%) seemed very active, 2 students were very active (7.14%), and 3 students (10.71%) very active in class. Based on these data, 6 students (21.42%) actively participated in learning activities, while 22 students (78.57%) carried out activities other than studying. Based on these data, 6 students (21.42%) actively participated in learning activities, while 22 students (78.57%) carried out activities other than studying. The data collected from these observations resulted in the conclusion that grade 2 students at SD Yos Sudarso Purwakarta were less active in arithmetic lessons. Student motivation and learning outcomes are both still inadequate. Researchers found that many second-grade students at SD Yos Sudarso Purwakarta scored below the school's required KKM of 70 on the math exam, indicating that there is still room for improvement. Sixteen (57.14%) of the 28 students achieved the KKM, while twelve (42.85%) did not. Therefore, to maximize the achievement of learning objectives, to stimulate student enthusiasm, so that later students can obtain meaningful learning.

Given these issues, it is important to find an educational model or approach that fits the demographics of the children involved. To maximize engagement and learning, a problem-based learning framework should be used. In a problem-based learning environment, students take an active role in the educational process.

The results of observations of mathematics learning for second-grade students at SD Yos Sudarso Purwakarta show that the level of activity is still low. Student statistics from 28 grade 2 students at SD Yos Sudarso Purwakarta showed that only one student (3.57%) seemed very active, two students were active (7.14%), and three students (10.71%) were quite active in class. These statistics show that 22 students (78.57%) are involved in activities other than learning, only 6 students (21.42%) are actively involved in learning activities. Analysis of the information obtained from these observations revealed that grade 2 students at SD Yos Sudarso Purwakarta were involved in relatively little arithmetic instruction. Student learning outcomes are still inadequate, besides that there is no student involvement. This can be seen when researchers see that there are still many SD Yos Sudarso Purwakarta students who still have scores below the KKM set by the school, namely 70 on the arithmetic content test for grade 2 students. Of the 28 students, 16 students (57.14%) have completed the KKM. while 12 students (42.85%) are still working on it. Therefore, to ensure today's children receive an education that prepares them for future success, it is important to optimize the achievement of learning objectives that can inspire student engagement.

The problems mentioned above require a solution, and the answer is a student-centered teaching model or method. The problem-based learning paradigm is one of the most successful techniques for increasing student engagement and learning outcomes. A learning paradigm called problem-based learning encourages student participation in class and real-world problem solving. According to Gunantara (2014), problem-based learning is a type of teaching where students learn to find solutions to actual problems. Motivation and curiosity are raised by this paradigm. Using the Problem-Based Learning (PBL) paradigm, students can develop their capacity for abstract reasoning and critical analysis.

The purpose of this research is to detail how the problem-based learning paradigm is used in second-grade students at SD Yos Sudarso Purwakarta to increase their activeness and success in mathematics. Increasing student involvement in learning mathematics by using a problem-based learning paradigm for second-grade students at SD Yos Sudarso Purwakarta. The second-grade students' mathematical abilities at SD Yos Sudarso Purwakarta were improved by using problem-based learning strategies.

The following will be applied in second-year special education classes based on the background and review of the literature. Activities and Learning Outcomes of Mathematics through Problem-Based Learning (PBL), by Yos Sudarso Purwakarta: (1) By using the procedures outlined in the problem-based learning paradigm, such as problem orientation, learning organization, and assessment, directing individuals/groups to add experience, development and presentation of the learning process. The use of problem-based learning strategies for grade 2 SD Yos Sudarso Purwakarta can increase the activity and results of learning mathematics by analyzing and assessing problem solutions. (2) Grade 2 students at SD Yos Sudarso Purwakarta can be more enthusiastic about learning mathematics if they use the Problem-Based Learning paradigm. (3) By using the Problem-Based Learning learning approach, class II students at SD Yos Sudarso Purwakarta can achieve better mathematics learning outcomes.

2. METHOD

This study used four steps of classroom action research (CAR): preparation, activity, observation, and reflection. Teachers can utilize classroom action research as a technique for pointing out various problems with student learning. Learning activities are planned by researchers and carried out by instructors. Researchers observed learning activities related to these activities with the help of colleagues. A total of 28 grade II students (16 boys and 12 girls) from SD Yos Sudarso Purwakarta participated in this study. There were two rounds for this research. According to Mawardi (2014: 119), it is suspected that there are two cycles of education. The first cycle occurred between April 26 and May 4, 2023, while the second cycle occurred between May 5 and May 6, 2023. The session in this analysis is divided into two 90-minute halves. Methods Both experimental and observational approaches were used to gather information for this investigation. The collection of duration calculation data uses essays as a type of assessment of students' mathematical knowledge. Researchers have paid observers to record student activity on the observation sheet which is then used to analyze the level of participation. Data is described using quantitative and qualitative techniques. Quantitative data in the form of numeric (data in the form of numbers) and qualitative data in the form of explanations were collected from test results and presented in the form of essays, observation sheets and rubrics. Then, comparative descriptive analysis was used to compare conditions in the pre-cycle, cycle I, and cycle II periods to draw conclusions about the quantitative data. These results indicate that problem-based learning is an excellent pedagogical strategy for improving learning processes and outcomes in the context of

formal education. This analysis uses two metrics for success: (1) process indicators, where the success of the process can be seen through observable shifts in the learning process of mathematical content using the Problem-Based Learning learning model, and (2) completing all stages of learning using the Problem learning model Based Methodical Instruction, (2) processing observation sheets that measure active activity markers, allowing for visual confirmation of progress or deficiencies. The success of efforts to increase student involvement in learning is marked by the increasing proportion of students who fall into the category of "active" involvement. While the assessment questions are used to measure student learning outcomes in cycles I and II. Student learning outcomes are monitored over time to see if they improve in each cycle. Minimum Completeness Criteria (KKM) is the metric of choice. When more than 80% of students achieve proficiency or higher on KKM, significant material gains are obtained by students. KKM value used is 70.

Analysis of learning engagement data was used to understand information collected in action research classroom settings. The purpose of this evaluation is to track how much students engage with and benefit from the problem-based learning approach. A percentage-based algorithm is used to perform direct analysis on the observation sheets. In this study, we only looked at productive behavior. To determine what proportion of students are actively involved in their studies, we apply the following formula:

$$\text{Percentage of positive activity (\%)} = \frac{\sum number\ of\ student\ each\ indicator}{\sum total\ number\ of\ students} \times 100\%$$

calculation results are compared for each iteration. In order to foster the growth of active learning through student involvement in the learning process. According to Suharsimi (quoted in Erniwati 2015: 5), the proportion of students who behave constructively is as follows.

Table 1. Criteria for Student Positive Activeness

Percentage Rate	Information
76%-100%	Very Good
51%-75%	Good
26%-50%	Pretty Good
0%-25%	Not Good

3. RESULTS AND DISCUSSION

Results There were two research cycles. The first cycle took place on April 26-27 2023. Cycle II was held on May 4-5 2023. Each cycle was divided into 2 sessions, so the number of sessions in this study was 4 sessions. From the pre-cycle to cycle I and cycle II, it was clear that both students' engagement and learning outcomes in mathematics had increased. Yos Sudarso Purwakarta uses the PBL approach throughout the 2022-2023 school year

Table 2. Increasing Student Activity in Pre-Cycle, Cycle I, and Cycle II

	Pre-Cycle	Cycle I	Cycle II
Average	6 Students (21,42%)	15 Students (53,57%)	22 Students (78,57%)
Category	Not Good	Good	Very Good

Table 2 shows that overall student engagement has increased during the pre-period, period I, and period II. Six students on average (21.42%) were active or in the less active category before the cycle I action; after cycle I, the number increased to 15 students (53.37), which is equivalent to an active class; and after cycle 2 increased to 22 students (active class). The following can be seen

in bar graph 1 regarding the increase in activity before the cycle (initial conditions), during the cycle I and cycle II.

Graph 1. Increasing the Activeness of Pre-cycle Students, Cycle I, Cycle II
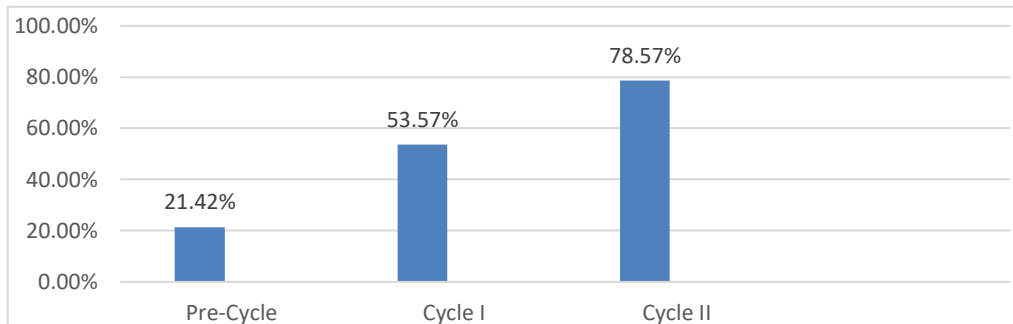

Based on Graph 1, student activity has increased. Before the cycle, the average activity of students in the less active category was 21.42%, then it increased to 53.57% in cycle I. In cycle II, the category of high engagement levels actually increased again with active student participation increasing to 78.57%. The average level of student engagement has increased during each cycle. The mathematics learning outcomes of grade 2 students for the 2022/2023 academic year at SD Yos Sudarso Purwakarta are also influenced by the application of the Problem-Based Learning approach. Researchers create a comparison table to record their findings about learning outcomes, which can be used to determine the extent to which students' knowledge is expanded.

Table 3. Improving Student Learning Outcomes

Information	KKM	Pre-Cycle		Cycle I		Cycle II	
		f	%	f	%	f	%
Passed	≥ 70	15	53,57	22	78,57	28	100
Not Passed	< 70	13	46,42	6	21,42	0	0
Total		28	100	28	100	28	100

Table 3 displays the results of the comparison of pre-cycle learning outcomes in cycle I and cycle II. A total of 70 KKM at SD Yos Sudarso Purwakarta. There were a total of 28 students enrolled in the pre-cycle, with 15 of them completing the course (53.57 percent) and the remaining 13 (46.42 percent) not even starting it. The number of students in cycle I was 22 students, with 78.57 percent completing and 21.42 percent not completing these students. In cycle II, all 28 students completed with a completeness level of 100%. This research is consistent with Eismawati, E, et. Al. (2019) who uses a problem-based learning approach to increase student involvement in mathematics. Graph 2 below is a bar chart showing the proportion of students who have achieved the learning objectives of the pre-cycle, cycle I, and cycle II.

Graph 2. Improving Student Learning Outcomes Pre-cycle, Cycle I, Cycle II
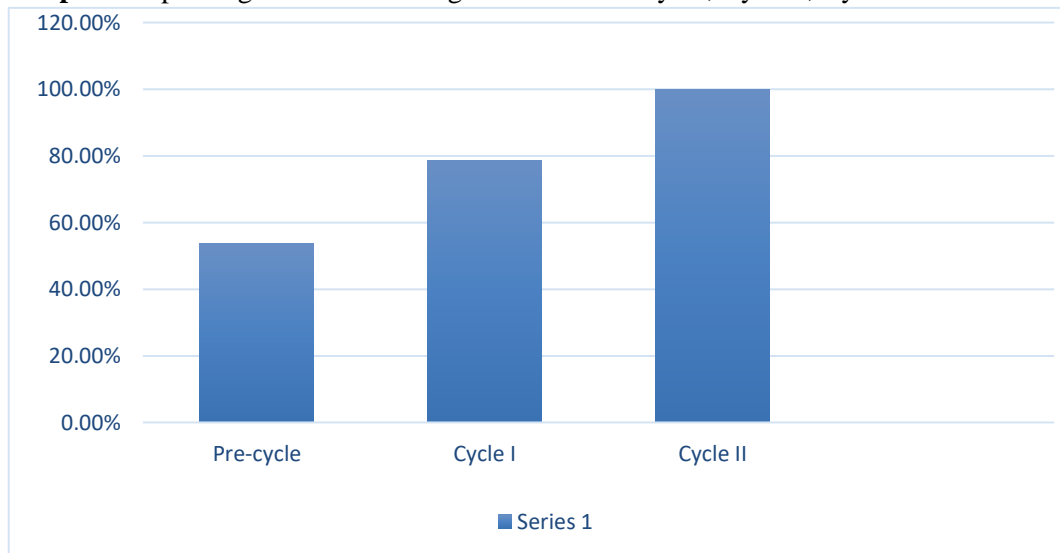
According to research, the cognitive capacities of elementary school students are at a concrete level, making it difficult for them to retain the abstract knowledge they encounter in mathematics. That mathematics is the study of abstract structures and the relationships between them can be understood in Subarinah's (2006) definition of the subject. The same can be said for physical seconds. In reality, you may find material units of time used each day. Teaching students the right units of time is essential for their accurate understanding of concepts. Focusing on Problems The goal of unit-time teaching is to help students make connections between the abstract mathematical concepts they are learning and the concrete ways of thinking they are still developing.

The information provided shows that second graders at Yos Sudarso Elementary School can benefit from using the Problem-Based Learning learning paradigm. Not only cognitive abilities were improved, but also emotional and physical skills in this study. Students are expected to take greater initiative in the problem-solving process while using a problem-based learning methodology. Second-grade students at SD Yos Sudarso Purwakarta for the 2022–2023 academic year will benefit from applying the Problem-Based Learning learning paradigm because it will facilitate and offer hands-on experience to students and teachers, making the information taught to them more relevant and relevant. interesting.

4. CONCLUSION

Applying the Problem Based Learning learning model in the classroom has been shown to increase student engagement and learning outcomes in mathematics. This is achieved through four principles of the model: introducing students to the problem at hand, asking them to listen to the teacher's explanation of the problem at hand, getting students organized to learn so they are ready to face the task at hand, and finally guiding individuals. and group investigations so that students can gather information through experimentation. The results showed that the proportion of active students increased from 21.42% (or as many as 6) in the pre-cycle to 53.57% (or as many as 15) in cycle I and to 78.57% (or as much as 22) in cycle II.

Pre-cycle results showed 53.57% or as many as 15 students achieved KKM; the results of the cycle I showed 78.57% or as many as 22 students; the results of cycle II showed that all students had successfully reached the KKM. This shows the usefulness of the research conducted at SD

YOS Sudarso Purwakarta only.

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