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Improving Mathematical Problem-Solving Skills through the Problem-Based Learning Model on Financial Literacy Material

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Abstrak

This study investigates the effectiveness of the Problem Based Learning (PBL) model in enhancing students' mathematical problem solving skills within the context of financial literacy. The study was motivated by the low level of students' ability to solve mathematical problems, particularly in applying concepts related to financial literacy. The purpose of this research was to improve students' problem solving skills by implementing the PBL model as an alternative to conventional teacher centered learning. The study employed a Classroom Action Research (CAR) design conducted with seventh grade students at SMP Al Ihsan Kotaraja, Jayapura City. The research was carried out in two stages consisting of a preliminary phase and one cycle of PBL implementation. The findings indicate that the application of the PBL model led to notable improvements in students' mathematical problem solving abilities. The results also revealed that students became more engaged, enthusiastic, and independent in the learning process. Teacher activities were observed to be more effective in facilitating student centered learning through the use of contextual problems in financial literacy. In conclusion, the PBL model proved to be an effective instructional approach for strengthening mathematical problem solving skills while simultaneously fostering collaboration, critical thinking, and meaningful learning experiences in financial literacy.

1. Introduction

One of the fundamental subjects that plays a strategic role in developing students' logical, systematic, and critical thinking skills is Mathematics (Aizikovitsh-Udi & Cheng, 2015; Firdaus et al., 2015). In modern mathematics education, problem-solving must be mastered by students to face real-life challenges (Inganah

et al., 2023; Santos-Trigo, 2020). Mathematical problem-solving ability is not only related to the mastery of mathematical concepts and procedures but also involves higher-order cognitive processes such as analysis, synthesis, and evaluation, which enable students to apply mathematical knowledge in authentic situations (English & Gainsburg, 2015; Tachie, 2019).

Financial literacy, as one of the topics in the mathematics curriculum, has strong relevance to students' practical lives (Bolstad, 2023). The Organisation for Economic Co-operation and Development (OECD) defines financial literacy as the knowledge and understanding of financial concepts and risks, along with the skills, motivation, and confidence to apply such knowledge in making effective financial decisions (OECD, 2019). Financial literacy materials in mathematics instruction cover concepts such as interest, investment, credit, insurance, and financial planning, all of which require strong problem-solving abilities to be properly understood and applied (Ozkale & Aprea, 2024). However, classroom realities indicate that students' mathematical problem-solving abilities remain relatively low. The results of the Programme for International Student Assessment (PISA) 2022 revealed that Indonesian students' mathematics literacy ranked 64th out of 81 participating countries, with an average score of 366, which is still below the international average of 472 (OECD, 2023). This condition highlights the need for innovation in mathematics learning approaches that can enhance students' problem-solving skills, particularly in subjects with direct application to everyday life, such as financial literacy.

The problems in conventional mathematics learning often lie in the teacher-centered approach, which emphasizes the transfer of knowledge from teacher to students without providing sufficient opportunities for students to construct their own understanding (Hapudin, 2021; Stephan, 2020). Such an approach tends to make students passive and less engaged in the learning process, resulting in the suboptimal development of their problem-solving abilities (Stephan, 2020). In addition, mathematics instruction that focuses mainly on memorizing formulas and following algorithmic procedures without connecting them to real-life contexts makes it difficult for students to apply mathematical knowledge to authentic problem situations (Jurdak, 2016; Österman & Bråting, 2019). This gap between theoretical learning and practical application underscores the importance of adopting more innovative and student-centered learning models that can bridge abstract concepts with meaningful, everyday experiences.

Conventional mathematics learning often faces challenges due to its teacher-centered approach, which primarily emphasizes the transfer of knowledge from teacher to students without providing sufficient opportunities for learners to construct their own understanding (Hapudin, 2021; Stephan, 2020). Such an approach tends to render students passive and disengaged in the learning process, leading to the underdevelopment of their problem-solving skills. Furthermore, mathematics instruction that relies heavily on memorizing formulas and algorithmic procedures without linking them to real-life contexts makes it difficult for students to apply mathematical knowledge in authentic situations (Jurdak, 2016; Österman & Bråting, 2019). This disconnect highlights the need for innovative and student-centered learning approaches that foster active engagement and bridge abstract concepts with meaningful experiences.

The Problem-Based Learning (PBL) model provides a promising alternative to overcome these challenges. As a student-centered approach, PBL uses real-world problems as the foundation for learning (Klamen et al., 2022). Within this model, students work collaboratively in small groups to identify, analyze, and solve complex problems that are relevant to their daily lives. This process not only improves mathematical problem-solving skills but also cultivates critical thinking, collaboration, and communication abilities (Xu et al., 2023). By situating learning in meaningful contexts, PBL equips students with the competencies needed to connect mathematical concepts with real-world applications, thereby enhancing both their academic achievement and life skills.

Several empirical studies have demonstrated the effectiveness of Problem-Based Learning (PBL) in enhancing mathematical problem-solving skills. Research conducted by Hmelo-Silver et al. (2007) revealed that students who learned through PBL showed better knowledge transfer compared to those taught with conventional methods. Similarly, Capraro et al. (2013) found that PBL significantly improved students' mathematics achievement, particularly in the areas of problem-solving and mathematical reasoning. These findings highlight the potential of PBL as a powerful instructional approach to strengthen higher-order thinking skills in mathematics. Therefore, this study aims to examine the effectiveness of the Problem-Based Learning model in improving students' mathematical problem-solving abilities in the context of financial literacy. Through the structured and systematic implementation of PBL, students are expected to develop stronger problem-solving skills while also gaining a deeper understanding of financial literacy concepts. This dual focus is intended not only to improve academic performance but also to equip students with essential life skills that are directly applicable to real-world financial decision-making.

2. Methods

This study employed Classroom Action Research (CAR) conducted in the second semester of the 2024/2025 academic year at SMP Al Ihsan Kotaraja, Jayapura City. The research was carried out in a Grade VII class with a total of 20 students, consisting of 9 male and 11 female participants. The primary purpose of this study was to improve students' mathematical problem-solving skills through the implementation of the Problem-Based Learning (PBL) model, with financial literacy as the main subject matter.

The research design followed two stages, namely the pre-cycle and Cycle I, both of which were aimed at identifying the baseline condition and examining the improvements achieved after the intervention. Each cycle consisted of four phases: planning, implementation, observation, and reflection. This cyclical process was intended to ensure continuous improvement of the teaching and learning activities, as well as to provide feedback for refining instructional strategies during the study. In the planning phase, lesson plans were designed to incorporate financial literacy problems contextualized in real-life situations, aligning with the PBL framework. During the implementation stage, the PBL model was applied systematically, beginning with the presentation of a financial literacy problem, followed by group discussions, collaborative problem analysis, and solution development. Students were encouraged to actively participate, share ideas, and engage in critical thinking while exploring possible solutions.

The instruments used to collect data included observation sheets for both teacher and student activities, affective assessment forms to evaluate student engagement and attitudes, and problem-solving tests in the form of essay questions. These instruments were designed to capture not only cognitive outcomes but also behavioral and affective changes during the learning process. The use of multiple instruments provided triangulated data to strengthen the validity and reliability of the findings, ensuring that the improvements observed were a result of the structured implementation of the PBL model.

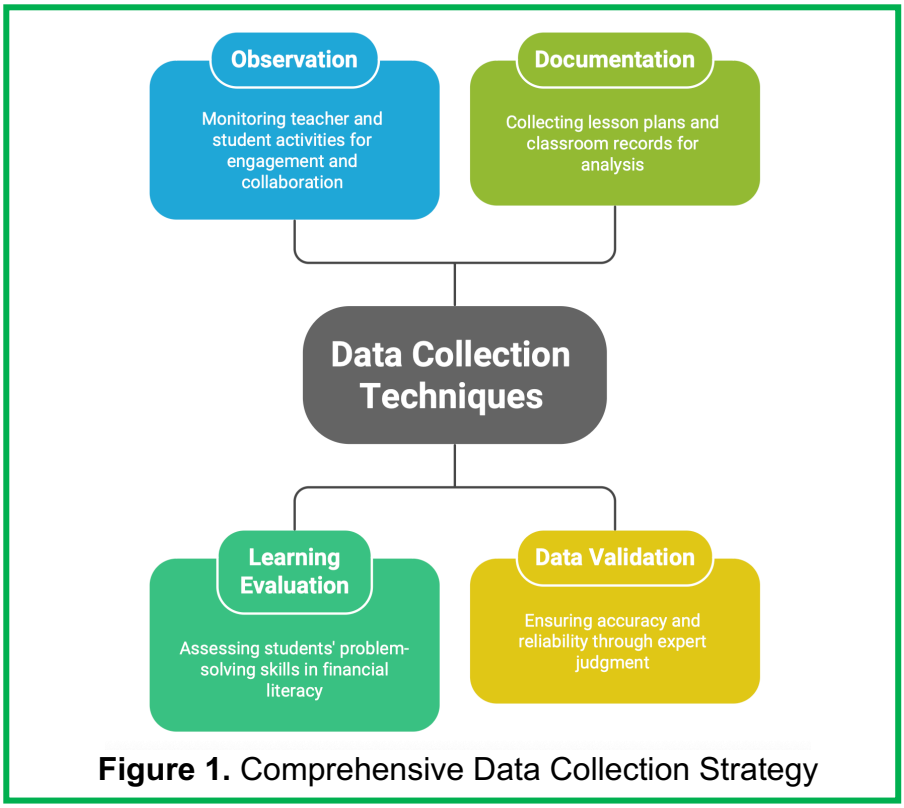

Figure 1. Comprehensive Data Collection Strategy

The data collection techniques in this study consisted of observation, learning evaluation, and documentation. Observations were carried out to monitor both teacher and student activities during the learning process, providing insights into the level of engagement, collaboration, and implementation of the Problem-Based Learning model. Learning evaluations were conducted through tests designed to measure students' mathematical problem-solving skills, particularly in the context of financial literacy. In addition, documentation in the form of lesson plans, student worksheets, and classroom records was used to complement the data and provide supporting evidence for the analysis. To ensure the accuracy and reliability of the findings, data validation was conducted through expert judgment. A team of experts evaluated the research instruments, including observation sheets, affective assessment forms, and problem-solving tests, to confirm their validity and suitability for the study. This process guaranteed that the instruments were capable of capturing the intended aspects of teaching and learning, thereby enhancing the credibility and trustworthiness of the research results.

Data analysis was carried out using both qualitative and quantitative approaches. The qualitative analysis focused on student activity during the learning process, which was measured through observation sheets and then converted into

percentages to capture levels of engagement and participation. Meanwhile, the quantitative analysis involved calculating the average scores obtained by students on problem-solving tests, as well as determining the level of mastery learning achieved by the class. This dual approach provided a comprehensive picture of both the process and outcomes of learning with the Problem-Based Learning model. The criteria for research success were established based on predetermined indicators. The study was considered successful if at least 75% of students achieved a minimum score of 70 in the problem-solving tests. In addition, student activity during the learning process had to reach a minimum level of 70%. These benchmarks were designed to ensure that improvements were not only evident in academic performance but also in the quality of student engagement, thereby reflecting the effectiveness of the PBL implementation in enhancing mathematical problem-solving skills within the context of financial literacy.

3. Findings and Discussions

3.1 Findings

This classroom action research was conducted in the seventh-grade class during the second semester at SMP Al Ihsan Kotaraja, Jayapura City, in the 2024/2025 academic year. The primary objective of the study was to improve students' mathematical problem-solving abilities through the implementation of the Problem-Based Learning (PBL) model. The focus of the intervention was on financial literacy material, which was chosen due to its high relevance to real-life applications and its potential to strengthen higher-order thinking skills. The research was carried out in two stages: the pre-cycle and Cycle I. The pre-cycle was intended to identify students' initial problem-solving abilities and provide a baseline for comparison, while Cycle I implemented the PBL model in a structured and systematic manner. Each stage was designed to capture both the process and outcomes of learning, allowing for reflection and evaluation of the effectiveness of the PBL approach in enhancing students' problem-solving performance.

Pre-Cycle Results

The pre-cycle was conducted to identify the baseline abilities of students in solving mathematical problems before the implementation of the Problem-Based Learning model. This stage served as a diagnostic tool to evaluate students' initial understanding and skills, which later became the basis for planning the intervention. The results of the pre-cycle problem-solving test are presented in Table 1.

Table 1. Pre-Cycle Problem-Solving Test Results

Criteria	Number of Students	Percentage (%)
Mastery (≥ 70)	6 students	30%
Non-Mastery (< 70)	14 students	70%
Total	20 students	100%

The results of the pre-cycle indicate that only 6 out of 20 students, or 30%, were able to achieve the minimum mastery score of 70. Meanwhile, the majority of students, totaling 14 or 70%, did not meet the required standard. This shows that students' problem-solving abilities in mathematics were still relatively low at the beginning of the study. Such findings highlight the need for innovative learning approaches that can actively engage students and enhance their cognitive skills in dealing with mathematical problems. From a broader perspective, the pre-cycle

results reveal the gap between students' current performance and the expected learning outcomes. The dominance of non-mastery results suggests that traditional instructional practices were not sufficient to foster problem-solving competence. Therefore, the application of the PBL model was deemed essential to address these shortcomings, with the expectation that its student-centered and contextualized learning strategies would lead to significant improvements in students' mathematical problem-solving abilities.

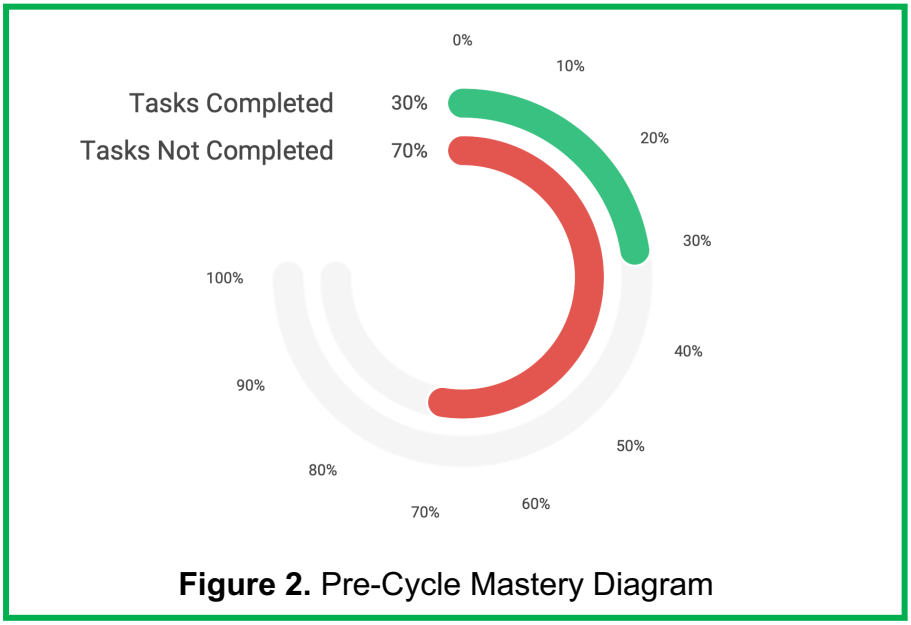

Figure 2. Pre-Cycle Mastery Diagram

The diagram illustrates the proportion of tasks completed compared to those not completed. The visual design uses contrasting colors to distinguish between the two categories, making it clear that one group represents successful outcomes while the other highlights unfinished work. The circular format emphasizes relative proportions, allowing viewers to quickly grasp the comparison without needing detailed numbers. This makes the diagram effective in providing an overview of performance or progress in a simple and accessible manner. From a discussion perspective, the diagram suggests that while some level of achievement has been reached, there remains a considerable portion of tasks that were not successfully completed. This gap indicates room for improvement in planning, execution, or support strategies. By reflecting on the factors contributing to both completion and non-completion, educators or practitioners can design interventions to strengthen performance and encourage higher levels of task accomplishment in future cycles.

Cycle I

After the implementation of the Problem Based Learning (PBL) model in financial literacy material, an evaluation of learning outcomes was conducted to determine its effectiveness. This evaluation was designed to measure the extent of improvement in students' mathematical problem solving abilities, which had previously been identified as an area of weakness. The assessment focused not only on academic achievement but also on how students engaged with the problem solving process, demonstrating their ability to analyze, reason, and apply mathematical concepts to contextual situations. The evaluation results showed that the PBL model created a positive shift in the classroom learning environment. Students displayed higher levels of participation, motivation, and independence in

approaching financial literacy problems, indicating that the intervention had strengthened both their cognitive and affective domains. These findings highlight the importance of student centered approaches such as PBL, which encourage collaboration, critical thinking, and meaningful connections between mathematical knowledge and real life applications. The results of the Cycle I problem-solving test are presented in Table 2.

Table 2. Cycle I Problem-Solving Test Results

Criteria	Number of Students	Percentage (%)
Mastery (≥ 70)	16 students	80%
Non-Mastery (< 70)	4 students	20%
Total	20 students	100%

The results of Cycle I show a significant improvement compared to the pre-cycle stage. A total of 16 students, or 80%, achieved the minimum mastery score of 70, while only 4 students, or 20%, did not meet the standard. This indicates that the PBL model had a positive impact on students' mathematical problem-solving performance, enabling the majority of students to reach the expected level of mastery in financial literacy material. In addition, the increase from 30% mastery in the pre-cycle to 80% in Cycle I highlights the effectiveness of PBL in creating a more engaging and meaningful learning environment. By involving students in real-world problem contexts and encouraging collaborative discussions, PBL provided opportunities for students to think critically, apply concepts, and develop strategies for solving problems. This result demonstrates that PBL not only improved academic outcomes but also promoted the development of essential 21st-century skills such as collaboration, communication, and critical thinking.

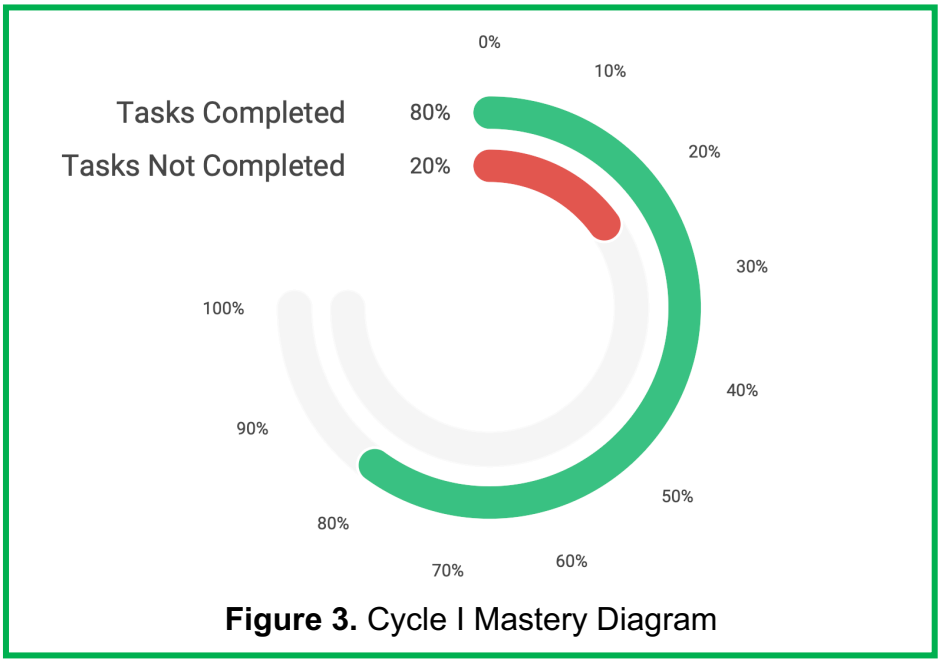

Figure 3. Cycle I Mastery Diagram

The diagram illustrates the outcomes of learning after the implementation of the Problem-Based Learning model in Cycle I. The green segment shows a large proportion of students who successfully achieved mastery in problem-solving, while the red segment represents the smaller group of students who had not yet reached the expected standard. The visual emphasizes a clear shift in performance compared to the pre-cycle stage, reflecting an overall improvement in student

learning outcomes. From a pedagogical perspective, the diagram highlights that the majority of students were able to adapt to the PBL approach, which encouraged active engagement and collaboration in addressing real-world financial literacy problems. The reduced portion of students who had not yet achieved mastery indicates that while most benefited from the intervention, a few still required additional support. This suggests that continuous refinement of instructional strategies and targeted scaffolding are necessary to ensure all students can fully develop their problem-solving abilities.

Observation was conducted to evaluate the activities of both students and the teacher during Cycle I. This stage aimed to assess the extent to which the Problem-Based Learning (PBL) model fostered active participation, enthusiasm, and independent learning among students. The results of student activity observations in Cycle I are presented in Table 3.

Table 3. Observation of Student Activities in Cycle I

Aspect Evaluated	Score Obtained	Percentage (%)	Category
Participation in Discussion	40/50	80%	Fair
Learning Enthusiasm	45/50	90%	Good
Independent Learning	42/50	84%	Good

The results indicate that student activities during Cycle I were generally positive, with enthusiasm and independence reaching the “good” category, while participation in discussion was categorized as “fair.” These findings suggest that the PBL model succeeded in creating a learning environment that stimulated student engagement and encouraged them to take more responsibility for their own learning process. However, the relatively lower category in discussion participation highlights the need for strategies that can further strengthen collaborative interaction among students. Overall, the observation results confirm that the implementation of PBL not only improved students’ problem-solving performance but also enhanced their affective aspects, such as motivation, enthusiasm, and autonomy. The increased quality of student activities during learning serves as supporting evidence that PBL creates a more interactive and meaningful classroom atmosphere. This reinforces the conclusion that PBL is an effective model for developing both cognitive and non-cognitive skills in mathematics learning, especially in the context of financial literacy.

Observation was also conducted on teacher activities during Cycle I to evaluate the quality of lesson implementation using the Problem-Based Learning (PBL) model. The observation focused on various aspects of instructional practice, including lesson planning and opening, core activities, as well as closing and reflection. The detailed results are presented in Table 4.

Table 4. Observation of Teacher Activities in Cycle I

Observation Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
Planning and Opening	10	12	83.3%	Good
Core Activities	25	28	89.3%	Good
Closing and Reflection	6	6	100%	Very Good
Total	41	46	89.1%	Good

The results of teacher activity observation show that all aspects were carried out effectively, with the highest performance recorded in closing and reflection, categorized as “very good.” Planning, opening, and core activities were consistently rated as “good,” indicating that the teacher successfully facilitated learning through well-prepared materials, structured delivery, and effective classroom management. These findings confirm that the teacher was able to implement the PBL model systematically and provide clear guidance for students throughout the learning process. In a broader sense, the overall teacher performance, which falls under the “good” category, demonstrates that the PBL approach was applied with fidelity to its principles. The strong performance in the reflection stage highlights the teacher’s role in helping students consolidate their understanding and evaluate their learning experiences. This balance between planning, execution, and reflection indicates that the teacher not only guided students effectively but also created a supportive learning environment that aligned with the objectives of developing problem-solving and financial literacy skills.

Based on the implementation of Cycle I, it can be concluded that the application of the Problem-Based Learning (PBL) model successfully improved students’ mathematical problem-solving skills. This improvement is evidenced by the increase in classical mastery from 30% in the pre-cycle to 80% in Cycle I, which surpassed the minimum classical mastery threshold of 75%. The average student score also showed a significant rise from 66.2 to 82.9. In addition, the observation results indicated that both student and teacher activities during the learning process were categorized as good. These findings confirm that the success indicators of this study were achieved, which included not only classical learning mastery but also the active involvement of students in the learning process. Thus, the implementation of the PBL model proved to be effective in enhancing both cognitive outcomes and classroom engagement within the context of financial literacy.

3.2 Discussions

The results of this study show that the implementation of the Problem Based Learning (PBL) model significantly improved the mathematical problem solving skills of seventh grade students in the context of financial literacy. This improvement was evidenced by an increase in the average student score from 66.2 in the pre cycle to 82.9 in Cycle I, as well as an increase in the percentage of mastery from 30 percent to 80 percent. These findings demonstrate that PBL encourages students to be more active, critical, and reflective in solving contextual mathematical problems. The PBL model allows students to begin learning from real life problems that are relevant to their daily experiences, in this case financial literacy (Fitria and Indra, 2021; Setiawati et al., 2024). Through the stages of PBL such as problem orientation, independent investigation, group collaboration, reflection, and presentation, students are required to think logically and creatively, while also communicating their solutions clearly (Istianah, 2022). This process aligns with the principles of constructivism, which emphasize that knowledge is constructed by learners through active experiences (Suparman, 2017). Within this framework, the teacher acts as a facilitator who guides students in exploring information and developing effective problem solving strategies.

The improvement in students’ problem solving ability was also supported by the intensive group interaction that occurred during the learning process. Students were not only solving problems individually but also engaging in discussions,

comparing ideas, and providing feedback to one another. This supports the findings of Junianto and Wijaya (2019), who stated that the application of the PBL model can enhance students' mathematical literacy through problem based learning that emphasizes contextual problem solving.

Learning financial literacy material became more meaningful when students were presented with contextual problems, such as simulating purchases, calculating profit and loss, and applying discounts and bank interest. These problems not only sharpened mathematical thinking skills but also instilled useful life skills. PBL facilitated students in connecting mathematical knowledge with real life situations, thereby increasing the relevance of learning and strengthening their motivation. Wahyuni and Septiati (2024) also found that the PBL model is effective in improving students' numeracy literacy through word problems that require both conceptual understanding and application in real contexts.

The implementation of PBL also encouraged teachers to be more creative in designing the learning process. Teachers were not only delivering material but also creating problem scenarios that could stimulate students' curiosity and reasoning skills. In this process, teachers guided students to discover diverse yet logical solutions. This aligns with research findings which emphasize that problem solving is a complex thinking activity that involves various flexible strategies and approaches. Overall, the application of PBL in mathematics learning has proven effective in developing critical thinking skills, enhancing mathematical communication, and increasing students' confidence in presenting solutions. This success provides a strong foundation for considering innovative learning models such as PBL as a primary alternative to improve the quality of mathematics education, particularly in applied topics such as financial literacy.

4. Conclusion

The implementation of the Problem Based Learning (PBL) model has been proven to significantly enhance the mathematical problem solving skills of seventh grade students, particularly in financial literacy material. As shown by the results from the pre cycle and Cycle I, there was a clear improvement in students' problem solving abilities, which was reflected in the increase in both their average scores and mastery levels. The shift from a teacher centered approach to a student centered model allowed for greater engagement, critical thinking, and a deeper understanding of real world problems, especially those related to financial literacy. The findings of this study indicate that PBL not only improves cognitive skills but also fosters stronger collaboration and communication among students. This approach encouraged students to actively participate in solving practical problems, which is essential for the development of real life skills. Furthermore, the positive impact of PBL on both student learning outcomes and teaching practices supports its adoption as an effective educational method for improving mathematical problem solving, particularly in applied contexts such as financial literacy.

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