Jigsaw Cooperative Learning and Its Impact on Students' Motivation in Mathematics Education

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Abstract

This study aimed to examine the effect of the jigsaw cooperative learning model on students' motivation in mathematics learning. A quantitative approach with a pre-experimental design was employed. The population consisted of eighth-grade students, from which one class of 41 students was selected using purposive sampling. Data were collected using a mathematics learning motivation questionnaire. Descriptive statistics were used to describe students' motivation levels, while inferential statistics using a t-test were applied to test the research hypothesis. The results showed that students' motivation in mathematics learning before and after the implementation of the jigsaw cooperative learning model was generally at a moderate level. However, the implementation of the jigsaw model resulted in an increase of 80.48% in overall students' motivation and a 96% increase across motivation indicators. The t-test results indicated that the calculated t-value (5.6774) exceeded the critical t-value (2.02), demonstrating a statistically significant effect of the jigsaw cooperative learning model on students' motivation in mathematics learning. These findings suggest that the jigsaw cooperative learning model is an effective instructional strategy for enhancing students' motivation in mathematics.

Keywords: *Cooperative learning, Jigsaw, Learning motivation, Mathematics education*

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1. Introduction

The teaching and learning process is a complex and dynamic activity, as it is not merely limited to the transfer of information from teachers to students or vice versa, but also involves various forms of activities, interactions, and actions that are consciously and systematically carried out (Akbar, Riyanti, et al., 2025). All of these activities are directed toward achieving optimal learning objectives, particularly when effective and sustainable learning outcomes are expected. Therefore, the learning process requires the active involvement of students at every stage of instruction (Suryadi, 2010). One effort that can be made to realize such conditions is the implementation of a particular instructional approach, as an approach essentially represents a systematic attempt to develop students' discipline, activeness, and responsibility in the learning process.

An instructional approach fundamentally emphasizes the importance of learning discipline through the stages that students must undergo to achieve a comprehensive understanding of the subject matter (Steffe & Kieren, 1994). The instructional approach not only serves as a guideline for teachers in conducting teaching activities but also becomes a determining factor in the success or failure of the teaching and learning process as a whole (Akbar, Herman, et al., 2025). The success of learning is highly dependent on the teacher's ability to design and implement approaches that are aligned with learning objectives as well as the characteristics of the subject matter and students. Therefore, teachers are required to be able to select and integrate

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appropriate approaches, strategies, and teaching methods to ensure that the learning process can be carried out effectively and efficiently (Blegur et al., 2017).

In instructional practice, particularly in mathematics education, most students tend to perceive mathematics as a difficult subject that requires a high level of thinking ability (Li, 2024). This perception often leads to low interest and learning motivation among students. Consequently, mathematics teachers are expected to possess adequate pedagogical competence, especially in developing various teaching methods and instructional skills that can attract students' attention and stimulate their learning motivation (Aidah & Nurafni, 2022; Budhiarti et al., 2025). Learning motivation plays a crucial role in encouraging students to actively engage in the learning process, as motivation serves as an internal driving force that prompts individuals to learn earnestly. Learning motivation can be reflected in ambitious attitudes, a willingness to work hard, perseverance in facing difficulties, and the ability to be creative and productive in learning activities, which ultimately contribute to the improvement of students' academic achievement (Strong et al., 2012).

Students' learning success is not determined by a single factor alone, but rather by various interrelated factors (Akbar et al., 2023a). These factors include students' prior abilities, the learning environment, educational facilities, and the way teachers manage the learning process. One factor that has a significant influence on learning success is the instructional model used by teachers in delivering subject matter. An appropriate instructional model can create a conducive learning atmosphere, encourage active student participation, and enhance students' learning motivation. Conversely, the use of less varied instructional models that tend to be teacher-centered may result in passive learning behavior and low student motivation, particularly in mathematics learning (Rahmandani et al., 2025).

Low learning motivation in mathematics is often indicated by students' lack of active participation in learning activities, such as reluctance to ask questions, low confidence in expressing opinions, and insufficient learning readiness (Herawati et al., 2023). This condition may occur even when students' academic performance is generally considered satisfactory; however, such achievements do not fully reflect students' actual abilities and learning motivation. Moreover, this situation suggests that the learning process is still dominated by conventional, teacher-centered instructional models, which limit interaction and student participation.

Along with the development of science and technology, the field of education is required to continuously innovate in developing instructional models that can improve the quality of both learning processes and outcomes (Fitriani et al., 2024). One instructional model that has been widely developed and recommended is cooperative learning, which emphasizes collaboration among students in small, heterogeneous groups. Through cooperative learning, students are encouraged to help one another, share knowledge, and take responsibility for both individual and group learning outcomes. This instructional model provides students with ample opportunities to actively participate in the learning process through asking and answering questions, expressing opinions, and engaging in discussions to solve learning problems (Akbar et al., 2023b).

One type of cooperative learning model is the jigsaw model, which has distinctive characteristics such as positive interdependence among group members, individual accountability for mastering learning material, heterogeneous group composition, shared leadership roles, and an emphasis on collective responsibility and teamwork (Harefa et al., 2022). The success of learning through this model largely depends on the cooperation and contribution of each group member. The learning atmosphere created through the implementation of the jigsaw cooperative learning model is considered highly conducive to fostering students' learning motivation, as each student is assigned a clear role and responsibility in the learning process (Nurainah et al., 2025). Based on the foregoing discussion, the implementation of the jigsaw cooperative learning model in mathematics instruction is considered necessary to be further examined through research in order to determine its effect on students' learning motivation.

2. Method

This study employed a quantitative approach using an experimental method by implementing the jigsaw cooperative learning model in mathematics instruction. The research population consisted of all eighth-grade students distributed across three parallel classes, totaling 124 students. Based on information from the mathematics teacher and previous academic performance records, one class with relatively lower levels of motivation in learning mathematics was selected as the research sample using purposive sampling, consisting of 41 students.

The research procedure began with a planning phase, which included the preparation of lesson plans, designing instructional scenarios based on the jigsaw cooperative learning model, and creating observation sheets to monitor classroom learning activities. Prior to the implementation of the model, a pre-questionnaire was administered to assess students' initial motivation in mathematics learning. Students were then grouped heterogeneously according to their prior academic achievement. During the instructional process, classroom activities were continuously observed to document the implementation of the jigsaw cooperative learning model. After the completion of instruction for a given topic, a post-questionnaire was administered to evaluate changes in students' motivation in learning mathematics.

The research instrument used was a motivation questionnaire consisting of four dimensions: ambition, hard work, perseverance in facing difficulties, and creativity and productivity, comprising a total of 30 indicators. The questionnaire employed five response options ranging from "very often" to "never," with scoring adjusted for positive and negative items. Prior to its use in the main study, the questionnaire was pilot-tested on a different class to examine its validity using the Pearson product–moment correlation and its reliability using Cronbach's alpha coefficient. The pilot test indicated that 25 out of 30 items were valid, and the reliability coefficient was 0.80665, classified as high.

Data collected were analyzed using descriptive and inferential statistics. Descriptive statistics were employed to describe students' motivation levels before and after the implementation of the jigsaw model, while inferential statistics were applied to test the research hypothesis. The normality of the data was examined using the Kolmogorov–Smirnov test to ensure that the data were drawn from a normally distributed population. Once normality was confirmed, a paired-sample t-test was conducted to evaluate the significance of differences in students' motivation levels before and after the intervention, with a significance level set at 0.05.

3. Results

Descriptive analysis indicated that students' motivation in learning mathematics before the implementation of the jigsaw cooperative learning model had an average score of 94.34, a median of 94, a mode of 94, a maximum score of 111, a minimum score of 71, and a standard deviation of 8.32. Based on the classification of scores into intervals, 6 students or 14.64 percent were categorized as having low motivation, 26 students or 63.41 percent were classified as moderate, and 9 students or 21.95 percent were categorized as high. These results suggest that the majority of students were at a moderate level of motivation prior to the application of the learning model. After the implementation of the jigsaw cooperative learning model, students' motivation in mathematics increased, with an average score of 99.83, a median of 100, a mode of 98, a maximum score of 114, a minimum score of 81, and a standard deviation of 7.00. The distribution of scores showed that 7 students or 17.07 percent fell into the low category, 28 students or 68.30 percent were in the moderate category, and 6 students or 14.63 percent were in the high category. The frequency distribution of changes in motivation revealed that 33 students or 80.48 percent experienced an increase, 4 students or 9.76 percent remained unchanged, and 4 students or 9.76 percent showed a decrease. Therefore, it can be concluded that the implementation of the jigsaw cooperative learning model had a positive effect on students' motivation in learning mathematics, as most students demonstrated an improvement in motivation after the learning intervention.

Table 1. Descriptive Statistics of Students' Motivation in Learning Mathematics Before and After the Jigsaw Cooperative Learning Model

Motivation Category	Before Implementation	Percentage (%)	After Implementation	Percentage (%)
High	9	21.95	6	14.63
Moderate	26	63.41	28	68.30
Low	6	14.64	7	17.07

The inferential statistical analysis revealed that the difference between students' motivation in mathematics learning before and after the application of the jigsaw cooperative learning model satisfied the assumption of normal distribution. The Kolmogorov Smirnov test produced a Dmax value of 0.1794 and a Dtable value of 0.2124. Because the Dmax value was lower than the Dtable value, the difference in students' mathematics learning motivation scores can be regarded as normally distributed. With the normality assumption fulfilled, hypothesis testing was subsequently conducted using a t test. The results demonstrated that the calculated t value of 5.3278 exceeded the critical t value of 2.02 at a confidence level of 0.95. This indicates that the statistical test yielded a significant result, leading to the rejection of the null hypothesis and the acceptance of the alternative hypothesis. Therefore, it can be concluded that the implementation of the jigsaw cooperative learning model had a statistically significant influence on students' motivation in mathematics learning.

Table 2. Results of Inferential Statistical Analysis

Analysis Type	Statistical Test	Calculated Value	Critical Value	Significance Level	Conclusion
Data normality	Kolmogorov Smirnov	D.max = 0.1794	D.table = 0.2124	0.05	Data are normally distributed
Hypoyhesis testing	T test	t.calculated = 5.3278	t.table = 2.02	0.05	Significant effect, H_0 rejected

These findings are further supported by the results of descriptive analysis, which showed that students' motivation in mathematics learning prior to the implementation of the jigsaw cooperative learning model was generally classified as moderate, accounting for 63.41 percent of the students. After the implementation of the model, students' motivation remained in the moderate category but increased in proportion to 68.30 percent. Moreover, the mean motivation score after the application of the jigsaw cooperative learning model was higher than that recorded before its application, rising from 94.34 to 99.83. This suggests that learning activities conducted using the jigsaw cooperative learning model were more effective than those carried out without the use of the model (Nurainah et al., 2025). These results emphasize that the selection of an appropriate learning model can positively affect students' motivation to learn. The jigsaw cooperative learning model promotes greater student engagement in the learning process through active participation such as asking questions, expressing ideas, and engaging in discussions to solve problems, thereby making mathematics learning more interesting and enjoyable. Consequently, students tend not to perceive mathematics as a difficult subject. The results of this study are consistent with the view that cooperative learning using the jigsaw approach can enhance students' motivation to achieve learning goals, as individual achievement is closely linked to group success. However, certain limitations were observed during its implementation, particularly the limited amount of instructional time available for mathematics lessons, which requires teachers to manage classroom time effectively to ensure optimal implementation of the jigsaw cooperative learning model (Harefa et al., 2022).

The findings of this study indicate that the implementation of the jigsaw cooperative learning model has a positive and significant effect on students' motivation in mathematics learning. Although students' motivation levels before and after the intervention were generally categorized as moderate, the results demonstrate a substantial improvement in motivation following the application of the jigsaw model. This improvement suggests that learning environments which actively involve students in cooperative tasks can effectively stimulate their interest and engagement in mathematics learning. Cooperative learning encourages students to take responsibility not only for their own learning but also for the learning of their peers, which can enhance intrinsic motivation and persistence in academic tasks (Nurhidayatika et al., 2025).

The increase in students' motivation after the implementation of the jigsaw cooperative learning model can be attributed to the active learning processes embedded in this instructional approach. Through structured group interactions, students are required to discuss, explain, and share information with group members, which promotes deeper cognitive processing and a sense of ownership over learning outcomes. Such learning conditions are consistent with social constructivist perspectives, which emphasize that knowledge is constructed through social interaction and collaboration (Vygotzky, 1978). When students are actively engaged in explaining concepts to peers, their confidence and motivation to learn mathematics tend to increase.

Furthermore, the improvement observed across motivation indicators suggests that the jigsaw cooperative learning model supports multiple dimensions of learning motivation, including persistence, effort, and creativity. Cooperative learning environments have been shown to foster positive interdependence and individual accountability, both of which are essential for sustaining student motivation (Sari & Ahmad, 2024). In this study, students were motivated to contribute meaningfully to group tasks because their success was closely linked to the success of the group, reinforcing a shared responsibility for learning outcomes.

The results of this study are also consistent with previous research indicating that cooperative learning strategies are more effective than traditional teacher centered instruction in promoting students' motivation and engagement in mathematics learning. Traditional instructional approaches often limit student participation and interaction, which may reduce motivation, particularly in subjects perceived as difficult such as mathematics (Hattie, 2009). In contrast, the jigsaw model creates a supportive learning atmosphere where students can actively participate, express ideas, and collaboratively solve problems, making mathematics learning more enjoyable and less intimidating.

Despite its positive impact, the implementation of the jigsaw cooperative learning model also presents certain challenges. One limitation identified in this study is the constraint of instructional time, as cooperative learning activities require careful planning and sufficient time for group discussion and knowledge sharing. Effective classroom management and time allocation are therefore crucial to ensure that learning objectives are achieved without compromising instructional efficiency (Suryadi, 2019). Nevertheless, when properly implemented, the jigsaw cooperative learning model offers a valuable instructional alternative for enhancing students' motivation in mathematics learning.

5. Conclusion

Based on the results of the analysis and discussion of this study, it can be concluded that students' motivation in learning mathematics, both before and after the implementation of the jigsaw cooperative learning model, was generally classified as moderate. Nevertheless, the application of the jigsaw cooperative learning model was able to significantly increase students' motivation in learning mathematics, as indicated by an improvement experienced by the majority of students, reaching 80.48 percent. In addition, the level of motivation across all indicators, both before and after the implementation of the jigsaw cooperative learning model, was also generally at a moderate level, but showed a substantial increase of 96 percent. These findings demonstrate that the jigsaw cooperative learning model has a significant effect on enhancing students' motivation in mathematics learning, indicating that this instructional model is effective in promoting students' motivation in mathematics.

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