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Enhancing Collaboration and Learning Outcomes through the Jigsaw Cooperative Learning Model among Elementary School Students

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Abstract. Low academic achievement and limited collaborative interaction remain prevalent challenges in primary education learning processes. Conventional teacher-centered approaches have been insufficient in fostering active participation and student cooperation. This study aims to analyze the impact of the Jigsaw cooperative learning model on improving learning outcomes and collaboration among elementary school students. Employing a quantitative approach with a one-group pretest-posttest pre-experimental design, the study involved 23 third-grade students from UPTD SDN Lajing 5 Arosbaya. The instruments used included a learning achievement test and a student collaboration questionnaire. Data were analyzed through validity, reliability, normality tests, and the Paired Sample T-Test using SPSS v21.0. The findings indicate a significant improvement in both academic performance and student cooperation following the implementation of the Jigsaw model. Post-test scores and collaboration indicators increased substantially, with a significance value of 0.000 ($p < 0.05$). The instruments were found to be valid and reliable, with normally distributed data. In conclusion, the Jigsaw model proved effective in enhancing both learning outcomes and student collaboration in primary education. This study contributes empirical evidence supporting the Jigsaw method's efficacy in the context of Pancasila Education and recommends it as an innovative strategy for fostering active and collaborative learning.

Keywords: *Cooperative Learning; Jigsaw; Collaboration; Learning Outcomes; Learning Evaluation*

INTRODUCTION

Primary education plays a fundamental role in shaping children's character, social skills, and intellectual development from an early age. In the context of an increasingly globalized world, educational systems are expected to meet the demands of 21st-century learning, which emphasizes collaboration, critical thinking, and technological adaptation (Arzfi & Montessori, 2025; Wahjusaputri et al., 2024). However, in many primary school settings, the dominant pedagogical approach remains traditional and teacher-centered, limiting opportunities for students' active engagement and peer collaboration (Obaid et al., 2025; Sukriono, 2020). This condition contributes to low academic achievement and a lack of meaningful social interaction among students (Arifin, 2021).

To address these challenges, innovative pedagogical strategies are necessary. One effective approach widely recognized for improving academic performance, motivation, and collaborative skills is cooperative learning, particularly the Jigsaw model (Baken et al., 2022; Blajvaz et al., 2022; Stanczak et al., 2022). The Jigsaw method encourages students to actively engage in small

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groups where they not only acquire knowledge from the teacher but also learn from one another (Chopra et al., 2023; González-Gálvez et al., 2023; Gunji, 2022).

Numerous studies across disciplines and educational levels have validated the effectiveness of this model. Applications in science, language, medical education, and civics have shown that Jigsaw enhances learning motivation, self-confidence, cognitive engagement, and conceptual understanding (Al-Yaseen, 2020; Costouros, 2020; Dağlı et al., 2025; Haftador et al., 2021). In addition to promoting active participation, the method supports higher-order thinking skills (H. Silva et al., 2023; Wu et al., 2024). In the Indonesian context, Jigsaw has increasingly been utilized to strengthen civic values within primary education, aligning with national curricular goals to foster national character development (Firmansyah et al., 2024; Komalasari et al., 2024; Waldi et al., 2025).

Methodologically, various studies have employed quasi-experimental and true-experimental designs to examine this model's effects on collaborative skills and conceptual understanding (Cochon Drouet et al., 2024; Jermsittiparsert et al., 2021; Y. M. Patil & Kumbhar, 2022). These findings consistently show that students exposed to Jigsaw instruction achieve significant improvements in cognitive, affective, and psychomotor domains (Kekeba, 2025; Kekeba et al., 2025; Zhan et al., 2024), suggesting the model's holistic educational benefits (Mulyana et al., 2024; Rahimi et al., 2020; Wang et al., 2023).

Recent scholarship has also highlighted the importance of integrating Jigsaw with digital learning and flipped classroom models, particularly in post-pandemic contexts that require remote and hybrid learning modalities (Haider et al., 2025; Mohebbi et al., 2022; Wu et al., 2023). Digital collaboration rooted in Jigsaw principles has been found to sustain motivation, engagement, and learning outcomes even in virtual environments (Chang & Benson, 2020; Jeong, 2021; Mahmud & Wong, 2021).

A comprehensive review of the literature underscores the urgency of implementing the Jigsaw cooperative learning model in value- and character-oriented subjects such as Pancasila Education. Although some studies have indicated the model's effectiveness in fostering national values and constructive group interaction (Kebede et al., 2025; Riant et al., 2024; Siddiqui & Gorard, 2023), specific investigations into its application at the primary school level within Pancasila Education remain limited. This gap forms the basis of the present study, which aims to analyze the impact of the Jigsaw model on collaboration and academic achievement among primary school students.

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RESEARCH METHODS

Research Design

This study employed a pre-experimental research design, specifically the One Group Pretest-Posttest Design, to evaluate the impact of the Jigsaw cooperative learning model on students' academic performance and collaborative skills. This design has been widely adopted in educational intervention studies where the research focuses on changes within a single group without a control group (Bhandary et al., 2024; Darabi et al., 2025; Kekeba et al., 2024; R. Y. Patil et al., 2025). The study design is illustrated as follows:

Treatment Model	Design
Cooperative Learning – Jigsaw Type	O1 → X → O2

O1: Pretest

X: Jigsaw intervention

O2: Posttest

Population and Sample

The study population consisted of third-grade students at UPTD SDN Lajing 5 Arosbaya during the 2024/2025 academic year. A total sampling technique was applied, involving all 23 students in the class. This approach is common in small classroom settings to enhance internal validity (Kebede et al., 2025; Usman et al., 2022).

Grade	Male	Female	Total
III	9	14	23

Research Instruments

Two instruments were utilized:

1. Academic Achievement Test: A multiple-choice test designed to assess students' cognitive improvement after the Jigsaw intervention, based on the Pancasila Education curriculum.
2. Student Collaboration Questionnaire: Developed from key indicators of group learning cooperation, including communication, responsibility, and participation.

This mixed-instrument strategy is consistent with previous studies that evaluated both cognitive and affective domains in cooperative learning contexts (Al-Kreimeen, 2024; Jermsittiparsert et al., 2021; Koçak, 2025).

Instrument Blueprint Highlights:

1. Achievement Test: Focused on cardinal directions and map reading skills.
2. Collaboration Questionnaire: Contained 15 items distributed across three indicators:
   a. Effective communication (5 items)

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b. Responsibility (5 items)
c. Active participation (5 items)

Procedures

The study was conducted in three phases:

1. Pretest Phase: Assessment of students' prior knowledge and collaborative behavior.
2. Intervention Phase: Implementation of the Jigsaw model in class-based instruction.
3. Posttest Phase: Administration of the same tests to evaluate post-intervention improvements.

The instructional implementation adhered to well-established Jigsaw steps found effective in increasing engagement and learning outcomes (Chopra et al., 2023; Haider et al., 2025; Nalls & Wickerd, 2023).

Data Analysis Techniques

Data were analyzed using the following procedures:

1. Instrument Validity and Reliability Testing: The Pearson product-moment correlation was used to verify item validity, while Cronbach's Alpha assessed reliability (Ahmad & Zainal, 2023; Fendos, 2021).
2. Normality Testing: Kolmogorov-Smirnov test confirmed whether data were normally distributed.
3. Inferential Statistics: Paired Sample T-Tests were conducted using SPSS version 21.0 to identify statistically significant differences between pretest and posttest results (Fitriana et al., 2023; Lin et al., 2025; Stanczak et al., 2022).

The quantitative analysis approach was appropriate for this research design, enabling empirical evaluation of the Jigsaw model's effectiveness in both cognitive and affective domains (Cerón-García et al., 2022; Eckert et al., 2023; H. Silva et al., 2023).

RESULT

Enhancement of Student Collaboration

The results of the student collaboration questionnaire revealed a significant increase in cooperative behavior following the implementation of the Jigsaw learning model. The average collaboration score improved from a "moderate" to an "excellent" category, aligning with previous studies that affirm the Jigsaw model's effectiveness in fostering teamwork, interpersonal communication, and empathy (Al-Kreimeen, 2024; Gunji, 2022; Jeppu et al., 2023).

The cooperative structure inherent in the Jigsaw model encouraged interdependence among students, leading to a heightened sense of collective responsibility and active participation

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(Stanczak et al., 2022; Chopra et al., 2023). This result is consistent with findings from studies conducted in both physical and virtual classrooms, where the Jigsaw approach significantly enhanced social and collaborative competencies (Mahmud & Wong, 2021; Wu et al., 2023).

According to the comparative analysis of pretest and posttest scores, the highest post-intervention collaboration score reached 80, while the highest academic test score was 90. The mean posttest score for learning outcomes was 86.1, indicating substantial academic gains after the Jigsaw method was applied.

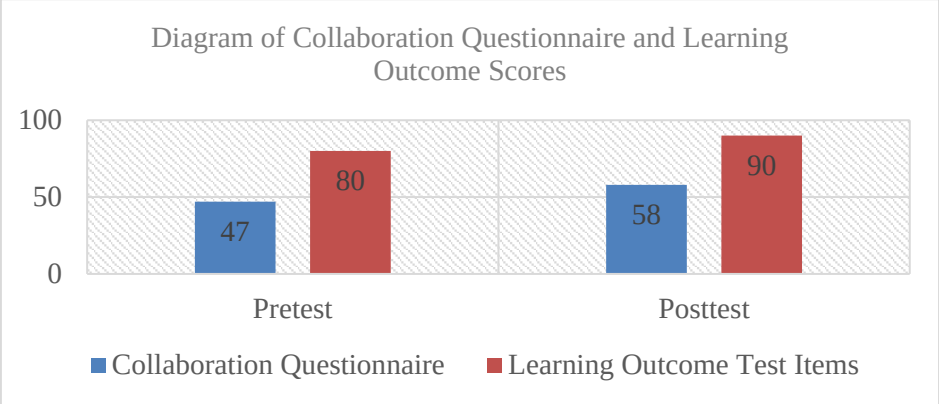

Diagram 1. Pretest-Posttest Scores of Collaboration Questionnaire and Highest Learning Outcomes

Based on Diagram 1, which illustrates the pretest-posttest scores from the collaboration questionnaire and students' learning outcomes, it can be concluded that the highest average scores were achieved by the group of students taught using the Jigsaw cooperative learning model. The highest collaboration questionnaire score was 80, while the highest score for the learning outcomes test was 90.

A trial of the learning outcomes test was conducted with 23 student respondents, using 10 essay-type questions. After administering the instrument, the total score obtained was $\sum x = 1{,}980$, with N = 23. Thus, the mean score was calculated to be 86.1. The results processed using SPSS software are presented as follows:

Table 1. Results of the Validity Test of the Cooperation Questionnaire

No Question	r_{xy}	r_{tabel}	Information
1	0.621	0.413	Valid
2	0.614	0.413	Valid
3	0.636	0.413	Valid
4	0.517	0.413	Valid
5	0.523	0.413	Valid
6	0.523	0.413	Valid
7	0.636	0.413	Valid
8	0.723	0.413	Valid
9	0.517	0.413	Valid

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10	0.723	0.413	Valid
11	0.520	0.413	Valid
12	0.543	0.413	Valid
13	0.621	0.413	Valid
14	0.723	0.413	Valid
15	0.526	0.413	Valid

Based on Table 1, which presents the Validity Test Results of the Collaboration Questionnaire, it was found that the critical value of r with N = 23 at a 5% significance level is 0.413. The calculated r-values were then compared with this critical value. The results indicate that all r values exceeded the r value, suggesting that all items in the collaboration questionnaire are valid. Therefore, these items are deemed appropriate for use as instruments for data collection in this research.

Academic Performance Improvement

The statistical analysis confirmed a significant enhancement in students' academic achievement. The mean test score increased from 71.3 (pretest) to 86.1 (posttest). The Paired Sample T-Test yielded a significance value of 0.000 ($p < 0.05$), demonstrating a strong effect of the Jigsaw model on students' learning outcomes. This aligns with findings from (Y. M. Patil & Kumbhar, 2022), who reported that Jigsaw fosters improved content retention and deep conceptual understanding. Similar trends were noted by (González-Gálvez et al., 2023) and (Bhandary et al., 2024), who observed consistent academic performance improvements with cooperative learning interventions.

Table 2. Results of Learning Outcome Validity Test Data

No Question	r_{xy}	r_{tabel}	Information
1	0.686	0.413	Valid
2	0.686	0.413	Valid
3	0.686	0.413	Valid
4	0.514	0.413	Valid
5	0.514	0.413	Valid
6	0.514	0.413	Valid
7	0.686	0.413	Valid
8	0.514	0.413	Valid
9	0.514	0.413	Valid
10	0.514	0.413	Valid

Based on Table 2, which presents the Validity Test Results of the Learning Outcome Test Instrument, it was determined that the critical r-value for N = 23 at a 5% significance level is 0.413. This critical value was then compared to the calculated r-values obtained from the test data. The comparison shows that all values are greater than the value, indicating that all items in the

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test instrument are valid. Therefore, the test items can be reliably used as instruments for data collection in this study.

Instrument Validity and Reliability

All test and questionnaire items were validated using the Pearson product-moment correlation method, with r-values exceeding the critical threshold (r_table = 0.413, N = 23). This confirmed that all items were valid for data collection. The reliability analysis produced Cronbach's Alpha values of 0.757 for the collaboration questionnaire and 0.494 for the achievement test, both surpassing the critical value, thereby confirming internal consistency (Fendos, 2021; V. S. Silva et al., 2022).

Table 3. Results of the Reliability Test of the Cooperation Questionnaire

Reliability Statistics	
Cronbach's Alpha	N of Items
.757	15

Based on Table 3, which shows the Reliability Test Results of the Collaboration Questionnaire, the Cronbach's Alpha coefficient was found to be 0.757. This value was compared to the critical r-value, which for N = 23 at a 5% significance level, is 0.413. Since Alpha (0.757) (0.413), it can be concluded that the collaboration questionnaire is reliable. In other words, the instrument demonstrates internal consistency and is therefore suitable for use as a data collection tool in this study.

Table 4. Reliability Test of Learning Outcomes

Reliability Statistics	
Cronbach's Alpha	N of Items
.494	10

Based on Table 4, which presents the Reliability Test Results for Learning Outcomes, the Cronbach's Alpha coefficient was calculated to be 0.494. This value was then compared with the critical r-value for N = 23 at a 5% significance level, which is 0.413. Since Alpha (0.494) > (0.413), it can be concluded that the learning outcomes instrument is reliable, indicating that the test items consistently measure students' performance.

The normality test was conducted to determine whether the data in this study followed a normal distribution. The Kolmogorov-Smirnov test, supported by IBM SPSS version 21, was employed for this purpose. The results of the normality test for the collaboration questionnaire are presented as follows:

Tabel 5. Hasil Uji Normalitas Angket Kerjasama

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One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		23
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	9.38107879
Most Extreme Differences	Absolute	.125
	Positive	.120
	Negative	-.125
Kolmogorov-Smirnov Z		.601
Asymp. Sig. (2-tailed)		.863
a. Test distribution is Normal.		
b. Calculated from data.		

Normality and Statistical Validity

Kolmogorov-Smirnov tests confirmed that the data were normally distributed (p-values > 0.05), validating the use of parametric tests for further analysis. This procedure supports the methodological rigor and justifies the interpretation of the Paired Sample T-Test results (Cochon Drouet et al., 2024; Jermsittiparsert et al., 2021).

Table 6. Normality Test Results for Learning Outcomes

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		23
Normal Parameters[a,b]	an	.0000000
	Std. Deviation	4.40457450
Most Extreme Differences	Absolute	.191
	Positive	.191
	Negative	-.156
Kolmogorov-Smirnov Z		.915
Asymp. Sig. (2-tailed)		.373
a. Test distribution is Normal.		
b. Calculated from data.		

Based on Table 6, which displays the Normality Test Results for Learning Outcomes, the significance value was found to be 0.373, which is greater than 0.05. This indicates that the data are normally distributed, and thus the assumption of normality is met for the learning outcomes variable.

Table 7. Paired Sample Test Results for the Collaboration Questionnaire

Paired Samples Test					
	Paired Differences		t	df	Sig. (2-tailed)

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		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	pretest posttest	-40.739	6.009	1.253	-43.3380	-38.141	-32.513	22	.000

Based on Table 7, which presents the results of the Paired Sample Test for the Pretest and Posttest of the Collaboration Questionnaire, the Sig. (2-tailed) value was found to be 0.000, which is less than 0.05. This result leads to the rejection of the null hypothesis (H_0), indicating that there is a statistically significant effect of the Jigsaw cooperative learning model. Therefore, it can be concluded that the Jigsaw model positively influences students' collaboration.

Table 8. Paired Sample Test Results for Students' Learning Outcomes

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest posttest	-19.86957	11.71753	2.44327	-24.93660	-14.80253	-8.132	22	.000

Based on Table 8, which presents the Paired Sample Test Results for Students' Learning Outcomes, the Sig. (2-tailed) value was found to be 0.000, which is less than 0.05. This result leads to the rejection of the null hypothesis (H_0), indicating that the Jigsaw cooperative learning model has a statistically significant effect on students' academic achievement. Therefore, it can be concluded that the implementation of the Jigsaw cooperative learning model has a positive impact on the learning outcomes of the students in the observed class.

DISCUSSION

The findings of this study reinforce previous evidence suggesting that the Jigsaw cooperative learning model plays a significant role in enhancing both academic achievement and students' collaboration skills. The observed increases in learning outcome scores and collaboration questionnaire responses reflect the effectiveness of this model, consistent with the results reported by (Stanczak et al., 2022), who found that Jigsaw consistently fosters improvements in cognitive performance and academic motivation.

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High levels of student engagement during the Jigsaw sessions appeared to contribute significantly to improved learning outcomes. Several studies have emphasized that this model allows learners to engage in deep information processing through reciprocal teaching, which supports meaningful knowledge construction and conceptual understanding (Bhandary et al., 2024; González-Gálvez et al., 2023). In this context, small-group social interactions are shown to foster collaborative skills development, as highlighted by (Jeppu et al., 2023) and (Gunji, 2022), who emphasized the pivotal role of communication in successful cooperative learning.

The model's effectiveness is also evident in the notable increases in students' motivation and self-confidence. Research by (Wang et al., 2023) and (Haider et al., 2025) demonstrated that students feel more valued and responsible for their learning when engaged in Jigsaw activities. These findings align with social constructivist theories, which position learners as active agents in knowledge construction through interaction (Al-Kreimeen, 2024; Rahimi et al., 2020).

In the context of elementary education, the findings are consistent with those of (Kekeba, 2025), who reported that the Jigsaw model significantly improves conceptual understanding and social skills among primary school students. This advantage is also supported by (Darabi et al., 2025), who compared Jigsaw with lecture-based methods and concluded that cooperative approaches are far more effective in increasing student satisfaction and engagement.

Several studies have pointed out that the success of the Jigsaw model is closely linked to the facilitator's role. (Chopra et al., 2023) and (Fitriana et al., 2023) emphasized the importance of teacher guidance in managing group dynamics to ensure equitable participation. (Eckert et al., 2023) further affirmed that optimal outcomes are achieved when group structures and role assignments are effectively implemented.

The model also demonstrates flexibility across various disciplines. For instance, (Baken et al., 2022) reported its effectiveness in biology laboratory practices, while (Lin et al., 2025) highlighted its role in building confidence in nursing education. Adaptations of the Jigsaw model in online learning settings, such as those examined by (Wu et al., 2023) and (Mahmud & Wong, 2021), also yielded positive outcomes in maintaining student engagement and interaction during the pandemic.

Overall, the Jigsaw learning model contributes not only to cognitive gains but also strengthens students' affective and social dimensions. This provides compelling support for its broader adoption by educators, as recommended in systematic reviews by (Vives et al., 2024) and (H. Silva et al., 2023), which concluded that Jigsaw is among the most effective cooperative learning strategies over the past four decades.

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Nevertheless, challenges remain, particularly in terms of time management and collaboration monitoring in large classes. (R. Y. Patil et al., 2025) and (Mohebbi et al., 2022) underscored the necessity of teacher training for effective facilitation, and the importance of employing supportive technologies to manage group work efficiently. In conclusion, the findings of this study provide robust support for the theoretical and empirical foundations of the Jigsaw model's effectiveness in improving student learning outcomes and collaboration. The practical implication is the necessity of integrating cooperative learning strategies, particularly the Jigsaw model, into elementary school curricula to promote balanced development of students' cognitive and social competencies**.**

CONCLUSION

This study affirms that the implementation of the Jigsaw cooperative learning model significantly enhances both academic achievement and student collaboration in primary education settings. Based on comprehensive statistical analysis, substantial improvements were observed in cognitive and affective domains following the intervention. The use of the Jigsaw model fostered active student engagement, individual accountability, and constructive social interaction within learning groups. These findings reinforce previous empirical evidence supporting the effectiveness of the Jigsaw model as an innovative instructional strategy. Not only does it improve conceptual understanding, but it also cultivates vital collaborative skills and social values essential for character development. The model's alignment with social constructivist principles further underscores its pedagogical value in fostering student-centered and participatory learning environments.

This research contributes to the growing body of literature on cooperative learning, particularly within the context of Pancasila Education in Indonesian primary schools. It provides empirical support for the integration of Jigsaw as a viable instructional method that addresses both academic and interpersonal learning goals. For future research and educational practice, the study recommends broader application of the Jigsaw model across various grade levels and subject areas. Integrating Jigsaw with digital and hybrid learning modalities can further extend its impact, especially in post-pandemic education. Additionally, enhancing teacher capacity in designing and facilitating Jigsaw-based instruction remains a key priority to ensure sustained and effective implementation.

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