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Effectiveness of Jigsaw Learning Strategy in Enhancing Grade 7 Students' Mathematics Performance

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Abstract. The Jigsaw Learning Strategy has proven effective in international contexts, but local studies in Philippine mathematics classrooms remain scarce. To address persistently low mathematics performance among Grade 7 students, this research investigated the effectiveness of this approach in enhancing students' performance. The study employed a quasi-experimental, non-equivalent pretest-posttest control group design involving 30 students from an existing section. Researchers matched learners based on pretest scores and assigned them to either the experimental group, which received instruction using the Jigsaw Learning Strategy, or the comparison group, which was taught through conventional methods. Mathematics performance was measured through a pretest, formative assessments, and a posttest. Descriptive statistics (mean, standard deviation, and five-number summary) were used to analyze score distribution and variability across pretest, formative, and posttest assessments. An independent-samples t-test compared formative and posttest mean scores between groups, while a paired-samples t-test evaluated pretest-to-posttest gains within each group. Lastly, Cohen's d measured the effect size of the Jigsaw Learning Strategy on student performance. The findings showed that both groups had comparable prior knowledge; however, students exposed to the Jigsaw Learning Strategy performed better on the formative and posttest assessments than those taught using traditional instruction. Statistical analysis also revealed significant differences between the two groups, indicating that the Jigsaw Learning Strategy effectively improved mathematics performance. However, variations in individual outcomes suggested the need for extended exposure and additional support for lower-achieving learners. It is recommended that teachers integrate Jigsaw into classroom practice to promote collaboration and confidence, institutions provide professional development to strengthen cooperative learning approaches, and future researchers examine its application across broader samples, grade levels, and mathematical domains.

Keywords: *Jigsaw Learning Strategy; mathematics performance; cooperative learning; quantitative research; elementary education*

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Introduction

Mathematics is globally recognized as a fundamental discipline that cultivates problem-solving, logical reasoning, and critical thinking skills. Despite its importance, it remains one of the most challenging subjects worldwide, often resulting in low performance, disengagement, and weak mastery of concepts. International assessments such as TIMSS and PISA consistently highlight these concerns, underscoring the need for instructional strategies that move beyond traditional, teacher-centered approaches toward learner-centered and interactive methods (Mullis et al., 2020; TIMSS & PIRLS, 2025).

In the Philippine context, persistent concerns about mathematics achievement are evident in both national and international assessments. Filipino students have consistently performed below global averages in PISA (2018, 2022) and ranked near the bottom in TIMSS (2003). The National Achievement Test (NAT) likewise shows continuous low performance compared to desired mastery levels (Apus & Quirap, 2024). In response, the Department of Education has emphasized learner-centered approaches through Republic Act No. 10533 and DepEd Orders promoting collaborative and constructivist strategies, aligned with the Enhanced MATATAG Curriculum.

One instructional approach that aligns with learner-centered reforms is the Jigsaw Learning Strategy, a cooperative learning method originally developed by Aronson. In this approach, students first become "experts" on a specific lesson segment before teaching it to members of their home groups, promoting individual accountability, positive interdependence, and collaborative knowledge construction. Social Interdependence Theory, Social Constructivism, and Cognitive Apprenticeship support the strategy by emphasizing learning through interaction, shared responsibility, and guided peer instruction.

Previous studies have emphasized the role of teaching methodologies in shaping mathematics performance. Obina et al. (2022) identified instructional approaches as a critical factor influencing achievement, while Felipe and Punzalan (2022) and Lapinid et al. (2022) highlighted the importance of motivational and pedagogical interventions. Cooperative learning strategies, particularly the Jigsaw method, have been shown to foster collaboration and improve outcomes. Phuntsho and Gyeltshen (2022) reported that Jigsaw improved mathematics performance and group dynamics, while Madrid and Deri (2024) found positive effects in Grade 7 classrooms in the Philippines and recommended wider adoption. However, Bhardwaj (2025) noted that most Jigsaw applications have focused on science, language, and social studies, leaving mathematics underexplored. Moreover, localized studies in Southeast Asia remain limited, underscoring the need for research that examines the strategy's effectiveness in Philippine mathematics classrooms.

Despite extensive international evidence and growing local support for the Jigsaw Learning Strategy, several gaps remain. Few studies have simultaneously examined students' formative learning progress and posttest achievement using a quasi-experimental design among Grade 7 learners in Philippine secondary schools. Moreover, evidence on implementing Jigsaw in Algebra under the MATATAG curriculum remains limited. Addressing these gaps is important for determining whether the strategy produces meaningful learning gains within the local educational context.

In response, the present study examined the effectiveness of the Jigsaw Learning Strategy in enhancing the mathematics performance of Grade 7 students at Canossa Academy Calamba. Specifically, the study compared the formative assessment and posttest performance of students taught using the Jigsaw Learning Strategy with those taught through conventional instruction. The findings provide localized evidence that may inform mathematics instruction and the implementation of learner-centered pedagogies in Philippine secondary schools.

The following hypotheses were tested at the level 0.05 level of significance:

1. No significant difference exists between the formative test mean scores of the comparison and experimental groups.

2. There is no significant difference between the posttest mean scores of the comparison and experimental groups.
3. There is no significant difference between the pretest and posttest mean scores of the comparison group.
4. There is no significant difference between the pretest and posttest mean scores of the experimental group.

Methodology

This study employed a quasi-experimental design, specifically the non-equivalent pretest–posttest control group design (Denny et al., 2023), to determine the effectiveness of the Jigsaw Learning Strategy in improving Grade 7 students' mathematics performance. Two intact Grade 7 classes served as the experimental and comparison groups. A total of 31 students initially participated; however, one student in the experimental group did not have a suitable match, resulting in 30 students included in the analysis, forming 15 matched pairs.

The experimental group was taught using the Jigsaw Learning Strategy, while the comparison group received instruction through conventional teacher-centered methods. This design was appropriate because random assignment was not feasible in the school setting, yet it allowed for meaningful comparison of performance outcomes between groups through pretest and posttest measures. The study used purposive sampling and, to establish baseline equivalence, applied a match-pairing technique in which students were paired by pretest mathematics scores. This ensured that differences in posttest scores could be attributed to the instructional strategy rather than initial ability levels. The researchers obtained parental consent before participation, and students were informed they could withdraw at any time without penalty. The researchers maintained confidentiality by anonymizing student data and conducted all procedures in accordance with ethical standards for research involving minors.

The intervention lasted four weeks, with five sessions per week, from February until the first week of March 2026, with adjustments for holidays and class suspensions. Both groups covered the same Grade 7 MATATAG curriculum topics in algebra, including solving equations, evaluating expressions, and problem-solving with formulas. The experimental group engaged in structured Jigsaw activities, while the comparison group received traditional lecture-based instruction. During the Jigsaw sessions, students formed “home groups” and were assigned subtopics. Each member joined an “expert group” to study their assigned subtopic in depth, then returned to their home group to teach their peers. This process ensured that every student contributed essential knowledge to the group’s collective understanding. The research monitored sessions to ensure fidelity of implementation and provided guidance when necessary.

The primary instrument was a teacher-made mathematics achievement test, along with formative assessments embedded in the validated lesson plans tailored for this research. The achievement test consists of 30 items aligned with the Grade 7 curriculum, covering computation, problem-solving, and application of algebraic concepts. To ensure validity, five mathematics teachers and subject matter experts reviewed the items. A pilot test was conducted with a separate Grade 7 class, and item analysis was performed to refine the test. Reliability was established using Cronbach’s alpha, yielding a coefficient of 0.81, which indicated good internal consistency. A parallel test was constructed for the posttest to avoid practice effects, ensuring that improvements reflected actual learning rather than familiarity with the test items. Formative assessments included quizzes, which were recorded and included in the data analysis, while worksheets and peer feedback provided valuable information for instructional monitoring but were not part of the statistical dataset. Both the pretest and posttest were administered under standardized conditions, with simultaneous distribution of test papers, clear instructions, and researcher supervision to maintain consistency.

Data collection occurred in three phases: pretest, intervention, and posttest. In the pretest phase, both groups completed the achievement test to establish baseline equivalence and enable match pairing. During the intervention phase, the experimental group received Jigsaw-based instruction, while the comparison group received conventional instruction. In the posttest phase, both groups received a parallel test equivalent to the pretest. The researchers collected, recorded, and tabulated pretest and posttest scores for statistical analysis.

The researchers analyzed the data using descriptive and inferential statistics. Mean, standard deviation, and five-number summary were computed to describe the score distribution. Independent-samples t-test compared mean scores between groups, while paired-samples t-test assessed within-group improvement from pretest to posttest. Cohen's d was calculated to measure effect size. The significance level was set at 0.05.

Although the number of participants was relatively small, this was acceptable in classroom-based quasi-experimental studies (Bulus, 2020). The study was limited by its sample size, short intervention duration, and focus on a single school and grade level. Results may not generalize to other contexts or mathematical domains, and individual differences such as motivation and home environment were beyond the study's scope.

Results and Discussions

Table 1.
Pretest Mean Scores of the Comparison and Experimental Group

Group(n=15)	Mean (M)	Std. Dev.	Descriptive Interpretation	Five Number Summary				
				Min	Q1	Q2	Q3	Max
Experimental	11.40	6.63	Low	4	6	10	16	23
Comparison	11.40	6.63	Low					

Legend: 25.00 - 30.00 Very High; 19.00 - 24.99 High; 13.00 - 18.99 Average; 7.00 - 12.99 Low; 1.00 - 6.99 Very Low

Table 1 presents the pretest performance of the experimental and comparison groups. Both the experimental and comparison groups obtained the same mean score of 11.40 (SD = 6.63), which is interpreted as Low. Scores ranged from 4 to 23, with a median of 10, indicating that both groups started with relatively low mathematics performance before the intervention.

The identical mean scores and standard deviations suggest the two groups were comparable in initial mathematics performance. This baseline equivalence supports the validity of subsequent comparisons and indicates that any posttest differences may be associated with the instructional strategies used. Okafor and Nwosu (2021), Matawal (2025), and Madrid and Deri (2024) reported similar findings, finding comparable pretest performance among groups before implementing the Jigsaw Learning Strategy.

Table 2.
Composite Formative Test Mean Scores of the Comparison and Experimental Group

Group (n=15)	Mean (M)	Std Dev	Descriptive Interpretation	Five Number Summary				
				Min	Q1	Q2	75%	Q3
Experimental	26.07	6.41	High	17	21.5	25	31	36
Comparison	21.07	6.05	Average	12	17	20	26.5	30

Legend: 32.01 - 40.00 Very High; 24.01 - 32.00 High; 16.01 - 24.00 Average; 8.01 - 16.00 Low; 0.00 - 8.00 Very Low

Table 2 shows the composite difference between the formative test mean scores of the experimental and comparison groups across four formative assessments. The experimental group obtained a higher mean score of 26.07 (SD = 6.41), interpreted as High, while the comparison group obtained a mean score of 21.07 (SD = 6.05), interpreted as Average. This indicates that students exposed to the Jigsaw Learning Strategy performed better in mathematics than those taught using conventional instruction.

The score distribution shows that the experimental group had higher and more dispersed performance levels, supported by its score range and five-number summary, with more learners reaching higher achievement levels. In contrast, the comparison group remained more concentrated within the average range, indicating fewer students reaching advanced performance.

The result is consistent with Cognitive Apprenticeship Theory (Collins et al., 1989), which emphasizes learning through modeling, coaching, and guided practice. In the Jigsaw Learning Strategy, students actively explain concepts, engage in peer teaching, and collaborate within expert and home groups, which supports deeper conceptual understanding. These findings align with studies reporting improved mathematics performance through cooperative learning strategies that promote peer interaction and shared responsibility (Fitriana et al., 2023; Partiga & Dhoruri, 2024).

Table 3.
Posttest Mean Scores of the Comparison and Experimental Group

Group(n=15)	Mean (M)	Std. Dev.	Descriptive Interpretation	Five Number Summary				
				Min	Q1	Q2	Q3	Max
Experimental	21.47	6.85	High	10	16	25	27	30
Comparison	15.33	7.58	Average	5	7	18	20.5	26

Legend: 25.00 - 30.00 Very High; 19.00 - 24.99 High; 13.00 - 18.99 Average; 7.00 - 12.99 Low; 1.00 - 6.99 Very Low

Table 3 presents the posttest mean scores of the experimental and comparison groups after implementing the instructional intervention. The experimental group obtained a higher mean score of 21.47 (SD = 6.85), interpreted as High, compared with the comparison group, which had a mean score of 15.33 (SD = 7.58), interpreted as Average. The five-number summary also shows higher central tendency and upper quartile values for the experimental group, indicating better overall posttest performance.

These results suggest that students exposed to the instructional strategy performed better than those taught using the conventional approach. The difference in scores indicates a possible positive effect of the intervention on students' mathematics performance.

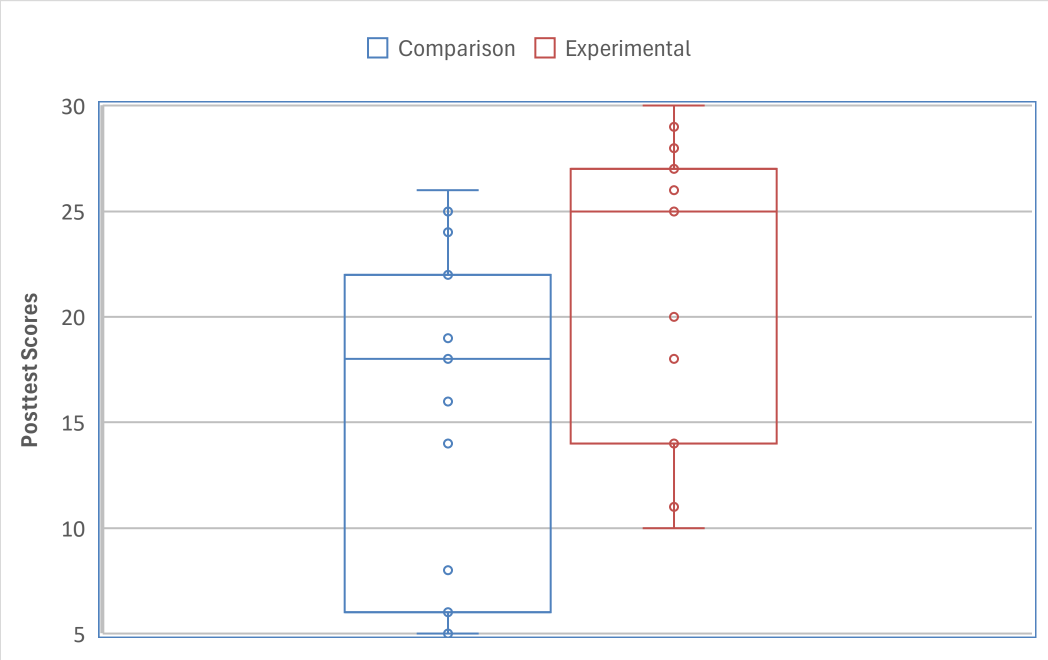

Figure 1. Box-and-Whisker Plot of Posttest Scores of the Experimental and Comparison Groups

As shown in Figure 1, the experimental group obtained a higher median score, although several lower scores widened the distribution and slightly lowered the mean. This suggests that while most students benefited from the intervention, a smaller proportion achieved lower outcomes, indicating variability in learning gains.

The distribution also shows that more students in the experimental group achieved Average to High performance levels, while fewer remained at the Low level. This indicates an overall positive effect of the Jigsaw Learning Strategy, despite differences in individual student progress.

This variability aligns with Social Constructivist Theory, which emphasizes that learners construct understanding through interaction but progress at different rates depending on engagement and group dynamics. Bhardwaj (2025) and Chen & Huang (2024) reported similar findings, noting improvements in mathematics performance through structured peer teaching in Jigsaw-based instruction.

Table 4.
Test of the significant difference between the mean scores of the Formative Test of the comparison and experimental group

Group	Mean (M)	Mean Difference	Test for Equality of Means		
			t-value	df	p-value
Experimental	26.07	5.00	2.20*	28	.036
Comparison	21.07				

Cohen’s d = 0.80 (Large)

*Significant at p <.05

Table 4 presents the test of difference for the formative test mean scores between the experimental and comparison groups. The results show that the experimental group obtained a higher mean score (M = 26.07) than the comparison group (M = 21.07), with a mean difference of 5.00. The computed t-value of 2.20 (df = 28) yielded a p-value of .036, which is less than 0.05, indicating a statistically significant difference in formative test scores between the two groups. Additionally, the Cohen's d value of 0.80 indicates a large effect size, suggesting a substantial impact of the instructional strategy on students' formative performance.

These findings suggest that the instructional strategy used in the experimental group significantly improved students' learning outcomes compared with conventional instruction. The result is consistent with Cognitive Apprenticeship Theory, which emphasizes learning through modeling, guided practice, and peer explanation in collaborative settings such as expert and home groups.

The findings align with studies reporting that the Jigsaw Learning Strategy enhances students' achievement and engagement in mathematics through structured peer interaction and collaborative learning (Jeppu et al., 2023; Paliwal et al., 2024). Similarly, peer teaching has been shown to strengthen conceptual understanding and improve academic performance (Mitayani & Ishartono, 2024; Chen & Huang, 2024).

Table 5.
Test of significant difference between the mean scores of the Posttest of the comparison and experimental group

Group	Mean (M)	Mean Difference	Test for Equality of Means		
			t-value	df	p-value
Experimental	21.47	6.14	2.32*	28	.028
Comparison	15.33				

Cohen's d =0.85 (Large)
*Significant at p <.05

Table 5 presents the test of differences in posttest mean scores between the experimental and comparison groups. The results indicate that the experimental group obtained a higher mean score (M = 21.47) than the comparison group (M = 15.33), with a mean difference of 6.13. The computed t-value of 2.32 (df = 28) yielded a p-value of .028, which is less than 0.05, indicating a statistically significant difference between the posttest scores of the two groups. In addition, Cohen's d value of 0.85 indicates a large effect size, suggesting a substantial effect of the instructional strategy on students' mathematics performance.

These findings suggest that the instructional strategy implemented in the experimental group was more effective than conventional instruction in improving students' posttest performance. This supports the view that structured collaborative learning enhances understanding and achievement in mathematics.

The results align with studies showing that the Jigsaw Learning Strategy leads to higher mathematics achievement than traditional teaching methods. Madrid and Deri (2024) and Bascal et al. (2021) reported similar improvements in students' performance using Jigsaw, while Ulandari and Fadila (2023) and Adji et al. (2023) found gains in problem-solving, retention, and mathematical representation under cooperative learning approaches.

Table 6.
Test of significant difference between the pretest and posttest mean scores of the comparison group

Test	Mean (M)	Test for Equality of Means

		Mean Difference	t-value	df	p-value
Posttest	15.33	3.93	3.48**	14	.004
Pretest	11.40				

Cohens's d =0.90 (Large)

**significant at p <.01

Table 6 presents the test of the difference between the comparison group's pretest and posttest mean scores. The results show that the posttest mean score (M = 15.33) is higher than the pretest mean score (M = 11.40), with a mean difference of 3.93. The computed t-value of 3.48 (df = 14) yielded a p-value of .004, which is less than 0.01, indicating a statistically significant difference between the comparison group's pretest and posttest scores. In addition, the Cohen's d value of 0.90 indicates a large effect size, suggesting a substantial improvement in students' mathematics performance under conventional instruction.

This improvement suggests that even without the experimental intervention, students benefited from regular instruction, practice, and exposure to mathematical concepts. It shows that teacher-centered instruction can still lead to measurable gains in achievement, though within a more limited scope than cooperative approaches.

These findings align with studies reporting that traditional instruction can improve basic computational skills and test performance, even if it is less effective at promoting deeper understanding and engagement. Ezeliora et al. (2024) and Peace and Bomboi (2024) found similar short-term improvements in mathematics achievement under conventional teaching, while Septiani (2020) and Bulaan et al. (2026) noted that teacher-centered approaches may support cognitive gains but provide less sustained learning compared to collaborative strategies.

Table 7.
Test of significant difference between the pretest and posttest mean scores of the experimental group

Test	Mean (M)	Mean Difference	Test for Equality of Means		
			t-value	df	p-value
Posttest	21.47	10.07	10.73**	14	.000
Pretest	11.40				

Cohens's d =2.77 (Huge)

**significant at p <.01

Table 7 presents the test of the difference between the experimental group's pretest and posttest mean scores. The results show that the posttest mean score (M = 21.47) is substantially higher than the pretest mean score (M = 11.40), with a mean difference of 10.07. The computed t-value of 10.73 (df = 14) yielded a p-value of .000, which is less than 0.01, indicating a highly significant difference between the experimental group's pretest and posttest scores. In addition, the Cohen's d value of 2.77 indicates a very large effect size, suggesting a strong impact of the instructional intervention on students' mathematics performance.

These findings indicate that the Jigsaw Learning Strategy significantly improved students' understanding and mastery of mathematical concepts after the intervention. This result is consistent with studies showing that Jigsaw leads to higher mathematics achievement than conventional instruction. Ranjan et al. (2025) and Madrid and Deri (2022) reported significant gains in mathematics performance using Jigsaw, while Bascal et al. (2021) and Ulandari and Fadila (2023) found improvements in problem-solving, retention, and conceptual understanding. Adji et al. (2023) further emphasized enhanced mathematical representation and comprehension through cooperative learning. Meta-analytic evidence also supports these findings, with Soebagyo (2024) and Güngör et al. (2026) reporting moderate to very high effect sizes for Jigsaw across mathematics and related disciplines, reinforcing the strong effect observed in the present study.

Overall, the results consistently indicate that the Jigsaw Learning Strategy improved students' mathematics performance across formative and posttest assessments. The experimental group showed greater gains than the comparison group, and inferential analyses confirmed statistically significant differences. While the findings support the strategy's effectiveness, performance variations suggest the need for continued practice and targeted support for some learners.

Conclusion

The study showed that the Jigsaw Learning Strategy significantly improved Grade 7 students' mathematics performance compared with conventional teacher-centered instruction. Learners in the experimental group consistently achieved higher formative and posttest scores, with large to huge effect sizes confirming the intervention's substantial impact. Beyond statistical gains, the findings highlight how Jigsaw fosters collaboration, accountability, and deeper conceptual understanding, validating theoretical perspectives such as Constructivism, Social Interdependence Theory, and Cognitive Apprenticeship.

Yet, the results also revealed variability in individual performance, reminding us that cooperative learning does not uniformly benefit all learners. Some students may require extended exposure, differentiated scaffolding, or targeted support to fully engage with peer-driven instruction. This nuance underscores that while Jigsaw is highly effective, its success depends on group dynamics, teacher facilitation, and learner readiness.

This study contributes not only by affirming Jigsaw's effectiveness but also by situating it within broader educational goals of learner-centered pedagogy, equity, and sustainable innovation. It demonstrates that cooperative learning can be a powerful tool for mathematics education, but its implementation must be sensitive to diverse learner needs and contextual realities.

Considering these findings, schools and curriculum planners are encouraged to institutionalize cooperative learning strategies such as Jigsaw by embedding them into teaching guides, syllabi, and professional development frameworks. Supporting teachers with structured training and flexible instructional resources will enhance their ability to apply learner-centered approaches effectively and respond to diverse classroom needs.

At the classroom level, mathematics teachers should adopt Jigsaw in abstract and concept-heavy topics like algebra and problem-solving, designing expert and home group activities that balance collaboration with individual accountability. Teachers are likewise urged to foster active student engagement in collaborative tasks, as peer interaction and shared responsibility strengthen comprehension, retention, and problem-solving skills.

Future research should extend inquiry into larger samples, longer interventions, and varied subject areas, while exploring how group composition, facilitation quality, and learner differences influence outcomes. Mixed-methods approaches may provide deeper insights into how cooperative learning strategies operate across contexts.

References

Adji, M., Prasetyo, M. A., Nada, L. K., Ulandari, L., & Fadila, L. (2023). Model Pembelajaran Kooperatif Tipe Jigsaw Untuk Meningkatkan Hasil Belajar Siswa. *Griya Journal of Mathematics Education and Application, 3*(2). https://doi.org/10.29303/griya.v3i2.324

Bascal, E., Ibañez, E., & Pentang, J. (2022). Jigsaw strategy: strengthening achievement and interest among elementary pre-service teachers. *The Palawan Scientist, 14*(1), 35-42. Retrieved from https://philarchive.org/rec/BACJSS?utm_source=copilot.com&__cf_chl_f_tk=Jn.EG2GI0BtNUkDf138Ee11ajZNwa.pYLq4GnKEcj8Q-1782834956-1.0.1.1-.Hi1Ibn2kQirk5_R1AzSQF8BxIDRixwjCZPsH2o08F8

Bhardwaj, S. (2025, June 6). Jigsaw Strategy's Impact on Students Achievement and Social Skills

Across Educational Levels: A Meta-Analytic Review. *International Journal of Research and Review, 12*(6). https://doi.org/10.52403/ijrr.20250633

Bulaan, Bacang, Hamac, Dejino, Ladion, Galvez, . . . Largo. (2026). Collaborative Learning in Mathematics: Impact on Grade 7 Students' Performance. *International Journal of Research and Innovation in Social Science*. https://doi.org/10.47772/IJRISS.2026.10200002

Bulus, M. (2021). Sample Size Determination and Optimal Design of Randomized/Non-equivalent Pretest-posttest Control-group Designs. *Adıyaman University Journal of Educational Sciences*. https://doi.org/10.17984/adyuebd.941434

Chen, C., & Huang, M. (2024, 08 04). Enhancing programming learning performance through a Jigsaw collaborative learning method in a metaverse virtual space. 10.1186/s40594-024-00495-2

Collins A., B. J. (1989). Cognitive apprenticeship:Teaching the crafts for reading, writing, and mathematics. *L.B. Resnick (Ed.)*(Knowing, learning, and instruction: Essays in honor of Robert Glaser), 453-494.

Denny, M., Denieffe, S., & & O'Sullivan, K. (2023). on-equivalent Control Group Pretest–Posttest Design in Social and Behavioral Research. *The Cambridge Handbook of Research Methods and Statistics for the Social and Behavioral Sciences, Volume 1: Building a Program of Research*, 314-332. https://doi.org/10.1017/9781009010054.016

Ezeliora, Okafor, Ifeanyi-Obiorah, & Peace. (2024). Effectiveness of Interactive Jigsaw Method in. *International Journal of Innovative Social & Science Education Research*. Retrieved from https://zenodo.org/records/14133089

Felipe, & Punzalan. (2022). Factors contributing to students' poor performance in mathematics in an integrated school, Zambales, Philippines. *Universe International Journal of Interdisciplinary Research*. https://www.doi-ds.org/doilink/03.2022-83272275/UIJIR

Fitriana, L., Tiyanto, Wiraya, A., Hendriyanto, A., Sahara, S., Muhaimin, L., & Putri, D. (2023). Implementation of the Jigsaw Model to Improve Critical-Thinking Skills. *Journal of Higher Education Theory and Practice, 23*(15). https://doi.org/10.33423/jhetp.v23i15.6402

Güngör, F., Altunbaşak, İ., Aydın, A. T., Kaya, M., & Erdem, C. (2026). A Second-Order Meta-Analysis on the Effects of Cooperative Learning on Students' Academic Achievement, Higher-Order Thinking, and Affective Behaviors. *Current Psychology, 45*(552). https://doi.org/10.1007/s12144-025-08943-0

Jeppu, K. J., Kumar, K. A., & Sethi, A. (2023). 'We work together as a group': implications of jigsaw cooperative learning. *BMC Medical Education*. https://doi.org/10.1186/s12909-023-04734-y

Lapinid, M., Cordel, Teves, J., Yap, S., Chua, U., & Bernardo, A. (2022). Contrasting Profiles of Low-Performing Mathematics Students in Public and Private Schools in the Philippines: Insights from Machine Learning. *Journal of Intelligence, 10*(3), 61. https://doi.org/10.3390/jintelligence10030061

Madrid, & Deri. (2024). Effectiveness of Jigsaw Classroom Strategy in Learning. *United International Journal for Research & Technology*. Retrieved from https://uijrt.com/articles/v5/i7/UIJRTV5I70025.pdf

Matawal, D. B. (2025). Effects of Jigsaw cooperative instructional strategy on senior school one students' achievement in quadratic equation in Nigeria. *Jurnal Kajian Pembelajaran Matematika, 9*(1), 28-33. Retrieved from https://journal2.um.ac.id/index.php/jkpm/article/view/59342/14936

Mitayani, & Ishartono. (2024). Transformative Pedagogy: Investigating the Impact of Online Jigsaw Model on Motivation and Academic Achievement in High School Mathematics. *INOMATIKA*. 10.35438/inomatika.v6i1.421

Mullis, Martin, Foy, Kelly, & Fishbein. (2020). TIMSS 2019: International Results in Mathematics and Science. *Trends in International Mathematics and Science Study*. Retrieved from https://timss2019.org/reports/wp-content/themes/timssandpirls/download-center/TIMSS-2019-International-Results-in-Mathematics-and-Science.pdf

Obina, Derio, Rosa, Gorit, Bolina, Martinez, & Bolaños. (2022). Factors Affecting the Mathematics Performance of Mathematics Major Students. *Psychology and Education*. 10.5281/zenodo.7160780

Okafor, & Nwosu. (2021). Effect of Jigsaw Teaching Strategy on Senior Secondary School Students' Achievement in Mathematics In Onitsha Education Zone of Anambra State. *Journal of Science*

Education and Allied Discipline, 3(1), 19-27. Retrieved from https://josead.com/index.php/JOSEAD/article/view/3/3

Paliwal, Jain, Kashyap, & Shoain. (2024). Introduction and Evaluation of Jigsaw Method of Learning for Undergraduates Students . *Journal of Population Therapeutics and Clinical Pharmacology*. https://doi.org/10.53555/jptcp.v31i3.5983

Partiga, M. B., & Dhoruri, A. (2024). The Effect of a Realistic Mathematics Education Approach with the Jigsaw Learning Model on Students' Creative Thinking Ability and Self-regulated Learning. *International Journal of Multiculturual and Multireligious Understanding*. http://dx.doi.org/10.18415/ijmmu.v11i10.6141

Peace, & Bomboi. (2024). *Effects of Jigsaw Cooperative Learning Approach and Lecture Instructional Approach on Students' Retention in Mathematics in Schools in Delta State.* https://doi.org/10.51244/IJRSI.2024.1106011

Phuntsho, & Gyeltshen. (2022). Effectiveness of Jigsaw Cooperative Learning Approach in Mathematics: A study in a Secondary School in Bumthang District. *Interdisciplinary Journal of Applied and Basic Subjects*. Retrieved from https://visnav.in/ijabs/wp-content/uploads/sites/11/2022/04/Effectiveness-of-jigsaw-cooperative-learning-approach-in-mathematics.pdf

Ranjan, Devi, & Gopinath. (2025). Evaluating the Impact of the Jigsaw Strategy on Students' Academic Performance in Mathematics: A Quasi-Experimental Study. *GYANKOSH Journal of Educational Research,* 5(1&2). Retrieved from https://www.academia.edu/165384750/Evaluating_the_Impact_of_the_Jigsaw_Strategy_on_Students_Academic_Performance_in_Mathematics_A_Quasi_Experimental_Study?

Septiani, I., & Qohar, A. (2020). Kerjasama Mahasiswa dalam Pembelajaran Kooperatif Tipe Jigsaw pada Mata Kuliah Pengantar Aljabar. *Jurnal Didaktik Matematikaa,* 7(1), 60-71. 10.24815/jdm.v7i1.15365

Soebagyo, Maarif, Suhendri, & Leonard. (2024). Is the Jigsaw Model Still Relevant for Improving Mathematical Ability? Meta-Analysis Studies. *FORMATIF: Jurnal Ilmiah Pendidikan MIPA, 14*(1). http://dx.doi.org/10.30998/formatif.v14i1.20436

TIMSS & PIRLS International Study Center. (2023). *TIMSS 2023 international results in mathematics and science.* Boston College. Retrieved from https://timssandpirls.bc.edu/

Ulandari, L., & Fadila, L. (2023). Model Pembelajaran Kooperatif Tipe Jigsaw Untuk Meningkatkan Hasil Belajar Siswa. *Griya Journal of Mathematics Education and Application, 3*(2), 256-263. https://doi.org/10.29303/griya.v3i2.324

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