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Improving Flat Building Learning Outcomes Through a Jigsaw Model Based on Culturally Responsive Teaching in Grade IV Elementary School

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Abstrack
The mathematics learning outcomes of Grade IV students at Sekolah Dasar Negeri Bandungrejosari 3 in Malang City on the topic of flat buildings remain relatively low and uneven due to a learning approach that does not sufficiently respond to students' cultural, social, and prior learning experiences. This study aims to improve mathematics learning outcomes through the application of the Jigsaw learning model based on Culturally Responsive Teaching. The Jigsaw model promotes collaboration, active participation, and individual responsibility within heterogeneous groups, while the principles of Culturally Responsive Teaching are integrated to create learning that is contextual, culturally relevant, and respectful of student diversity. This research employed classroom action research conducted in two cycles, each consisting of planning, implementation, observation, and reflection. The research subjects were 28 students in Grade IV. Data were collected through learning outcome tests, student activity observation sheets, and field notes. The results showed that applying the Jigsaw model based on Culturally Responsive Teaching was effective in increasing student activeness, confidence, and conceptual understanding of flat buildings. The completeness of students' learning outcomes increased from 35.71 percent in the pre-cycle to 71.43 percent in the first cycle and reached 92.86 percent in the second cycle, with the average score also showing a significant improvement. These findings demonstrate that the combination of the Jigsaw model and Culturally Responsive Teaching can create an inclusive learning environment, adapt to classroom diversity, and effectively improve mathematics learning outcomes in elementary schools.

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Introduction

At the global level, education in the twenty-first century demands learning models that go beyond merely focusing on academic achievement. It should also emphasize the development of collaboration, critical thinking skills, and the ability to interact effectively in multicultural environments. According to UNESCO (2020), one of the primary challenges in contemporary education is to create learning environments that are inclusive and responsive to the cultural diversity and backgrounds of students. This is crucial because education cannot be separated from the socio-cultural context in which students live and learn. Furthermore, the Organization for Economic Cooperation and Development (2018) in *Teaching for the Future* highlights that the ability to understand diversity and collaborate across different backgrounds is a core competency for the twenty-first century. Such competencies need to be cultivated from the earliest stages of formal education. Consequently, educators are encouraged to design instructional strategies that are not only knowledge-driven but also culturally sensitive, fostering a sense of inclusion and mutual respect among students from varied backgrounds. The integration of these competencies into the learning process ensures that students are better prepared to face global challenges and engage constructively in diverse social settings.

A similar situation can be observed in Indonesia, where mathematics learning in elementary schools still largely relies on conventional approaches that provide minimal integration of students' cultural contexts. According to the National Assessment report by the Ministry of Education and Culture (2022), numeracy achievement among elementary school students in Indonesia remains low, with only thirty-four point fifty-eight percent of students reaching the advanced category. This condition is further complicated by the diversity of students' cultural backgrounds, which has not been optimally addressed in the learning process. Initial observations at an elementary school in Malang City revealed that only forty-five percent of Grade IV students were able to achieve the Minimum Competency Criteria score in the topic of flat buildings. Moreover, student participation in group discussions and in solving contextual problems was also limited, reflecting a weak classroom climate in terms of collaboration and active engagement. These findings suggest that conventional teaching methods alone are insufficient to meet the needs of students from diverse backgrounds. Therefore, there is a critical need to implement learning models that are culturally responsive and promote both individual understanding and cooperative learning practices.

The Jigsaw-type cooperative learning model has been widely implemented to enhance both students' academic learning outcomes and social skills. Research by Alfazr and colleagues (2016) demonstrated that the Jigsaw model was effective in increasing student activity from twenty-one point four percent to eighty-nine point three percent, as well as improving learning completeness from sixty point seven percent to eighty-nine point three percent. This model encourages collaboration, mutual responsibility, and active engagement within heterogeneous groups, making it suitable for diverse classroom settings. In contrast, the Culturally Responsive Teaching approach, developed by Gay (2010) and adapted by Kurniawan and Saputra (2022), has been shown to improve motivation, confidence, and learning outcomes among students from minority cultural groups. Culturally Responsive Teaching emphasizes designing learning experiences that are contextual, culturally relevant, and responsive to the diversity of students'

backgrounds. By integrating students' cultural knowledge, experiences, and perspectives into the learning process, this approach helps to make learning more meaningful and engaging. Therefore, combining the Jigsaw model with Culturally Responsive Teaching has the potential to foster both academic achievement and socio-emotional development in culturally diverse classrooms.

However, a review of the literature indicates that previous studies have generally applied the Jigsaw model and Culturally Responsive Teaching separately in elementary school learning. Most research on the Jigsaw model has focused primarily on academic outcomes and the development of student cooperation, whereas Culturally Responsive Teaching has been more commonly applied in subjects such as Indonesian language or social studies to foster cultural awareness. Few studies have systematically integrated these two approaches in mathematics learning, particularly on the topic of flat buildings in multicultural elementary classrooms. This gap is significant because mathematics learning in diverse classrooms can benefit from instructional strategies that simultaneously enhance conceptual understanding and cultural inclusivity. In fact, research by Erwin and colleagues (2021) demonstrated that combining cooperative learning strategies with culturally responsive approaches can substantially improve students' cognitive, social, and affective engagement. Such findings suggest that an integrated approach may not only strengthen learning outcomes but also promote a more inclusive and interactive classroom environment. Therefore, exploring the combined application of the Jigsaw model and Culturally Responsive Teaching in mathematics learning is both timely and necessary for enhancing student engagement and achievement in diverse educational contexts.

Therefore, this study proposes the integration of the Jigsaw learning model with the principles of Culturally Responsive Teaching as a complementary instructional framework. The Jigsaw model offers an effective collaborative structure that encourages active participation, peer interaction, and shared responsibility among students. At the same time, Culturally Responsive Teaching ensures that the learning materials, activities, and processes are relevant, meaningful, and adaptive to the diverse cultural backgrounds of students. By combining these approaches, the study aims to address inequalities in classroom participation and enhance students' confidence in learning mathematics. Moreover, this integration is expected to create a learning environment that is not only academically effective but also socio-culturally equitable. It promotes inclusive practices that recognize and respect student diversity while fostering collaborative problem-solving skills. Ultimately, this integrated approach seeks to improve both cognitive outcomes and socio-emotional engagement, making mathematics learning more meaningful and accessible for all students in multicultural elementary classrooms.

This research aims to improve the mathematics learning outcomes of Grade IV elementary school students through the application of the Jigsaw learning model integrated with Culturally Responsive Teaching on the topic of flat buildings. The study also seeks to create an inclusive, collaborative, and culturally relevant learning environment that accommodates the diverse backgrounds of students. By combining these approaches, the research intends to enhance student engagement, active participation, and conceptual understanding in mathematics. In addition to providing practical guidance for elementary school teachers in implementing culturally responsive and cooperative instructional strategies, this study is expected to contribute to the theoretical development of integrating cooperative learning models

with culturally responsive approaches. Furthermore, the findings may serve as a reference for future research on effective teaching strategies in multicultural elementary classrooms. Overall, the study aims to demonstrate that educational practices can simultaneously promote academic achievement and socio-cultural inclusivity, thereby fostering a more equitable and meaningful learning experience for all students.

Method

This study employed Kurt Lewin's model of Classroom Action Research, which consists of four iterative stages: planning, implementation, observation, and reflection. This approach was deemed suitable for addressing learning problems in a contextual and sustainable manner in Grade IV elementary school students. The research subjects were twenty-eight Grade IV students at Sekolah Dasar Negeri Bandungrejosari 2 in Malang City during the even semester of the 2024/2025 school year. Participants were purposively selected based on low mathematics learning outcomes in the topic of flat buildings, as well as their diverse cultural backgrounds and ages of nine to ten years. Data were collected using multiple instruments, including learning outcome tests consisting of twenty multiple-choice questions to measure cognitive achievement, observation sheets assessing student activities such as active discussion, courage to ask questions, involvement in group problem-solving, and participation in presenting discussion results, semi-structured interviews with the classroom teacher to evaluate responses to the learning model, and documentation consisting of photographs, field notes, and student work. All instruments were validated by two expert lecturers in mathematics education and partner teachers using expert judgment techniques and achieved a Content Validity Index of at least 0.80. The research procedure began with a pre-cycle to assess initial conditions of student learning outcomes and participation, followed by two action cycles, each consisting of two meetings of thirty-five minutes, focusing on the application of the Jigsaw model integrated with Culturally Responsive Teaching, linking flat building materials to students' local cultural context. Quantitative data were analyzed descriptively and comparatively by calculating average scores, learning completeness percentages, and normalized gain using the formula N-gain = (Post-test score – Pre-test score) / (Maximum score – Pre-test score), with effectiveness categories referring to Hake (1999). Qualitative data were analyzed through data reduction, data presentation, and descriptive conclusion drawing to capture changes in student behavior, interaction, and engagement during learning. This research obtained permission from the school principal and approval from the class teacher and students, ensuring that students' identities remained confidential throughout the study.

Results and Discussion

Result

This research was conducted in three stages: a pre-cycle, Cycle I, and Cycle II. Data were collected from student learning tests and observations of student activities during the learning process. The pre-cycle aimed to identify the initial conditions of students' mathematics learning outcomes and their participation in classroom activities. Observations focused on indicators such as active involvement in discussions, willingness to ask questions, collaboration in solving group problems, and participation in presenting group results. These data served as a baseline to

determine the effectiveness of the Jigsaw learning model integrated with Culturally Responsive Teaching. The results from each cycle were then compared to assess improvements in both cognitive achievement and student engagement. By analyzing the progression from the pre-cycle through Cycle II, the study provides insights into the impact of the integrated instructional approach on learning outcomes and classroom dynamics. Overall, this stage established a clear foundation for understanding the effectiveness of the applied intervention.

Table 1. Pre-Cycle Test Results for Grade IV Students of SDN Bandungrejosari 2

Criteria	Number of Students	Percentage
Finished (≥75)	0	0%
Incomplete	28	100%
Average	40,82	

In the pre-cycle stage, the learning process still relied on conventional methods dominated by lectures and practice questions, without incorporating students' cultural contexts. The results of the learning tests indicated that none of the students achieved the Minimum Competency Criteria score of seventy-five, with an average score of only forty point eight two. Consequently, all students, representing one hundred percent of the class, were classified as not having completed their learning requirements. Observations of classroom activities also revealed minimal student engagement, limited participation in discussions, and low collaboration in problem-solving tasks. These findings highlight the ineffectiveness of traditional instructional methods in promoting both cognitive achievement and active involvement among students. The data from this stage served as a baseline for evaluating the impact of the Jigsaw model integrated with Culturally Responsive Teaching in the subsequent cycles. It also emphasized the need for a more inclusive and interactive learning approach that considers the cultural diversity of students. Overall, the pre-cycle results demonstrated significant gaps in both academic performance and student engagement.

Table 2. Results of the First Cycle Test for Grade IV Students of SDN Bandungrejosari 2

Criteria	Meeting 1	Meeting 2
Finished (≥75)	3 (10,71%)	5 (17,86%)
Incomplete	25 (89,29%)	23 (82,14%)
Average	57,61	61,79

In Cycle I, the Jigsaw learning model integrated with Culturally Responsive Teaching began to be implemented. The instructional activities were conducted over two meetings, each with a duration of thirty-five minutes per session. The results of the formative tests demonstrated an improvement compared to the pre-cycle stage. In the first meeting, three students, representing ten point seven one percent of the class, achieved the learning completeness criteria, and this number increased to five students, or seventeen point eight six percent, in the second meeting. The average class score also rose to sixty-one point seven nine, indicating a notable improvement in cognitive achievement. Observations of student activities revealed

increased participation in discussions, more active collaboration in problem-solving tasks, and a growing willingness to ask questions. The learning outcomes data for Cycle I are presented in Table 2, which illustrates the progress achieved through the implementation of the integrated instructional model. These results suggest that the combination of the Jigsaw model and culturally responsive strategies began to positively influence both academic performance and classroom engagement.

Table 3. Results of the Second Cycle Test for Grade IV Students of SDN Bandungrejosari 2

Criteria	Number of Students	Percentage
Finished (≥75)	26	92,86%
Incomplete	2	7,14%
Average	74,29	

Cycle II was conducted after implementing improvements based on reflections from the previous cycle, including the formation of more heterogeneous groups, the use of visual media reflecting local culture, and providing additional guidance for less active students. The results demonstrated a substantial increase in learning outcomes, with twenty-six out of twenty-eight students, or ninety-two point eight six percent, achieving learning completeness and an average score of seventy-four point two nine. Observations also indicated a progressive enhancement in student engagement from one cycle to the next. While most students were passive during the pre-cycle, they began to participate in discussions during Cycle I, and by Cycle II, nearly all students actively engaged in discussions. They enthusiastically associated flat building materials with images of batik motifs and traditional tile patterns, integrating cultural context into their learning. This indicates that the integration of the Jigsaw learning model with Culturally Responsive Teaching effectively increased both cognitive achievement and socio-cultural engagement. The findings underscore the importance of culturally relevant instructional strategies and collaborative learning structures in fostering an inclusive and dynamic classroom environment. Overall, Cycle II results demonstrate the success of the intervention in improving mathematics learning outcomes and student participation in a multicultural elementary school setting.

The observation results indicated a progressive increase in student involvement across the cycles. During the pre-cycle, most students were passive and exhibited low confidence in participating in classroom activities. In Cycle I, students began to engage in discussions more actively, although participation was unevenly distributed among the class. Significant improvements were observed in Cycle II, where nearly all students actively participated in discussions and enthusiastically utilized visual media reflecting local cultural contexts. One observation note highlighted, "Most of the students seemed enthusiastic when explaining the shape of the flat building found in the drawing of batik cloth and the pattern of traditional house tiles" (Observation, Cycle II). These findings suggest that integrating the Jigsaw learning model with Culturally Responsive Teaching not only enhanced academic engagement but also encouraged students to connect mathematical concepts with their cultural knowledge. The

progressive improvement across cycles demonstrates that culturally relevant and collaborative learning strategies can foster greater student confidence, participation, and meaningful engagement in the learning process..

Discussion

The improvement in learning outcomes from the pre-cycle to Cycle II indicates that the application of the Jigsaw learning model integrated with Culturally Responsive Teaching has the potential to be effective in enhancing the mathematics learning outcomes of elementary school students. These results are consistent with the findings of Alfazr and colleagues (2016) and Kurniawan and Saputra (2022), who demonstrated that culture-based cooperative learning models can significantly improve student participation and academic achievement. In Cycle I, although there was an observable improvement in learning outcomes, the level of completeness remained relatively low, as some students experienced difficulties adapting to the structure of group discussions and the culturally contextualized questions. This observation aligns with Gay's (2010) research, which emphasizes that implementing culturally responsive learning requires a gradual adaptation process, particularly in multicultural classrooms. The findings suggest that students need time to adjust to collaborative learning methods that incorporate cultural elements, as this approach demands both cognitive engagement and socio-cultural awareness. Overall, the progressive improvement from Cycle I to Cycle II highlights the importance of providing structured guidance, culturally relevant materials, and active support to facilitate students' adaptation and maximize the effectiveness of the learning model. These results underscore the potential of combining cooperative learning and culturally responsive approaches to create a more inclusive, engaging, and effective mathematics learning environment.

Reflections from Cycle I served as a critical foundation for improvements implemented in Cycle II, which were shown to enhance student engagement through the reinforcement of culturally contextual media, the formation of heterogeneous groups, and the provision of intensive guidance. This strategy aligns with Vygotsky's perspective on the importance of scaffolding in cooperative learning that is responsive to cultural contexts (as cited in Suparno, 2013). Observational data indicated that when students were provided opportunities to connect learning materials with their own cultural experiences, both enthusiasm and active participation increased significantly. This heightened engagement had a direct and positive effect on students' learning outcomes, demonstrating the value of culturally relevant scaffolding in the learning process. Furthermore, these findings suggest that structured guidance and culturally informed instructional strategies can help students navigate collaborative learning more effectively. The progressive improvements across cycles highlight that combining cooperative learning with culturally responsive approaches fosters not only cognitive achievement but also socio-emotional growth and confidence. Overall, this evidence reinforces the importance of reflective practices in adapting instructional methods to optimize student learning in multicultural classroom settings.

However, this study has several limitations. The absence of a control group means that claims regarding the effectiveness of the intervention are limited to the context of the class under study. In addition, students' initial ability to recognize and relate to local cultural elements varied, which influenced the pace at which they adapted to the learning model. Future research should consider employing comparative or mixed-method designs to examine the impact of integrating the Jigsaw model with Culturally Responsive Teaching across different mathematics

topics and educational levels. Such studies would provide more generalizable evidence regarding the effectiveness of this integrated approach. Moreover, the model has the potential to be further developed to foster twenty-first century social skills, empathy, and competencies in multicultural classrooms. By emphasizing both cognitive achievement and socio-cultural engagement, this approach offers a promising framework for preparing students to navigate diverse and collaborative learning environments effectively.

Conclusion

This study aimed to improve the mathematics learning outcomes of Grade IV students through the application of the Jigsaw learning model integrated with Culturally Responsive Teaching. Based on the implementation of actions over two cycles, it can be concluded that this integrated model is effective in enhancing students' conceptual understanding of flat buildings and their active involvement in the learning process. Significant improvements were observed in learning completeness, active participation, and enthusiasm during culturally contextualized group discussions. The findings demonstrate that the simultaneous integration of cooperative learning and culturally responsive approaches can create more inclusive, contextual, and meaningful mathematics learning experiences. Practically, teachers are encouraged to develop techniques for incorporating local cultural contexts into instruction, prepare relevant culture-based teaching materials, and design group activities that consider students' cultural backgrounds. Furthermore, teachers are advised to conduct periodic evaluations of post-intervention learning outcomes to ensure that the model not only produces immediate improvements but also sustains long-term impacts in fostering a fair, participatory, and diversity-respecting learning environment in elementary schools.

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Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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