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Implementation of the Problem-Based Learning (PBL) Model with a Culturally Responsive Teaching (CRT) Approach to Improve Students Learning Outcomes

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ABSTRACT

Mathematics learning is often teacher-centered, causing some students to have limited understanding of concepts and their real-life applications. Observations of XI DKV 1 students at SMKN 2 Madiun revealed that 85.3% of students perceived mathematics as boring and difficult, resulting in low participation and suboptimal learning outcomes. This classroom action research aimed to improve students' learning outcomes by implementing Problem-Based Learning (PBL) integrated with a Culturally Responsive Teaching (CRT) approach, encouraging active student participation through real-life problem-solving while considering cultural backgrounds. Data were collected through tests. The findings indicate that the implementation of PBL with CRT effectively enhanced learning outcomes, with mastery percentages increasing from 26.47% in the pre-cycle to 50% in Cycle I and 73.53% in Cycle II. The study highlights the effectiveness of PBL and CRT in improving learning outcomes, increasing engagement, and linking material to real-life contexts. Further research is recommended to optimize mathematics learning activities in accordance with instructional model syntax.

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1. INTRODUCTION

Based on observations of students in Grade XI DKV 1 at SMKN 2 Madiun, it was revealed that 85.3% of the students perceived mathematics as a boring subject and difficult to comprehend. Consequently, students demonstrated low levels of active participation during the learning process, which ultimately had a negative impact on their learning outcomes. Therefore, teachers are required to possess the competence to select appropriate instructional models and methods to ensure that learning activities become more engaging and accessible for students (Lasminawati et al., 2023). The selection of

suitable learning models and approaches is expected to enhance students' learning outcomes, which reflect their abilities and behavioral changes following the learning process (Paramita et al., 2023). Positive learning outcomes indicate that the established learning objectives have been successfully achieved. Within the framework of the *Merdeka* Curriculum, the objectives of mathematics education include the development of students' interest, curiosity, active engagement, and inquiry skills (Asrobanni & Fitriani, 2024). The primary emphasis is placed on students' holistic development, enabling them to actively contribute to their surrounding environment while gaining a deeper understanding of mathematical concepts.

The low level of student participation in mathematics learning indicates a gap between students' learning needs and the instructional strategies implemented by teachers. This condition underscores that teacher competence in selecting and applying appropriate learning models is a crucial factor in enhancing students' active engagement (Pramaishella Putri & Fitriani, 2025). Teachers who are able to employ varied, interactive, and student-centered learning models can create a more engaging learning environment, thereby fostering students' interest, curiosity, and active participation in the learning process (Awwaliya et al., 2025). This is consistent with the findings of (Hesti et al., 2021),who emphasize the importance of teachers' skills in determining appropriate learning models and methods to increase student participation. Furthermore, this view is supported by (Karenina et al., 2024), who state that students' active engagement directly contributes to improved learning outcomes and the achievement of instructional objectives in accordance with the demands of the Merdeka Curriculum.

Learning strategies that actively and interactively engage students are required to improve students' learning outcomes (Septiani et al., 2024). Problem-Based Learning (PBL) is an instructional model that encourages students to actively participate in solving real-world problems (Andelia et al., 2024). The Problem-Based Learning (PBL) model can train students to develop critical thinking skills and encourage active participation in the learning process, as well as collaboration in solving problems related to the subject matter (Lestari et al., 2023). Through collaborative activities, learners can enhance their social skills and critical thinking abilities when dealing with various problems relevant to daily life (Awwaliya et al., 2025; Hasanah et al., 2023). The real-world problems incorporated into learning activities should take students' cultural backgrounds into account (Sari et al., 2023), as culturally relevant problems are more easily understood by students (Lutfiani et al., 2023). Lasminawati et al. (2023) argue that mathematics is widely embedded in various aspects of everyday life and can be conveyed through cultural contexts. In addition to the PBL model, a culture-based approach known as Culturally Responsive Teaching (CRT) can also be implemented.

Learning processes that connect cultural elements with instructional content aim to provide deeper meaning to students' learning experiences (Fitriah et al., 2024). Within this pedagogical approach, educators recognize that each learner brings distinct bodies of knowledge, values, and cultural experiences into the classroom. Accordingly, culturally responsive content and instructional strategies are systematically integrated into the curriculum and pedagogical practices. This approach aims to foster an inclusive learning environment in which learners feel acknowledged, respected, and actively engaged in the learning process (Nurhalizah et al., 2025; Rochaminah et al., 2024). A study by Lailiyah et al., (2024) demonstrated that learning outcomes assessed through formative assessment at the end of instruction using the CRT approach showed a significant improvement in the cognitive domain of knowledge, categorized as high. Considering these findings, it is essential for educators to recognize the relationship between culture and students' ways of thinking (Girsang et al., 2024; Waluya, 2024). Integrating students' cultural backgrounds can help bridge learning contexts and enhance awareness of cultural identity (Qona'ah et al., 2024). With such awareness, students' learning outcomes are

expected to improve, resulting in more meaningful and effective learning experiences.

The implementation of the Problem-Based Learning (PBL) model with a Culturally Responsive Teaching (CRT) approach in the classroom aims to connect learning with students' everyday lives, thereby enhancing students' learning outcomes and participation. Observations indicate that the PBL model integrated with the CRT approach has not yet been implemented in Grade XI DKV 1. These two approaches are designed to address the low level of students' participation in the mathematics learning process and to improve learning outcomes.

2. METHODS

This study employed a Classroom Action Research (CAR) design. Classroom Action Research is a type of research conducted by teachers in the classroom with the aim of improving the teaching and learning process. CAR is implemented through a series of stages referred to as cycles, with each cycle consisting of four phases: planning, implementation, observation, and reflection. The study was conducted at SMK Negeri 2 Madiun. The participants were 34 students of Grade XI DKV 1 in the 2024/2025 academic year. The research instrument consisted of a test in the form of non-routine essay questions on annuity material. Non-routine problems were chosen to assess students' conceptual understanding, higher-order thinking, and ability to apply annuity concepts meaningfully in real-world contexts, rather than merely using formulas procedurally (Endah Wulandari et al., 2023). The test comprised five items and was used to assess students' learning outcomes.

Data were collected through testing. Prior to the implementation of the PBL method, students were administered a pre-test to measure their initial learning outcomes before the intervention. The implementation of the PBL method involved several aspects: (1) students observed and analyzed problems presented by the teacher with the assistance of the Student Worksheet (LKPD) as learning material, which was designed to be relevant to students' cultural backgrounds and experiences; (2) students participated in group discussions to solve the problems; (3) students collected data related to the problems; (4) students were able to solve problems through group discussions; (5) students presented the results of their discussions related to the LKPD, linking them to cultural contexts in collaboration with their group; and (6) students concluded the discussion and presentation results together with the teacher.

Post-tests were conducted twice, at the end of Cycle I and Cycle II, with each post-test administered after the completion of the respective cycle. The purpose of administering these tests at the end of each cycle was to determine the extent to which the implemented interventions influenced students' learning outcomes. The reflections from Cycle I were subsequently used as a basis for improving and refining the instructional planning for Cycle II. Students' performance was evaluated based on the results of the pre-test and post-tests from each cycle conducted during the study. The assessment scale ranged from 0 to 100, with the Minimum Mastery Criterion (KKM) for mathematics set by the school at 70. The mean score was calculated by summing all students' scores and dividing the total by the number of students.

3. FINDINGS AND DISCUSSION

Based on the research data obtained, an improvement in the test results of Grade XI DKV 1 students at SMK Negeri 2 Madiun was observed following the implementation of the Problem-Based Learning (PBL) model integrated with the Culturally Responsive Teaching (CRT) approach in teaching annuity material.

3.1. Pre-Cycle Results

Prior to the implementation of the classroom action research, a diagnostic test was administered to measure students' initial cognitive abilities before learning the annuity material. The diagnostic test consisted of five non-routine fill-in questions covering annuity-related topics. Based on the results of the pre-test, 20 students had not yet met the Minimum Mastery Criterion (KKM). The pre-test aimed to evaluate students' learning outcomes before the implementation of the Problem-Based Learning (PBL)

model integrated with the Culturally Responsive Teaching (CRT) approach. The pre-test results are presented as follows:

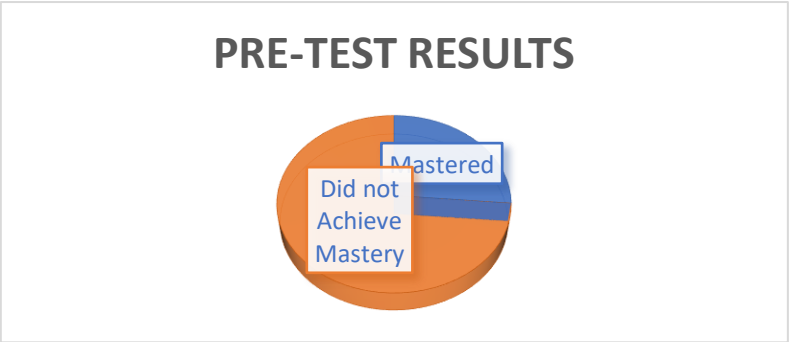

Figure 1. Percentage of Mastery Achievement in Pre-Test

Based on the above percentages, it was found that the test results were dominated by students who had not yet achieved the Minimum Mastery Criterion (KKM). Only 26.47% of students were able to meet the KKM, while 73.53% of students had not reached the required mastery level. In response to this condition, the learning process was implemented using the Problem-Based Learning (PBL) model integrated with the Culturally Responsive Teaching (CRT) approach for the annuity material.

Cycle I Results

During Cycle I, the learning process was conducted by the teacher following the designed teaching module, employing the Problem-Based Learning (PBL) model integrated with the Culturally Responsive Teaching (CRT) approach. The instructional activities were carried out over three sessions, during which students engaged in problem-solving tasks that connected annuity concepts with culturally relevant contexts. This approach aimed to foster active participation, critical thinking, and meaningful learning experiences.

Upon completion of the learning activities, all 34 students were administered a post-test to evaluate their learning outcomes after the intervention. The results of the post-test were used to determine the percentage of students who achieved the Minimum Mastery Criterion (KKM) set by the school. These results are presented in Figure 2. The post-test provided insight into the effectiveness of the PBL model combined with the CRT approach in improving students' understanding of annuity material, as well as their engagement and ability to apply mathematical concepts in culturally relevant scenarios.

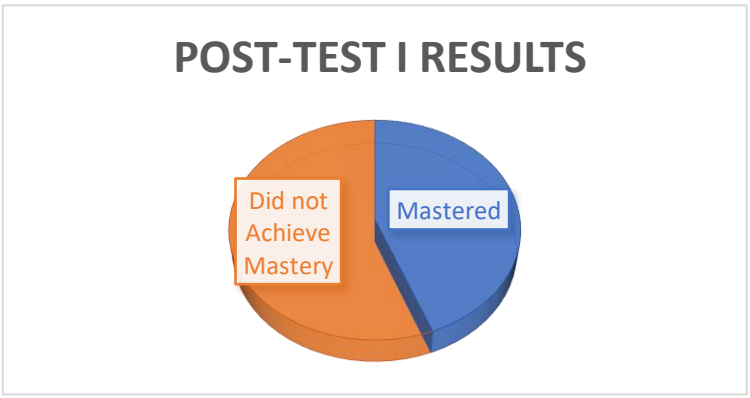

Figure 2. Percentage of Mastery Achievement in Post-Test I

The percentages shown above indicate that the students' mastery level in Post-Test I reached 50%, with 17 students achieving mastery and 17 students not yet meeting the criterion. Although the

learning outcomes in Cycle I were still dominated by students who had not achieved mastery, the comparison with the pre-test results shows an improvement of 23.53% in the mastery level.

Cycle II Results

Consistent with Cycle I, in Cycle II the researcher conducted the learning process according to the prepared teaching module using the Problem-Based Learning (PBL) model integrated with the Culturally Responsive Teaching (CRT) approach. However, in Cycle II, the focus was more on problem-based story tasks related to the annuity material. The Cycle II learning activities were conducted in two sessions. All 34 students participated in the post-test. The percentage of students achieving mastery is represented by the Post-Test II results, as shown in Figure 3.

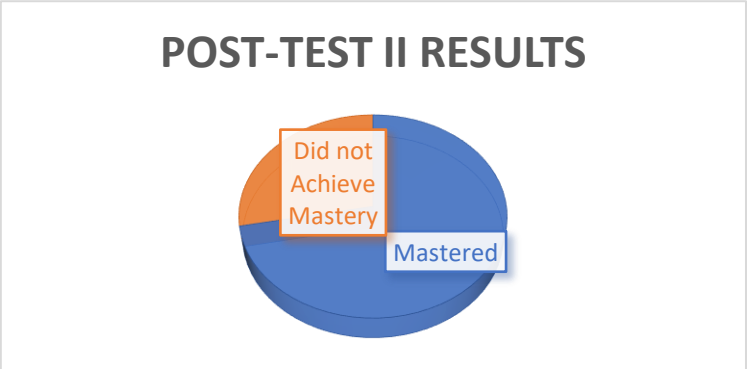

Figure 3. Percentage of Mastery Achievement in Post-Test II

Based on the percentages shown above, the students' mastery level in Post-Test II reached 73.53%, with 25 students achieving mastery, while 26.47%, or 9 students, had not yet met the criterion. Compared to Cycle I, the students' mastery level increased by 23.53%, indicating a significant improvement in learning outcomes following the implementation of the Problem-Based Learning (PBL) model integrated with the Culturally Responsive Teaching (CRT) approach.

3.2 Discussion

Based on the analysis of students' learning outcomes in the Pre-Cycle, Cycle I, and Cycle II, it was observed that students demonstrated active engagement throughout the learning process. Shortcomings identified in the previous cycle were addressed, resulting in improved learning outcomes in Cycle II that met the expected percentage criteria. The progression of students' learning outcomes is summarized in the following recap table:

Table 1. Recapitulation of Students' Learning Outcomes Percentages

Cycle Stage	Number of Students Did not Achieve Mastery	Number of Students Mastered	Mastery Percentage
Pre-Cycle	20 Students	14 Students	26,47%
Cycle I	17 Students	17 Students	50%
Cycle II	9 Students	25 Students	73,53%

Table 1 presents a comparison of the research results obtained. As shown in the table, the percentage of students achieving mastery in the Pre-Cycle was 26.47%, which subsequently increased to 50% in Cycle I and 73.53% in Cycle II. Despite variations in students' initial abilities, available learning resources, and the effectiveness of collaboration, which may prevent some from achieving mastery, the obtained scores met the established success criteria. Thus, the study concluded that implementing the Problem-Based Learning (PBL) model with a Culturally Responsive Teaching (CRT) approach resulted in a continuous improvement in students' learning outcomes.

4. CONCLUSION

Based on the results and discussion, it can be concluded that the implementation of the Problem-Based Learning (PBL) model combined with the Culturally Responsive Teaching (CRT) approach is effective in enhancing students' learning outcomes. The observed decrease in the percentage of students who did not achieve mastery indicates that a greater number of students were able to meet the Minimum Mastery Criterion (KKM) after the intervention. Specifically, the learning outcomes showed continuous improvement from the Pre-Cycle to Cycle I and Cycle II, demonstrating that iterative action and reflective teaching positively impacted students' understanding of the annuity material. In addition, the integration of local cultural elements into the mathematics learning process played a significant role in helping students relate the content to their daily lives and cultural contexts. This connection not only made the learning process more meaningful but also encouraged greater student engagement, motivation, and active participation in problem-solving activities. By linking mathematical concepts with familiar cultural contexts, students were able to develop deeper conceptual understanding and critical thinking skills. Furthermore, the findings suggest that culturally responsive instructional strategies can serve as a valuable tool for teachers to address learning difficulties, especially in subjects perceived as abstract or challenging, such as mathematics. Future research is recommended to further explore and refine the aspects used to observe and assess students' learning activities in accordance with the syntactic stages of the PBL model, as well as to examine long-term impacts on students' academic achievement and cultural awareness. For mathematics teachers, particularly in financial topics such as annuities, cultural contexts can be selected from students' local economic activities or customary practices, such as family savings or community savings groups (arisan). Annuity concepts can be linked to routine saving practices or commonly applied arisan systems. Local micro-investments can also be used, for example, small businesses, cooperatives, or local savings and loan practices familiar to the students. Additionally, local traditions involving periodic payments, such as land lease payments, cultural activity contributions, or regular community contributions, can serve as relevant contexts. This approach enables students to perceive a direct connection between mathematical concepts and their daily lives, making Problem-Based Learning (PBL) more engaging while Culturally Responsive Teaching (CRT) provides meaningful cultural relevance. Consequently, students' active participation and conceptual understanding of financial topics are expected to improve.

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