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Improving Learning Outcomes through Problem Based Learning (PBL) in Data Presentation for Elementary School Students

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Abstract

The learning outcomes of fifth-grade students at Muhammadiyah Elementary School Sumberejo, particularly in mathematics, remain relatively low. This is due to the use of learning models that lack variety and still rely heavily on the lecture method. Consequently, student engagement in the learning process is low. This study aims to implement the Problem Based Learning (PBL) model on data presentation to improve learning outcomes for fifth-grade students at Muhammadiyah Elementary School Sumberejo. We employed Classroom Action Research (CAR) as the research method, involving 20 fifth grade students comprising 9 male and 11 female as the research subjects. Data were collected using written test and observation. The collected data were the analyzed using descriptive-comparative method. The results revealed a significant increase in learning outcomes, with mastery levels rising from 30% in the pre-cycle to 100% in cycle II. These findings suggest that PBL is an effective model for improving student engagement and learning outcomes, offering valuable insights for educators seeking to enhance mathematics instruction at the elementary school level.

Keywords: Data Presentation; Elementary School Teaching Strategies; Mathematics Learning Outcomes; Problem Based Learning.

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INTRODUCTION

Mathematics plays a vital role in developing students logical, analytical, and critical thinking skills (Surat, 2016). Mathematics involves abstract concepts, requiring students to apply their problem-solving abilities (Eismawati et al., 2019). Therefore, the learning process starts from the simplest concepts to more complicated concepts (Trisnani, 2022). This learning process is accompanied by an increase in the ability and way of thinking possessed by students. This makes mathematics a subject that must be taught at all school levels, including elementary school (Rahmaini & Chandra, 2024).

At the elementary school level, one of the essential competencies students are expected to master is data presentation. This topic teaches students to collect, process, and present data using pictograms, tables, and bar charts (Faradilla et al., 2021). It also helps students develop logical thinking, draw conclusions, and communicate data effectively (Izzah & Azizah, 2019). Consequently, data presentation supports the development of numeracy literacy and forms a foundation for understanding statistic at more advanced levels (Andani et al., 2021).

Despite its importance, many students struggle with data presentation due to challenges in understanding abstract concepts and visualizing quantitative information (Andrianti et al., 2016). A study by Zahro et al (2024) revealed that students often have trouble grasping arithmetic concepts, remembering the steps for constructing bar charts, and accurately interpreting complex data sets. These difficulties have an impact on students' low learning outcomes, especially in cognitive aspects related to data interpretation (Shahira et al., 2025). The low learning outcomes are influenced not only by internal student factors, but also by teaching methods that tend to be monotonous, making the learning process less engaging and decreasing student's interest and attention (Cahyani et al., 2023).

These mathematics learning problems are further supported by interviews and initial observations conducted in the fifth-grade class at Muhammadiyah Elementary School Sumberejo. The findings indicate that most students struggle to understand the concept of data presentation, as seen in their low participation during lessons and frequent inaccuracies ehen answering related questions. The teaching methods used are not varied and rely heavily on textbooks, resulting in predominantly one-way instruction with limited student engagement. If left unaddressed, this situation could negatively affect student's learning outcomes.

This problem can be addressed by implementing the Problem based Learning (PBL) model. This model is designed to encourage critical thinking, increase active participation, and develop student's problem-solving skills (Ariyani & Kristin, 2021; Kotto et al., 2022). Jaswadi & Damayani (2025) define PBL as learner-centered approach focused on real-world problems that fosters analytical thinking and collaboration. In this model, teachers act as facilitators, guiding students through investigation, discussion, and problem-solving (Narsa, 2021). PBL encourage teamwork, multiple perspectives, and the use of credible learning resources (Navitri et al., 2025). Consequently, students become more active learners and improve their ability to express mathematical ideas clearly and confidently (Yasmini, 2021; Khakim et al., 2022).

Various studies have shown the success of implementing the Problem based Learning (PBL) model in mathematics education at the elementary school level. Astuti et al (2021) found that PBL enhances students' confidence and engagement while helping teachers tailor learning strategies to student characteristics. Zainal (2022) further showed that PBL fosters high-order thinking skills through investigation, problem-solving, and solution presentation. Furthermore, Ardanari et

al (2024) stated that PBL effectively improves conceptual understanding, mastery of the material, and creates a more inclusive.

These findings indicate the great potential of the PBL model to improve the quality of mathematics learning. However, the application of PBL specifically to the topic of data presentation at the elementary school level is still rarely studied. In fact, the topic of data presentation requires a deep conceptual understanding, logical thinking skills, and effective data communication (Widyastuti & Airlanda, 2021; Sihaloho & Saragih, 2024). The PBL model is expected to encourage critical thinking and problem-solving through real-world challenges, which can help students become more engaged and better understand data presentation (Arba'atussholihah & Saepuloh, 2025). Therefore, it is important to further investigate the implementation of PBL in this topic.

Based on interviews with fifth-grade teachers at Muhammadiyah Elementary School Sumberejo, it was found that the PBL model has never been applied in mathematic learning, including in the topic of data presentation. This situation indicates a need to address this gap through research. Therefore, this study aims to implement the Problem Based Learning (PBL) model on the topic of data presentation to improve the learning outcomes of fifth-grade students at Muhammadiyah Elementary School Sumberejo.

METHOD

This study is a type of research is Classroom Action Research (CAR) that employs Stinger 's model (2007), which consists of three stages : look, think, and act (Utomo et al., 2024). The research was conducted collaboratively between the researcher and classroom teachers in grade V at Muhammadiyah Elementary School Sumberejo during the even semester of the 2024/2025 academic year. The research subjects comprised 20 fifth-grade students (9 males and 11 females), selected through purposive sampling due to the class's relevance to the research focus.

The research process was carried out in two cycles. The Look stage began with observations to identify issues. In the Think stage, researcher and teacher designed solutions through the implementation of the Problem Based Learning (PBL) model. During the Act stage, the learning activities were implemented in the classroom, and the results from one cycle were used to inform the planning of the subsequent cycle (Suhaity, 2023). The research design flow implemented is presented in Figure 1.

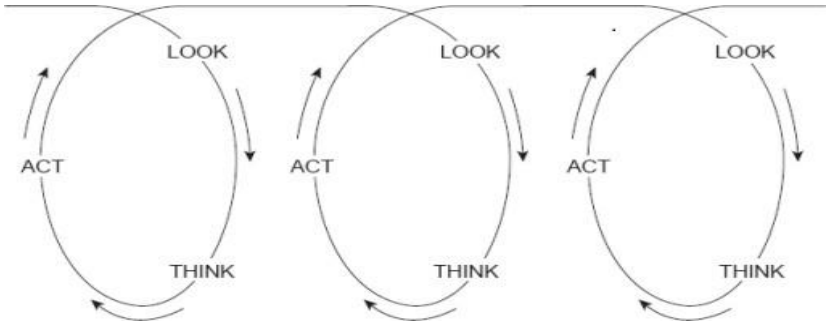


Figure 1. Flow of Stringer model classroom action research (Yaumi, 2014).

Data collection instruments included written test and observation sheets. The written test consisted of multiple-choice questions designed to assess students' learning outcomes on data presentation material. Meanwhile, the observation sheets were used to evaluate student engagement, such as active questioning and group collaboration. The instruments had been validated beforehand.

The data were analyzed using a descriptive-comparative method by comparing the percentage of students who achieved mastery learning in the pre-cycle, cycle I, and cycle II. The research was considered successful if 100% of the students met the mastery learning criteria (Hidayati et al., 2021).

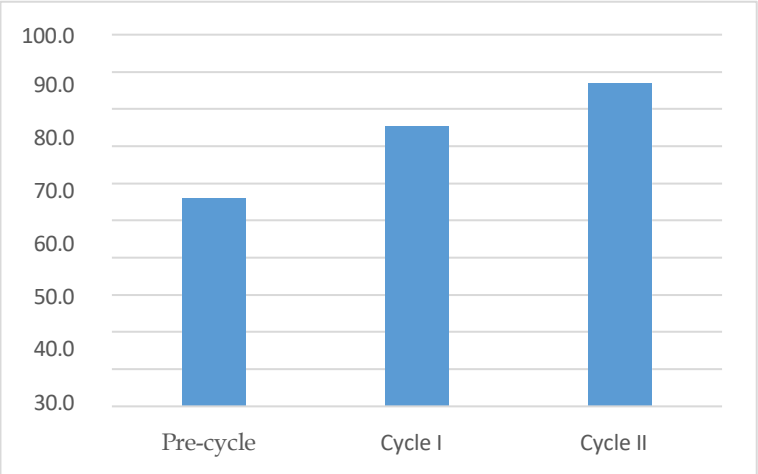
RESULTS AND DISCUSSION

The implementation of the Problem Based Learning (PBL) approach on data presentation material for grade V students at Muhammadiyah Elementary School Sumberejo in the 2024/2025 academic year was carried out in two cycles, each consisting of a single lesson. All teaching activities were aligned with the lesson plans developed in advance. Adjustments to the steps of the PBL model were made in each cycle, informed by reflection and evaluations from the previous cycle's outcomes. Before implementing cycle I and II, the researcher first conducted pre-cycle observations with the aim of facilitating the analysis of research results between before implementing the action (pre-cycle) and after implementing the action (cycles I and II).

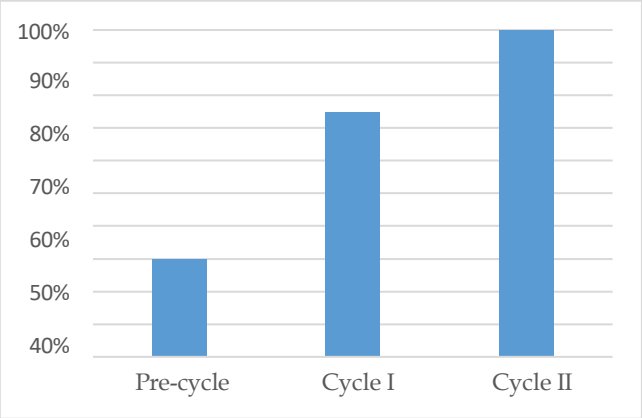
The summary of student learning outcomes in mathematics learning from the pre-cycle stage, cycle I to cycle II is presented in the following table.

Table 1. Recapitulation of Research Results

No.	Criteria	Type of Action			Category.
		Pre test	Cycle I	Cycle II	
1.	KKM score	70,0	70,0	70,0	Increased
2.	Average score	56,0	75,5	87	Increased
3.	Learning completeness	30%	75%	100%	Increased
4.	Many students	6	15	20	Increased
5.	Incomplete learning	70%	25%	0%	Increased
6.	Many students	14	5	0	Increased



Graph 1. Average score of students



Graph 2. Percentage of Completion of Learning Outcomes

During the pre-cycle phase, the researchers administered a pre-test to assess the students initial comprehensions of the data presentation material. Additionally, the pre-test results served as a baseline to evaluate any improvements in student learning outcomes following the implementation of the PBL approach. Based on table 1, it is known that the learning outcomes of students in the pre-cycle of 20 students are 6 students (30%) who are declared complete and 14 students (70%) are declared incomplete. The average classical score obtained is still low category, namely 56.0. This result indicate that most students do not yet understand the material on data presentation. This is due to a lack of motivation to learn as well as the suboptimal delivery of the material that has been taught previously. This obstacle results in students' poor absorption of the material being studied.

Furthermore, researchers carried out cycle I by implementing the PBL model in the learning process. Based on table 1, information was obtained that in cycle I learning completeness experienced a significant increase where there were 15 (75%) students who were declared complete and 5 students (25%) were declared incomplete. The average classical score also increased to 75.5. This increase shows that the implementation of the PBL learning model is able to improve students' understanding and learning outcomes on data presentation material. In cycle I, the percentage of learning completeness has not reached 100% so the researcher concluded that it is necessary to do cycle II in the hope of getting better grades and achieving this completeness.

In cycle II, student's learning outcomes showed a continued and significant improvement. All students (100%) achieved the minimum mastery criteria, with the class average increasing to 87. This improvement reflects the effectiveness of the adjustment made after cycle I, particularly in group coordination and focused teacher guidance. These changes contributed to better student performance and understanding. The steady increase in both mastery levels and average scores from the pre-cycle to cycle II demonstrates not only the success of the intervention but also the sustained impact of the PBL model. These findings reinforce that PBL model, when implemented with structured planning and reflective revisions, can effectively enhance student's academic achievement.

Before the pre-cycle phase, students had received data presentation material from the math teacher, but the learning was still using the lecture model. During the pre-cycle phase, a pretest was administered to assess student's initial

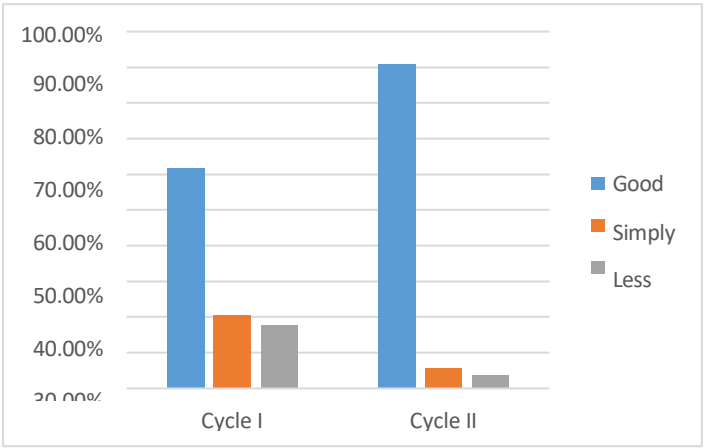
understanding before the implementation of PBL learning (Susriyati & Yurida, 2019). The pretest consisted of multiple choice items related to data collection and presentation. The results revealed that student's learning outcomes were still low, with the most not reached learning completeness. These results are based on data obtained showing that the average pretest score of students is still low, namely 56.0. Of the 20 students, only 6 students managed to achieve the minimum passing grade. This problem became the basis for conducting classroom action research (CAR) to improve learning outcomes in data presentation material at Muhammadiyah Elementary School Sumberejo.

After the implementation of PBL in learning, learning completeness increased significantly in cycle I where 25 (75%) students were declared complete. The classical average score also increased. However, because it had not reached 100% learning completeness, the researcher decided to continue the learning to cycle II. In cycle II, the classical average score further increased and learning completeness had reached 100% which meant that all students had been declared complete. Based on these observations, it can be concluded that the PBL model is an effective method to improve the learning outcomes of data presentation material. The results of this study are in line with previous research Dewi et al (2021) that the application of the problem-based learning model can improve student learning outcomes and transform passive learning conditions into active ones. These results are also supported by other studies that show the application of the problem-based learning model can significantly improve student motivation and learning outcomes (Arifin et al., 2024).

This research does not only use tests, but also observation of students carried out by the class teacher. This observation aims to measure the level of activeness of students during the learning process. This activeness can be measured from the frequency of students to ask and answer questions from the teacher, as well as their enthusiasm and involvement in working on problems in groups. The observation results can be seen in the following table and graph.

Table 2: Learner Activity

Description	Good liveliness	Enough liveliness	Lack of liveliness
Cycle I	61,72%	20,56%	17,72%
Cycle II	90,76%	5,67%	3,57%



Graph 3. Learner's Activeness

The data presented in the table and graph above illustrates the level of student activity during cycle I, showing that there are 61.72% of participants who are in the good category, 29.56% are sufficient category, and 17.72% are in the less category. While in cycle II it shows that there are 90.76% of students who are in the good category, 5.67% are sufficient, and 3.57% are less. Based on these results, it can be seen that the activeness of students has increased in cycle II. The students showed a high collaboration in completing the student worksheet assigned by the teacher accurately. Moreover, they showed great enthusiasm when presenting the outcomes of their group discussions in front of the class. So that when working on *post test* questions at the end of cycle I and II students' learning outcomes and student activeness increased. This shows that the implementation of PBL on data presentation material achieved success.

The results of this study indicate that the application of the Problem-Based Learning (PBL) model to data presentation material in grade V at Muhammadiyah Sumberejo Elementary School successfully improved student learning outcomes and participation. This success was supported by systematic improvements made in each cycle based on the results of previous evaluations. The results of this study are also supported by other studies that present work results, analyze, and evaluate the problem-solving process. The application of the PBL learning model can improve students' mathematics learning outcomes (Sriwati, 2021). Other studies also state that the application of the problem-based learning model can provide opportunities for students to connect existing knowledge with new knowledge to be learned, increase student activity in the learning process, achieve meaningful learning, enhance students' self-confidence, and develop learning concepts tailored to students' characteristics (Astuti et al.,2021) Furthermore, teachers are expected to apply the problem-based learning model to teach other subjects. Additionally, it is also recommended that all teachers facilitate their students in implementing learning using the problem-based learning model.

CONCLUSION

Based on the research results and analysis, it can be concluded that the implementation of the Problem Based learning (PBL) model effectively improves the learning outcomes of fifth-grade students at Muhammadiyah Elementary School Sumberejo in the topic of data presentation. This is evidenced by the increase in average class scores and the percentage of learning mastery from an initial average of 56,0 with 30% learning mastery in the pre-cycle, rising to 75,5 with 75% learning mastery in Cycle I, and finally reaching an average of 87 with 100% learning mastery in Cycle II. Furthermore, observation results indicate that student engagement during the PBL process was in the good category. Based on these findings, PBL is effective to improve student engagement and learning outcomes, and offers valuable insight for improving elementary mathematics instruction.

RECOMMENDATION

Future studies are encouraged to apply the Problem Based Learning (PBL) model to broader mathematical domains and across different grade levels to further investigate its consistency and long-term impact on student learning outcomes. Expanding the implementation to varied classroom settings may also reveal contextual factors influencing effectiveness, particularly related to student readiness, teacher facilitation skills, and availability of learning resources. Researchers should also consider integrating digital tools or multiliteracy approaches to strengthen student engagement, especially when addressing obstacles such as limited prior knowledge and varying levels of student activeness that may affect the overall success of PBL implementation.

Author Contributions

Conceptualization, Miftahul Hasanah and Dias Novita; methodology, Miftahul Hasanah; validation, Miftahul Hasanah, Dias Novita, Setia Rahmawan, and Istiqomah; formal analysis, Setia Rahmawan; investigation, Istiqomah; resources, Dias Novita; data curation, Setia Rahmawan; writing—original draft preparation, Miftahul Hasanah; writing—review and editing, Setia Rahmawan; visualization, Istiqomah; supervision, Setia Rahmawan; project administration, Dias Novita. All authors have read and agreed to the published version of the manuscript.

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Conflict of interests

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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