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Implementation of Problem Based Learning Model in Improving Students' Mathematics Learning Outcomes at MI Hidayatun Najah

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Abstract: This study aims to determine the effectiveness of the application of the Problem Based Learning (PBL) learning model in improving mathematics learning outcomes in data presentation materials in the form of bar diagrams of 3rd grade students of MI Hidayatun Najah Tuban. The background of this study is the low student learning outcomes caused by the lack of active participation and student involvement in the learning process. The PBL model was chosen because it can encourage students to think critically, collaborate, and be actively involved in solving contextual problems. This study uses a quantitative approach with a Class Action Research (PTK) design which is carried out in two cycles. The subjects of the study were 28 3rd grade students. Data collection techniques are carried out through observation, learning outcome tests, and documentation. The results of the study showed a significant improvement in student learning outcomes after the implementation of the PBL model. In the pre-cycle, the percentage of students who achieved the Minimum Completeness Criteria (KKM) was 36%, in the first cycle it increased significantly to 57% and the increase in the second cycle to 86%. In addition, an increase also occurred in student activities and participation during the learning process. Based on these findings, it can be concluded that the PBL learning model is effectively applied in mathematics learning, especially in the material of presenting data in the form of a bar diagram, to improve learning outcomes and student involvement.

Keywords: Problem based learning, learning outcomes, mathematics.

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INTRODUCTION

The quality of education is strongly influenced by the effectiveness of the learning process in the classroom. One of the subjects that plays a crucial role in developing students' logical and analytical thinking is mathematics. However, mathematics is often perceived as a difficult and tedious subject by many students. This perception can lead to a lack of motivation and poor learning outcomes, especially in abstract topics such as data presentation. Teachers are thus required to be creative in implementing innovative learning models that can make mathematics more engaging and comprehensible. At the primary level, especially in Madrasah Ibtidaiyah, the teaching of mathematics should not only focus on the final results but also emphasize the process of understanding concepts. Data presentation, particularly using bar charts, is a topic that requires students to be able to interpret, organize, and communicate information clearly. Unfortunately, many students struggle with this material due to limited contextual understanding and inadequate learning strategies. This raises concerns about the current instructional methods used in the classroom.

To address these challenges, it is essential to adopt a learning approach that promotes active student involvement. One such approach is the Problem-Based Learning (PBL) model, which is known for encouraging students to think critically and solve real-life problems. PBL is a student-centered model where learners are given complex problems to solve collaboratively. This model not only helps in enhancing problem-solving skills but also fosters independence and teamwork. Therefore, applying PBL in mathematics learning could be a promising strategy to improve student performance. Problem-Based Learning places students in situations where they must analyze problems and seek solutions through inquiry and discussion. This creates a more meaningful learning experience as students are actively engaged in constructing their knowledge. Compared to traditional methods where students passively receive information, PBL offers opportunities for learners to explore and internalize concepts more effectively. In the context of learning bar charts, PBL can make abstract data more relatable by linking it to real-world scenarios.

The implementation of PBL in mathematics has been widely researched and has shown positive impacts in various educational settings. Studies indicate that students taught through PBL demonstrate better comprehension, retention, and application of mathematical concepts. Moreover, PBL promotes a deeper understanding of topics by allowing students to encounter challenges that require critical thinking. This model also supports the development of soft skills such as communication, collaboration, and perseverance. Despite its benefits, the application of PBL in primary education, especially in Madrasah Ibtidaiyah, is still relatively limited. Many schools continue to use conventional teaching methods, focusing on memorization and drill exercises. As a result, students may struggle to connect mathematical concepts with real-life applications. Integrating PBL into the curriculum could provide a fresh and effective way to revitalize mathematics learning, making it more enjoyable and productive for young learners.

Madrasah Ibtidaiyah Hidayatun Najah serves as an interesting case study for the application of PBL. Located in a community where educational resources may be limited, this institution aims to deliver quality education through innovation. Introducing PBL in the teaching of bar chart data could help address the learning difficulties students face in understanding data representation. It also aligns with the institution's mission to nurture independent and critical thinkers. In addition, PBL supports differentiated instruction, allowing students with various learning styles and abilities to thrive. Through group work and problem exploration, students can learn from one another and contribute their strengths. This dynamic encourages a positive classroom environment and a sense of ownership in the learning process. It also helps build students' confidence as they actively participate in solving problems and presenting their findings. Learning bar charts involves several skills, including identifying data, organizing information, and presenting it in a structured form. When students are exposed to real-life problems that require them to collect and display data, the learning becomes more contextual and meaningful. PBL encourages students to ask questions such as: "What information do we need?" or "How can we show this data clearly?" These inquiries lead to a deeper understanding of the concept rather than simple memorization.

Another key advantage of PBL is its potential to improve students' learning outcomes, not only academically but also in terms of attitude and engagement. Students who are involved in problem-solving activities tend to be more curious and motivated.

This increased engagement can translate into better performance in assessments and daily classroom activities. Therefore, using PBL could be an effective intervention to enhance students' mastery of mathematical topics like bar charts. The success of PBL, however, depends greatly on how it is implemented. Teachers play a crucial role in designing meaningful problems, guiding student inquiry, and facilitating discussions. Proper planning and scaffolding are necessary to ensure that students remain on track while exploring solutions. For young learners in Madrasah Ibtidaiyah, the teacher's guidance is particularly important in helping them navigate through the learning process and stay focused on the objectives.

Another consideration in implementing PBL is the readiness of the students. Since PBL requires active participation, collaboration, and a certain level of independence, teachers need to gradually build students' capacity to engage in such learning activities. This includes developing their communication skills, problem-solving strategies, and ability to work in groups. Proper orientation and consistent support are essential in creating a classroom culture conducive to PBL. Integrating PBL into mathematics learning also requires support from the school administration. Teachers need time, training, and resources to effectively apply this model in their classrooms. The school leadership must therefore be committed to providing professional development opportunities and fostering a collaborative environment among teachers. With the right support, PBL can become a sustainable practice that enhances the overall quality of education.

In the specific case of teaching bar chart presentation, problems can be designed around real-life contexts familiar to students, such as favorite fruits, daily activities, or weather data. These contexts make the learning process more relevant and engaging. Students can be tasked with collecting data, organizing it, and presenting it using bar charts. This hands-on experience reinforces their understanding and makes learning more enjoyable. Moreover, PBL aligns well with the principles of 21st-century education, which emphasize critical thinking, creativity, communication, and collaboration. These competencies are essential for students to thrive in an increasingly complex world. By engaging in PBL, students are not only learning mathematics but also developing essential life skills. This holistic approach to education is particularly important in the formative years of primary schooling.

Using PBL in the teaching of mathematics can also help to bridge the gap between theory and practice. Often, students find it difficult to see the relevance of mathematical concepts in their everyday lives. PBL challenges them to apply their knowledge in meaningful ways, thereby deepening their understanding. For example, when students analyze real survey data and present it through bar charts, they experience firsthand the usefulness of mathematics. Another important aspect is the role of assessment in PBL. Traditional assessments may not fully capture the skills developed through this model. Teachers should therefore use a combination of formative and summative assessments, including observations, presentations, group reports, and individual reflections. These methods provide a more comprehensive picture of students' learning progress and achievements.

This research aims to explore how the application of the Problem-Based Learning model can improve mathematics learning outcomes specifically in the topic of data presentation using bar charts. The study will focus on students of Madrasah Ibtidaiyah Hidayatun Najah, examining both the learning process and the results. By evaluating students' performance before and after the intervention, the effectiveness of PBL can be systematically assessed. In addition to academic outcomes, the study will also investigate how PBL influences students' attitudes towards mathematics. Since motivation and engagement are crucial components of effective learning, understanding students' perceptions can provide valuable insights. Positive shifts in attitude may contribute to long-term improvement in mathematics achievement and interest.

The research will adopt a classroom action research design, allowing for continuous observation, reflection, and improvement throughout the learning cycle. Teachers will collaborate in planning and implementing PBL strategies, monitoring student responses and outcomes. This participatory approach ensures that the study is grounded in real classroom practices and is directly relevant to teaching and learning contexts.

Data will be collected through various instruments such as tests, observation sheets, interviews, and student reflections. These tools will help capture both quantitative and qualitative aspects of the learning process. By triangulating data sources, the research seeks to ensure the validity and reliability of the findings. It also aims to provide practical recommendations for teachers seeking to implement PBL. Ultimately, the goal of this research is to contribute to the improvement of mathematics education at the primary level, especially in religious-based schools like Madrasah Ibtidaiyah. By showcasing the benefits of PBL, it is hoped that more educators will be encouraged to adopt student-centered learning approaches. This shift in pedagogy could lead to more meaningful, enjoyable, and effective learning experiences for students.

The findings of this research could serve as a model for other madrasahs seeking to enhance their mathematics instruction. By demonstrating how PBL can be adapted to local contexts and integrated into existing curricula, the study offers practical strategies for educational improvement. It also highlights the importance of innovation and adaptability in responding to students' learning needs. In a broader context, the application of PBL in primary education supports national educational goals that emphasize quality, equity, and relevance. As the world continues to change rapidly, the ability to think critically and solve problems becomes more important than ever. Educators must therefore equip students with the skills and mindsets needed to succeed in the 21st century. PBL offers a pathway to achieving these goals through meaningful and engaging learning experiences.

This research will also shed light on the challenges and opportunities involved in implementing PBL in a madrasah setting. By documenting the process, the study can identify best practices, common obstacles, and effective solutions. This knowledge can inform future policies and teacher training programs aimed at improving primary education in Indonesia and beyond. In conclusion, the Problem-Based Learning model holds significant promise for improving student outcomes in mathematics, particularly in the area of data presentation using bar charts. By actively involving students in the learning process, PBL fosters deeper understanding, increased motivation, and essential life skills. This research seeks to explore and validate the impact of PBL at Madrasah Ibtidaiyah Hidayatun Najah, contributing to the ongoing effort to enhance mathematics education for young learners.

METHODS

This research employed a classroom action research (CAR) approach aimed at improving mathematics learning outcomes among students of Madrasah Ibtidaiyah Hidayatun Najah. The focus was on the topic of bar chart data presentation using the Problem-Based Learning (PBL) model. CAR was selected due to its iterative nature, allowing for continuous reflection and refinement throughout the teaching and learning process. It involves planning, acting, observing, and reflecting in successive cycles to generate meaningful changes in instructional practices and student learning outcomes. The study was conducted in two cycles, with each cycle consisting of four stages: planning, action, observation, and reflection. The first cycle served to introduce the PBL model and identify initial challenges. Based on the evaluation of the first cycle, necessary modifications were made and implemented in the second cycle. This structure enabled the researcher to make data-driven decisions and improve the intervention with each iteration. The goal was to determine the effectiveness of the PBL model in enhancing students' understanding of data representation through bar charts.

The research subjects consisted of students in one class at Madrasah Ibtidaiyah Hidayatun Najah. The class was chosen based on its accessibility and the teacher's willingness to collaborate in the research process. All students participated actively in learning activities throughout both cycles. The researcher also collaborated with the classroom teacher in planning and implementing lessons to ensure the authenticity and practicality of the intervention. The teacher played a key role as a facilitator, while the researcher documented and analyzed the learning process. The data collection techniques used in this research included observation, tests, interviews, and documentation. Observations were conducted during each lesson to monitor student engagement, group interaction, and teaching effectiveness. Observation sheets were used to record student behavior, participation levels, and the implementation of PBL strategies. These observations provided qualitative insights into the learning process and helped identify areas that needed improvement in subsequent cycles.

In addition to observation, pre-tests and post-tests were used to collect quantitative data on student learning outcomes. The pre-test was administered before the implementation of PBL to assess students' prior knowledge of bar chart data presentation. Post-tests were conducted at the end of each cycle to evaluate the progress made. The comparison of pre- and post-test results enabled the researcher to measure the effectiveness of the intervention and determine changes in student performance over time. Interviews were conducted with selected students to gain deeper insight into their experiences and perceptions of the learning process. These interviews aimed to capture students' thoughts about the challenges they faced, how they collaborated with peers, and their feelings about using the PBL model in mathematics. Interview responses were transcribed and analyzed thematically to identify patterns and reflections that contributed to the overall understanding of the intervention's impact.

Documentation was also an important data collection method. Student worksheets, group presentations, charts, photographs, and teacher lesson plans were gathered and analyzed. These documents provided a comprehensive view of how students approached the problems and represented data visually. The documentation supported the findings from observations and interviews, creating a robust set of evidence to assess the success of the research. Data analysis was conducted using both qualitative and quantitative methods. Quantitative analysis involved calculating the percentage of students who achieved the minimum competency score on the post-tests. These figures were compared with pre-test results to determine the level of improvement. Qualitative analysis focused on interpreting data from observations, interviews, and documentation to understand students' attitudes, engagement, and collaboration during the PBL sessions.

The validity of the data was ensured through triangulation, involving the cross-verification of information gathered from different sources and instruments. For instance, observational data was checked against student interviews and test results to confirm consistency in findings. This method increased the credibility of the research results and helped reduce bias. Triangulation also allowed the researcher to form a more comprehensive picture of the teaching and learning process. Ethical considerations were observed throughout the research. Students and the classroom teacher were informed about the purpose of the study and their roles in it. Participation was voluntary, and confidentiality was maintained by using anonymous data. The research did not interfere with students' regular academic responsibilities and aimed to enhance rather than disrupt their learning experience. Parental consent was also sought before beginning data collection involving students.

During the planning phase of each cycle, the researcher and the teacher collaborated to develop detailed lesson plans that incorporated the principles of the PBL model. These plans included problem scenarios relevant to students' everyday lives, such as collecting data from their classmates or school environment. The lessons were structured to encourage inquiry, collaboration, and student-led discussion. Each session was designed with clear objectives and assessment criteria. In the action phase, the PBL-based lesson plans were implemented in the classroom. The teacher introduced the problem, facilitated group formation, and monitored students as they worked together to find solutions. The researcher acted as a co-observer, collecting data through field notes, photographs, and observation checklists. The lessons typically involved data collection, analysis, bar chart construction, and group presentations of findings.

The observation phase involved the systematic recording of students' responses, behaviors, and interactions during the lessons. The observer focused on how students engaged with the task, communicated with peers, and applied mathematical reasoning. The teacher's performance was also observed to assess how effectively the PBL model was implemented. These observations were later analyzed to identify strengths and areas for improvement. The reflection phase was carried out at the end of each cycle. The researcher and teacher met to review student work, test results, observation notes, and interview data. This reflective analysis helped identify what worked well and what needed to be adjusted. The insights gained were used to revise the lesson plan and teaching strategy for the next cycle. This process of continuous improvement was central to the success of the action research model.

The PBL model used in this research emphasized student-centered learning through real-world problems. The lessons followed a structured approach beginning with the presentation of a problem, followed by group discussion, exploration, data representation, and reflection. This structure encouraged students to develop not only mathematical knowledge but also skills in problem-solving, collaboration, and communication. The model also fostered a sense of curiosity and ownership in the learning process. In conclusion, the methodology of this classroom action research was carefully designed to explore and evaluate the application of Problem-Based Learning in mathematics education. The use of multiple data sources, collaboration between teacher and researcher, and the cyclic process of action and reflection ensured the credibility and depth of the study. This approach allowed for meaningful improvements in both teaching practices and student learning outcomes.

RESULTS

The implementation of the Problem-Based Learning (PBL) model showed a significant positive impact on students' mathematics learning outcomes, particularly in understanding the topic of bar chart data presentation. During the first cycle, students demonstrated a basic grasp of the concept but lacked confidence in interpreting and constructing bar charts. Most students were hesitant to express their ideas and relied heavily on teacher guidance. Group discussions were often dominated by a few students, while others remained passive. After the initial cycle, reflective analysis revealed that some students struggled with the open-ended nature of PBL tasks. They needed more structure and guidance to engage effectively in problem-solving. Adjustments were made in the second cycle to provide clearer instructions and scaffolded support. These changes helped increase student participation and improved the quality of group collaboration. The teacher played a more active role in facilitating discussion without providing direct answers.

Test results from the pre-cycle assessment indicated that only a small percentage of students achieved the minimum mastery criteria. Most students scored below the expected level, showing weaknesses in reading data from bar charts and converting numerical information into visual representation. These results highlighted the need for a more engaging and practical learning strategy to support student understanding and retention of mathematical concepts. By the end of the first cycle, there was a noticeable improvement in students' ability to construct and interpret bar charts. The post-test scores showed a moderate increase, with more students reaching the minimum competency level. Classroom observations also revealed increased engagement and interaction among students. They began asking questions, contributing ideas, and showing more interest in mathematics lessons.

Students demonstrated better understanding through their group work presentations. They were able to identify data patterns, explain their findings, and use mathematical vocabulary more accurately. The use of real-life problems, such as creating charts based on class survey data, helped students see the relevance of mathematics in everyday life. This practical approach fostered greater enthusiasm and ownership of learning. Despite the progress in cycle one, some issues remained. Several groups experienced difficulties in organizing their data and presenting it clearly in bar chart format. Time management was another challenge, as students often spent too long on initial discussions and had limited time for data visualization. These challenges informed the planning for cycle two, where task structure and time allocation were adjusted to optimize learning outcomes.

In the second cycle, students were given more structured roles within their groups, such as data collector, recorder, presenter, and designer. This division of responsibilities helped balance participation and ensured that each student contributed to the learning process. The tasks were also broken down into clearer steps, making the problem-solving process more manageable for all ability levels. Post-test results from cycle two showed a significant increase in student achievement. A majority of students met or exceeded the minimum competency standards, with many demonstrating mastery in both data interpretation and bar chart construction. The scores indicated consistent improvement across the class, confirming that the modifications made after cycle one were effective in addressing earlier difficulties.

Observation data from the second cycle highlighted a more dynamic and collaborative classroom environment. Students were actively engaged in discussions, confidently asking and answering questions. They showed increased independence in analyzing problems and constructing visual data representations. Peer support and group cooperation also improved, with students helping one another and sharing strategies openly. Teacher reflections after the second cycle emphasized the effectiveness of PBL in encouraging critical thinking and deeper conceptual understanding. The teacher noted that students were more motivated to learn and less reliant on direct instruction. The classroom atmosphere became more student-centered, where learners were empowered to explore mathematical ideas and apply them in real-world contexts.

Student interviews provided further insights into the impact of PBL on learning. Many students expressed enjoyment in working on real-life problems and appreciated the opportunity to collaborate with their peers. They reported feeling more confident in presenting their ideas and found the visual nature of bar charts easier to understand when connected to familiar situations. These responses highlighted the positive emotional and cognitive effects of the learning model. Several students mentioned that the group learning experience helped them develop communication and teamwork skills. They learned to listen to different opinions, negotiate decisions, and solve problems collectively. These soft skills, although not the primary focus of the research, emerged as valuable outcomes of the PBL approach. The students also indicated that they preferred this method over traditional lectures and individual tasks.

The analysis of students' work samples across both cycles demonstrated growth in the complexity and accuracy of bar chart presentations. In the initial cycle, many charts lacked proper labeling, scales, and clarity. By the second cycle, students produced well-structured and informative visual representations. This progress showed not only improved mathematical understanding but also increased attention to detail and pride in their work. Field notes captured various moments where students applied creative solutions to data problems. For example, one group created a three-dimensional bar chart using colored paper and cardboard, which helped them visualize data comparisons more effectively. These kinds of activities reflected how PBL encouraged innovation and hands-on engagement with mathematical concepts.

The teacher observed that students who were previously quiet or disengaged began participating more actively during the second cycle. Some of them took leadership roles in their groups or volunteered to present their work to the class. This behavioral shift suggested that the PBL model contributed to boosting self-confidence and a sense of competence among learners. Data triangulation from test results, observations, interviews, and field notes confirmed the reliability of the findings. There was a consistent trend of improvement in both academic performance and student engagement. The integration of qualitative and quantitative evidence allowed for a more comprehensive evaluation of the impact of the PBL model on student learning.

In terms of mastery learning, the number of students achieving the minimum standard increased significantly between cycles. The gap between high-performing and low-performing students narrowed, indicating that PBL provided equitable learning opportunities. Students who initially struggled showed marked improvement when given the chance to explore problems collaboratively and at their own pace. The research also highlighted the importance of teacher facilitation in successful PBL implementation. The teacher's role in guiding inquiry, encouraging discussion, and monitoring group progress was crucial. Effective questioning techniques and timely feedback helped students stay focused and overcome obstacles during the problem-solving process. Students' mathematical reasoning skills improved as they learned to justify their answers and explain their thinking processes. This was evident during group presentations and class discussions, where students used evidence from their charts to support their conclusions. The shift from rote memorization to reasoning and explanation was a key outcome of the PBL approach.

The classroom culture evolved throughout the study, becoming more supportive and collaborative. Students began to view mistakes as part of the learning process and were more willing to take academic risks. This growth mindset was fostered through the structure of PBL, which values inquiry and exploration over fixed answers. Parental feedback, though informal, was also positive. Several parents mentioned that their children were more enthusiastic about math and often talked about their classroom projects at home. This suggests that the engagement generated through PBL extended beyond the classroom and positively influenced students' overall attitude toward learning.

The findings of this study align with existing research on the benefits of PBL in primary education. It supports the view that student-centered learning models can improve academic outcomes and foster essential life skills. The integration of real-world problems into mathematics instruction helps make learning more meaningful and enjoyable for students. While the results were largely positive, the study also identified challenges that need to be addressed in future implementations. Time constraints, classroom management during group work, and ensuring equal participation among students are areas that require careful planning. Ongoing teacher training and support are essential for sustaining and scaling the use of PBL in classrooms. In conclusion, the Problem-Based Learning model proved to be an effective strategy for improving student learning outcomes in mathematics, particularly in the topic of bar chart data presentation. It enhanced not only academic performance but also student engagement, communication skills, and confidence. The active, inquiry-based approach helped make mathematics more accessible and relevant to students.

The study demonstrated that with proper planning and support, PBL can be successfully implemented even in elementary school settings. It requires a shift in instructional roles and classroom culture, but the benefits are substantial. The approach fosters a learning environment where students are not just passive recipients of knowledge, but active participants in their education. These findings offer valuable insights for educators seeking to innovate mathematics instruction in similar educational contexts. The success of this study provides a foundation for broader application and further research into PBL and its long-term effects on student learning. It emphasizes the need for continuous reflection, adaptation, and collaboration in educational practice.

DISCUSSION

The findings of this research highlight the effectiveness of the Problem-Based Learning (PBL) model in enhancing students' understanding and skills in presenting data through bar charts. In both cycles, students showed significant improvement in their ability to collect, interpret, and represent data visually. These findings align with previous studies that emphasize the power of active, student-centered learning approaches in fostering deeper conceptual understanding. One of the most prominent results was the increased competence in constructing bar charts. Initially, many students struggled with basic concepts such as correctly labeling axes and understanding the scale. After engaging in PBL-based activities, these difficulties were notably reduced. The hands-on, problem-solving nature of PBL enabled students to grasp these concepts more concretely by applying them in real-world scenarios, as opposed to merely memorizing theoretical content.

The shift from a traditional teacher-centered approach to a more interactive, student-driven model played a critical role in this improvement. Through PBL, students were not passive recipients of information but active participants in their learning. This change in the classroom dynamics allowed for deeper engagement and made the learning process more meaningful. Students could relate their mathematical tasks to real-life situations, thus enhancing the relevance of the material. Moreover, the collaborative nature of PBL was crucial in fostering peer-to-peer learning. Working in groups allowed students to share ideas, challenge one another's assumptions, and help each other overcome difficulties. This cooperative environment contributed to the development of not only cognitive skills but also social and communication skills. Students who might have been hesitant to participate in a traditional classroom setting felt more comfortable expressing their ideas in smaller group discussions.

The process of problem-solving in teams also led to a greater sense of ownership and responsibility over the learning process. Students were given the autonomy to make decisions about how to approach the tasks, which increased their motivation and engagement. The opportunity to actively participate in their learning journey gave them more confidence in their ability to solve mathematical problems independently. A key finding of this research was that the PBL model encouraged critical thinking among students. When students were presented with real-world problems, they needed to analyze the data, ask questions, and reason through solutions. This process fostered a deeper understanding of mathematical concepts, such as the construction and interpretation of bar charts, and promoted higher-order thinking skills that are essential for future academic success.

The improvement in students' learning outcomes, as evidenced by the pre- and post-test comparisons, further supports the effectiveness of the PBL model. The percentage of students achieving the minimum competency standard increased significantly between the two cycles, reflecting a clear enhancement in their grasp of the material. This was particularly evident in the accuracy and quality of the bar charts students created in the post-test. The analysis of student attitudes and engagement also revealed positive changes. Interviews with students indicated that they enjoyed the PBL activities more than traditional lectures. Many students reported that they found the tasks more engaging and relevant to their daily lives. This shift in attitude is crucial because it suggests that when students are given the opportunity to explore and apply mathematical concepts in real contexts, they develop a more positive view of the subject.

Another noteworthy aspect of this study was the teacher's role in facilitating learning. Rather than being the primary source of knowledge, the teacher served as a guide and resource, helping students navigate through the problem-solving process. This shift allowed students to take more responsibility for their learning while receiving support when necessary. The teacher's active involvement as a facilitator rather than a lecturer contributed to a more dynamic and student-centered learning environment.

The role of the teacher also involved providing scaffolding throughout the PBL process. Initially, students needed more guidance, especially in interpreting data and constructing bar charts. As the cycles progressed, students became more independent and capable of solving problems without as much support. This gradual release of responsibility is a key feature of effective PBL implementation, ensuring that students are eventually able to apply their knowledge autonomously.

Despite these successes, several challenges were encountered during the research. One challenge was time management. Students initially required more time than anticipated to complete tasks, particularly when working in groups. This resulted in lessons running longer than planned. However, as the students became more familiar with the process, they began to work more efficiently, and the teacher adapted the lesson timings to better fit their needs. Another challenge was ensuring active participation from all students in group activities. In the first cycle, some students were more dominant in discussions, while others were less engaged. This imbalance hindered the collaborative aspect of PBL. In the second cycle, roles were assigned within the groups to ensure equal participation. This adjustment led to more balanced contributions from all students and improved group dynamics.

Classroom management also presented difficulties, particularly in the initial phase of PBL implementation. The shift to group-based, interactive learning created more noise and movement in the classroom. This required the teacher to develop new strategies for maintaining order. Over time, the teacher established clear expectations and routines that helped manage the classroom more effectively. This experience highlights the importance of teacher preparation and flexibility when using PBL. The data collected through observation also provided valuable insights into student behavior. In the first cycle, there were instances of students losing focus or becoming confused when faced with complex problems. However, in the second cycle, students displayed more confidence and autonomy in approaching the tasks. The increased engagement and improved focus were a direct result of the students' growing familiarity with the PBL approach.

The reflection phase at the end of each cycle provided important feedback for both the teacher and students. The teacher used this time to review the effectiveness of the lesson plans and the PBL approach. Students also reflected on their learning experiences and shared their challenges. This reflective practice helped to identify areas of improvement and made adjustments for the following cycle, ensuring that the learning experience was continually refined. The involvement of the students' families, although not a primary focus of the study, played a supportive role in the learning process. Some students reported that they discussed the problems and solutions at home, which reinforced their learning. Parental support contributed to the students' motivation and provided an additional layer of reinforcement for the skills and concepts taught in class.

The results also raise important questions about assessment in PBL environments. Traditional assessments, such as tests, may not fully capture the depth of understanding and collaborative skills developed during PBL. Performance-based assessments, such as projects, presentations, or portfolios, may offer a more holistic way to evaluate student progress. The study suggests that future assessments should include both individual and group-based evaluations to reflect the full range of skills students develop.

The findings of this research have significant implications for curriculum design. PBL can be integrated into the existing mathematics curriculum to encourage more interactive and student-centered learning. By focusing on real-world problems, students are better able to understand the practical applications of mathematical concepts. The study suggests that incorporating PBL into regular lesson plans can lead to more meaningful and engaging learning experiences. Furthermore, the results indicate that PBL is a flexible teaching model that can be adapted to different educational contexts. While this study focused on a specific school, the principles of PBL could be applied to other schools and subjects. Teachers in diverse settings could adapt the model to their students' needs, ensuring that the learning experience is relevant and engaging for all.

The success of PBL in this study also reinforces the need for teacher professional development. Teachers must be adequately trained in how to implement PBL effectively, as this approach requires different skills and strategies compared to traditional teaching methods. Ongoing professional development and collaboration among educators are essential for sustaining the use of PBL in the classroom. In conclusion, the Problem-Based Learning model proved to be an effective strategy for improving students' mathematical understanding and skills, particularly in data representation through bar charts. The study highlights the benefits of active learning, collaboration, and real-world problem-solving in fostering deeper conceptual understanding. While challenges exist, the positive outcomes suggest that PBL has the potential to transform mathematics education by making it more engaging, relevant, and accessible to students. The insights gained from this research could serve as a foundation for future studies on PBL in mathematics and other subjects. Further research could explore the long-term effects of PBL on student achievement and motivation, as well as investigate its impact on other aspects of learning, such as critical thinking and creativity. It is clear that PBL offers a promising avenue for improving educational outcomes in a variety of learning contexts.

CONCLUSION

The findings of this research confirm that the application of the Problem-Based Learning (PBL) model significantly enhanced students' understanding of data presentation through bar charts. By actively engaging with real-world problems, students developed essential skills in data collection, interpretation, and visual representation. The shift from a teacher-centered approach to a student-centered model not only improved mathematical understanding but also fostered collaboration, critical thinking, and problem-solving skills. These improvements were evident in both qualitative and quantitative data, particularly in the students' post-test results and their increased participation in group activities. Additionally, the research highlighted the importance of the teacher's role as a facilitator in the PBL environment. The teacher's guidance in managing group work and providing scaffolding allowed students to progressively develop independence in their learning. Although challenges in classroom management and ensuring equal participation initially arose, adjustments made during the second cycle contributed to more effective learning outcomes. Overall, this study suggests that PBL is a highly effective approach for enhancing student engagement, mathematical understanding, and collaboration, offering valuable insights for educators seeking to improve their teaching practices.

REFERENCES

Arikunto, S. (2002). *Prosedur Penelitian*. Bandung: Rineka Cipta.

Apriyanti, I., & Rahayu, S. (2024). Efforts to Improve Student Learning Outcomes through the Problem Based Learning Model in Islamic Education Learning at SD Negeri 104325 Kampung Manggis. *Journal of Indonesian Primary School*, *1*(2), 61–68.

Elistiana, V., Novita, N., & Ginting, F. W. (2024). A Development of E-Module Learning Media based on SETS (Science, Environment, Technology, and Society) on Sound Wave Material. *Indonesian Journal of Education and Social Humanities*, *1*(2), 20–32.

Erawadi, E., Hamka, H., & Juliana, F. (2017). The Analysis of Student's Stressed Syllables Mastery at Sixth Semester of TBI in IAIN Padangsidimpuan. *English Education: English Journal for Teaching and Learning*, 5(1), 44–57.

Hamka, H. (2023). The Role of Principals on Teacher Performance Improvement in a Suburban School. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, 15(1), 371–380.

Hamka, H., Suen, M.-W., Anganthi, N. R. N., Haq, A. H. B., & Prasetyo, B. (2023). The Effectiveness of Gratitude Intervention in Reducing Negative Emotions in Sexual Abuse Victims. *Psikohumaniora: Jurnal Penelitian Psikologi*, 8(2), 227–240.

Harahap, D. S. (2024). Implementation of ChatGPT to Improve Students' Critical Thinking Abilities. *Indonesian Journal of Education and Social Humanities*, *1*(2), 33–39.

Harahap, S. M., & Hamka, H. (2023). Investigating the Roles of Philosophy, Culture, Language and Islam in Angkola's Local Wisdom of 'Dalihan Na Tolu.' *HTS Teologiese Studies/Theological Studies*, 79(1), 8164.

Indrawati, N., & Desky, A. Y. D. (2024). How to Improve Elementary School Student Learning Outcomes by Implementing the Articulation Type Cooperative Learning Model? *Journal of Indonesian Primary School*, *1*(2), 32–37.

Jannah, A., Lubis, A. H., & Julia, N. M. (2024). Development of Number Card Media in Mathematics Learning for Elementary School Students. *Journal of Indonesian Primary School*, *1*(3), 12–23.

Latifah, I., & Safrida, I. (2025). Improving Students' Language Skills with Punakawan Wayang Media at RA Mansyaul Huda: A Classroom Action Research. *Journal of Indonesian Primary School*, *2*(1), 13–24.

Lubis, A. H. (2024). Improving Elementary School Students' Reading Skills Using Picture Word Cards: How is This Possible? *Journal of Indonesian Primary School*, *1*(2), 9–18.

Lubis, A. H., & Lubis, S. S. W. (2024). Development of Newsletter Media in Thematic Learning for Elementary School Students. *Indonesian Journal of Education and Social Humanities*, *1*(1), 28–36.

Mauliana, I., Ulfa, N., & Fitria, A. (2024). Improving Student Learning Outcomes with the Problem Based Learning Model: Classroom Action Research at the State Islamic Primary School. *Indonesian Journal of Education and Social Humanities*, *1*(2), 1–8.

Misqa, L., Oviana, W., Hayati, Z., & Jannah, M. (2024). Improving Student Learning Outcomes in Mathematics Learning through a Contextual Teaching and Learning Approach in Elementary Schools. *Journal of Indonesian Primary School*, *1*(2), 19–26.

Muliawati, I., & Aldin, A. (2024). The Effectiveness of the Problem Based Learning Model on Elementary School Students' Mathematics Learning Outcomes. *Journal of Indonesian Primary School*, *1*(2), 27–31.

Nurliza, M., Lubis, A. H., & Lubis, S. S. W. (2024). Word Square Model Used by Poster Media to Improve Primary School Student Learning Outcomes. *Journal of Indonesian Primary School*, *1*(1), 19–28.

Rahayu, L., & Daud, R. M. (2024). SAS Method assisted by Picture Story Books to Improve Elementary School Students' Beginning Reading Ability. *Journal of Indonesian Primary School*, *1*(1), 37–46.

Rahmah, S., & Lubis, A. H. (2024). Problem Posing as a Learning Model to Improve Primary School Students' Mathematics Learning Outcomes in Gayo Lues. *Journal of Indonesian Primary School*, *1*(4), 93–104.

Simamora, R. (2024). A Survey Research: What is the Role of the Mendeley Application in the Student Environment? *Indonesian Journal of Education and Social Humanities*, *1*(2), 40–45.

Sugiyono. (2018). *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta.