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The Jigsaw Cooperative Learning Model with a Culturally Responsive Teaching Approach to Improve Mathematics Learning Outcomes of Grade XI Senior High School Students

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Abstract: This study aims to improve students' mathematics learning outcomes through the implementation of the Jigsaw Cooperative Learning Model integrated with the Culturally Responsive Teaching (CRT) approach in the topic of circles. The issue addressed in this research is the low level of student engagement and the suboptimal achievement in mathematics learning. This Classroom Action Research (CAR) was conducted in three stages: pre-cycle, cycle I, and cycle II. The subjects of the study were students of class XI.1 at SMAN 5 Mataram. Each cycle consisted of the stages of planning, implementation, observation, and reflection. The results revealed an increase in the average score from 35.15 in the pre-cycle to 72.3 in cycle I, and further to 83.07 in cycle II. The percentage of students achieving mastery also rose from 10% to 82.5%. This improvement was supported by the application of culturally based learning, which made the material more contextual and meaningful for students. Therefore, the implementation of the Jigsaw Cooperative Model combined with the CRT approach proved to be effective in promoting student engagement and enhancing mathematics learning outcomes.

Keywords: jigsaw cooperative learning, culturally responsive teaching, learning outcomes, mathematics, circles

Introduction

Mathematics is one of the fundamental subjects that plays a crucial role in shaping students' logical, critical, and systematic thinking patterns. However, mathematics learning is often perceived as a difficult and challenging subject by most students. One of the causes is the low level of active student engagement in the learning process, often resulting from the use of conventional, one-way teaching methods that provide limited opportunities for students to interact and explore concepts independently. Cultural factors and socioeconomic backgrounds also influence how students comprehend and absorb learning materials, leading to disparities in learning outcomes among students. Madu (2024) states that an effective learning approach must not only be academically sound but also culturally responsive, to ensure that the learning process is both inclusive and optimal. The Jigsaw Cooperative Learning model is one strategy that has been widely used to improve mathematics learning outcomes. This model allows students to work collaboratively in heterogeneous groups, where each member is responsible for learning a specific part of the material and then teaching it to their peers **(**Arrow & Prayitno, 2023**).**

Various studies have been conducted to identify effective learning models that improve students' understanding and learning outcomes in mathematics. Research by Purwaningsih and Harjono (2021) shows that the Jigsaw model can enhance critical thinking and learning outcomes among elementary school students. Meanwhile, Siregar and Harahap (2020) concluded that the Jigsaw model is effective in improving mathematical problem-solving skills among junior high school students. Amin et al. (2020) further confirmed that the implementation of the Jigsaw model can boost student motivation and engagement in learning mathematics, thereby contributing to improved learning outcomes.

However, most existing studies have not integrated students' cultural backgrounds as an essential component of the learning approach, indicating a need for further development that is more responsive to cultural diversity. This gap highlights the importance of adopting a learning approach that

explicitly accommodates students' cultural and social backgrounds through the implementation of the Culturally Responsive Teaching (CRT) concept. By research Yuniati (2025) CRT approach emphasizes the importance of aligning teaching methods and materials with students' cultural contexts so they feel valued and motivated to learn. In mathematics education, teachers are expected to connect learning materials with students' local cultural contexts and real-life experiences to make the content more relevant and comprehensible. Research by Elya and Prabawati (2025) demonstrates that applying CRT can improve student achievement and interest, especially in classrooms with diverse cultural backgrounds. Nevertheless, there is still a lack of research exploring the integration of the Jigsaw model with the CRT approach in mathematics instruction, thus creating a need for studies that address this gap and offer more inclusive and effective teaching innovations.

This study employs a Classroom Action Research (CAR) approach, which enables teachers to continuously reflect on and improve the learning process (Nurulanningsih, 2023). By integrating the Jigsaw model with the CRT approach, teachers can design learning experiences that not only improve academic achievement in mathematics but also foster appreciation and recognition of students' cultural diversity. Research Sukendra & Fridayanthi (2025) This approach is highly relevant and important given the increasingly heterogeneous nature of today's classrooms and the urgent need for inclusive education. Through the implementation of this strategy, the learning process is expected to become more meaningful, and students' mathematics learning outcomes are expected to improve significantly.

Based on the above background, this study is entitled:

"The Jigsaw Cooperative Learning Model with a Culturally Responsive Teaching Approach to Improve Mathematics Learning Outcomes of Grade XI Senior High School Students."

Method

The research was conducted in two cycles, with each cycle consisting of four stages based on the model proposed by Kemmis and McTaggart: (1) planning, (2) acting, (3) observing, and (4) reflecting. Prior to Cycle I, a preliminary stage known as the pre-cycle was carried out to identify problems. The subjects of this study were 40 students from class XI.1 at SMAN 5 Mataram in the 2024/2025 academic year. This school has students from diverse cultural backgrounds, and mathematics achievement in class XI.1 varied considerably.

During the planning stage, the teacher prepared a lesson plan (RPP) applying the Jigsaw Cooperative Learning model integrated with the CRT approach. The plan included the identification of teaching materials and their adaptation to the students' local cultural context. Heterogeneous learning groups were also formed based on academic ability. The teacher developed various assessment instruments, including individual formative test items, observation sheets, and daily reflection journals to evaluate students' engagement and understanding.

In the action implementation stage, the teacher carried out the learning process according to the prepared lesson plan. The learning materials were divided into several sub-topics, which were studied in depth by students in expert groups. After mastering the material in their expert groups, students returned to their home groups to share the knowledge they had acquired.

The next stage was observation, in which the teacher observed student activities during the learning process. The observation focused on student engagement in group discussions and their ability to communicate their understanding.

The final stage of each cycle was reflection, during which the teacher evaluated the learning process. This reflection involved analyzing the observation results and students' individual formative assessment outcomes. The purpose of the reflection was to assess the effectiveness of the learning strategy used, identify any obstacles or challenges encountered, and formulate necessary improvements or reinforcements for the next cycle.

The research instruments included test items designed to measure mathematics learning outcomes and determine the extent of student engagement in problem-based learning and the relevance of the material to their local cultural context. Test results were analyzed quantitatively by calculating the average score and the percentage of students achieving mastery, based on the Minimum Mastery Criteria (KKM) applied.

Result and Discussion

This study was carried out in three stages: pre-cycle, cycle I, and cycle II, all of which implemented the Jigsaw Cooperative Learning model combined with the Culturally Responsive Teaching (CRT) approach. In the pre-cycle stage, observations were conducted to identify students' initial abilities and their level of participation in the learning process. The observation results indicated that most students had not yet demonstrated active engagement in learning, which negatively impacted their cognitive learning outcomes. This reflects that the previously used conventional teaching approach had not succeeded in fostering student

participation or creating meaningful connections between students and the learning material.

The cognitive ability test results at each stage showed a significant improvement, although the progress occurred gradually. This demonstrates that the use of the Jigsaw Cooperative Learning model integrated with the principles of Culturally Responsive Teaching can create a meaningful and relevant learning environment for students, thereby promoting an increase in their learning outcomes. This study used a Minimum Mastery Criteria (KKM) score of 74, in accordance with the standard set by SMAN 5 Mataram.

Table 1. Research data from all cycles

Remarks	Results		
	Pre cycle	Cycle I	Cycle II
Highest Score	87	95	100
Lowest Score	10	55	64
Average	35,15	72,3	83,07
Students Passed	4	16	33
Students Failed	36	24	7
Classical Mastery	10%	60%	82,5%

The formula for classical mastery

$$T = \frac{\Sigma\ Students\ Passed}{\Sigma\ All\ Students} \times 100\%$$

Based on Table 1, it can be seen that in the pre-cycle stage, the students' average score was only 35.15, with a classical mastery of 10%. After the implementation of the Jigsaw Cooperative Learning model in cycle I, the average score increased to 72.3 with a mastery level of 60%. In cycle II, the average score further increased to 83.07, with classical mastery reaching 82.5%. This indicates a significant improvement from one cycle to the next. Classical mastery is achieved when at least 75% of the students obtain scores above the Minimum Mastery Criteria (KKM) set by the school. This is in line with the opinion of Panjaitan et al. (2020), who state that a class is considered to have achieved classical mastery if ≥75% of the students score above the KKM.

The improvement in students' learning outcomes from the pre-cycle to cycle II indicates that the Jigsaw Cooperative Learning model has a positive impact on students' understanding and achievement in mathematics. This aligns with Vygotsky's socio-cultural learning theory, which emphasizes the importance of social interaction and collaboration in developing students' cognitive abilities. In the Jigsaw model, students work in expert groups to master a subtopic and are then responsible for teaching it to their home groups. This process fosters both individual and social responsibility, while also encouraging active student engagement in the learning process.

The findings of this study are consistent with previous research showing that the Jigsaw model enhances learning outcomes and student interaction. This study reinforces the idea that empowering students within groups can accommodate differences in academic abilities within the classroom. However, it cannot be denied that the implementation of this model also presents challenges, such as imbalances in group member contributions, as also noted by Sari (2020). Nevertheless, these challenges can be addressed through teacher guidance and effective group management.

In cycle I, the topic discussed was the relationship between central angles and inscribed angles. Each student studied one of the subtopics: the definition of central angles, inscribed angles, the relationship between angles and arc length, and their applications in daily life. The learning process was connected to the local cultural context through the CRT approach by utilizing images of decorative patterns found in *ketak* (woven bamboo) crafts, which contain circular angle elements, to explain the concept in a contextual and meaningful way. This encouraged students to understand the material visually and in a way that was more relevant to their lived experiences. However, some students lacked the confidence to explain the subtopics they had studied in their expert groups. This imbalance hindered the equitable flow of information within the groups. The challenge of uneven participation was addressed through teacher guidance and effective group management. The teacher monitored group dynamics and provided direct guidance to groups showing role imbalances.

In cycle II, the learning materials focused on arc length, angle measurement, and the area of a sector. To address this, the teacher applied CRT principles by providing alternative visual representations and contextualizing problems using local examples, such as calculating the area of segments in traditional snacks. The teacher also gave direct feedback and encouraged students to support one another without any sense of dominance. With these strategies, barriers to understanding the material were minimized, students became more motivated to learn, and a more balanced contribution within the groups was observed. As a result, there was a significant improvement in cycle II, with classical mastery reaching 82,5%.

The theoretical implication of this study reinforces the concept that collaborative learning and active student engagement can enhance learning outcomes. Practically, the implementation of the Jigsaw Cooperative Learning model combined with the CRT approach offers an alternative teaching strategy for educators—especially in mathematics instruction,

which is often perceived as difficult by many students. This model encourages students to deepen their understanding through peer discussion and the re-explanation of material.

Conclusion

Based on the results of the study, it can be concluded that the implementation of the Jigsaw Cooperative Learning Model with a Culturally Responsive Teaching (CRT) approach can improve the mathematics learning outcomes of Grade XI.1 students at SMA Negeri 5 Mataram, particularly in the topics of functions and circles. Students' learning outcomes showed a gradual increase in classical completeness: 10% in the pre-cycle, rising to 60% in cycle I, and reaching 82.5% in Cycle II.This improvement occurred due to refinements in the learning process, especially the integration of local cultural contexts that are more relatable to students' experiences, such as decorative patterns in *ketak* weaving and traditional snacks, which were used to explain the concepts of central angles, arc lengths, and sector areas. The use of the CRT approach encouraged active student engagement in group discussions and strengthened understanding through visual representation and culturally relevant narratives.

Thus, the Jigsaw Cooperative Learning Model based on CRT has proven effective in enhancing mathematics learning outcomes and can serve as an alternative instructional strategy that is responsive to the diverse backgrounds of students in achieving optimal learning mastery.

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Author Contributions

Conceptualization, H.H; methodology, H.H.; data curation, H.H.; formal analysis, H.H. & S.P.; writing—original draft preparation, H.H.; supervision, S.P.; writing—review and editing, S.N.; resources, S.N.

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Conflicts of Interest

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

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