The Effectiveness of the Jigsaw Cooperative Learning Technique in Enhancing Mathematical Achievement at the Secondary School Level

K. S. Charutha
Parimanam, Kollam, Kerala, INDIA

ORIGINAL ARTICLE

Author
K. S. Charutha
E-mail : kscharutha2015@gmail.com

shodhsamagam1@gmail.com

Plagiarism Checker X - Report
Originality Assessment

8%

Overall Similarity

Date: Oct 10, 2025 (06:52 AM)
Matches: 193 / 2502 words
Sources: 12

Remarks: Low similarity detected, consider making necessary changes if needed.

Verify Report:
Scan this QR Code

ABSTRACT

This study investigated the effectiveness of the Jigsaw Cooperative Learning Technique as an instructional strategy for improving the mathematical achievement of students at the secondary school level. Despite mathematics being a critical subject, traditional teaching methods often fail to adequately engage students, leading to persistent challenges in comprehension and performance. An experimental research design utilizing a post-test only control group structure was employed. The research was conducted at a Government Higher Secondary School located in Kollam district of Kerala, India. The sample consisted of 40 students of class 8 equally divided into an Experimental Group (taught using the Jigsaw Technique) and a Control Group (taught using traditional Instruction). Data analysis using descriptive statistics and an independent samples t -test revealed that the Experimental Group achieved a significantly higher mean score (mean = 16 and SD= 3.20) compared to the Control Group (mean = 12 and SD = 4.72). The computed t- value of 3.14 was significant (p < 0.01) These findings strongly support the research hypothesis, indicating that the Jigsaw Technique is a powerful and viable pedagogical tool for transforming mathematics education, fostering active learning, and ultimately enhancing student achievement.

KEY WORDS

October to December 2025 www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

Impact Factor SJIF (2025): 8.019

1435

INTRODUCTION

Mathematics serves as the foundational pillar for scientific, technological, and economic development in the 21st century. Consequently, it occupies a central and indispensable position within the secondary school curriculum. However, the subject is frequently perceived by students as difficult, abstract, and challenging, leading to low engagement, anxiety, and consequently, underperformance.

The prevalent traditional instructional methodologies, often characterized by lecture-based delivery and passive note-taking, tend to emphasize rote memorization over conceptual understanding. This approach frequently fails to cater to diverse learning styles or cultivate essential soft skills such as communication, critical thinking, and collaborative problem-solving. This deficiency necessitates the exploration and validation of alternative pedagogical approaches that actively involve students in the learning process.

The Jigsaw Technique, developed by Elliot Aronson, is a highly structured form of cooperative learning. It is designed to foster interdependence and individual accountability by requiring each student to master one part of a topic and then teach it to their peers. This structure directly addresses the passive nature of traditional instruction by placing the learner at the center of knowledge construction.

Therefore, the core problem addressed by this study is the consistent underachievement in mathematics attributable to ineffective conventional teaching methods. This research specifically aims to determine if the implementation of the Jigsaw Technique can significantly overcome this challenge and improve student performance.

Significance of the Study

This experimental study offers immediate, high-impact contributions to mathematics education. By confirming with statistically significant evidence that the Jigsaw Technique is superior to traditional instruction, this research fills a critical gap by providing empirical validation for collaborative learning models within the challenging domain of secondary mathematics. The findings serve as a powerful, actionable mandate for educators, justifying a pedagogical shift toward active, student-centered strategies that foster both peer collaboration and individual accountability. Furthermore, the conclusive results provide administrators and policy makers with the necessary data to support and fund professional development initiatives focused on implementing the Jigsaw Technique system-wide to meaningfully enhance mathematical achievement.

Statement of the Problem

The present study is entitled as "Effectiveness of Jigsaw Cooperative Learning technique in enhancing Mathematical Achievement of students at secondary school level".

Objective of the Study

To investigate the effectiveness of the Jigsaw Cooperative Learning Technique in enhancing the mathematical achievement of secondary school students compared to the conventional instructional method.

Hypothesis of the Study

H_1 There will be a significant impact of Jigsaw Cooperative Learning technique on the mathematical achievement of secondary school students.

Theoretical Framework and Review of Literature

1.   The Jigsaw Cooperative Learning Technique

The Jigsaw Technique is rooted in the social interdependence theory, which posits that the way learning tasks are structured (cooperatively, competitively, or individually) fundamentally influences student motivation and academic outcomes. The mechanism is simple yet powerful: students work in small, interdependent groups where each member holds a unique and essential piece of information (like a piece of a jigsaw puzzle).

October to December 2025   www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

**Impact Factor
SJIF (2025): 8.019** | 1436

The implementation sequence involves five key steps:

1. **Home Groups:** Students are organized into diverse base groups.

2. **Expert Groups:** Each student leaves their home group to meet with "experts" on the same sub-topic from other home groups. They master their specific content piece.

3. **Return to Home Groups:** Students return to their original home groups.

4. **Teaching Phase:** Each expert teaches their sub-topic to their home group members.

5. **Assessment:** Individual assessment is conducted, ensuring individual accountability.

The technique inherently promotes greater engagement, ownership of learning, and active oral communication, all of which are essential for deep mathematical understanding.

2. Literature Review on Cooperative Learning and Mathematics

Previous research has consistently demonstrated the positive impact of cooperative learning models in STEM fields. Studies by Johnson and Johnson (1999) highlighted that cooperative learning structures generally lead to higher achievement and retention than competitive or individualistic structures. Specifically concerning the Jigsaw Technique in mathematics:

➢ **Enhanced Conceptual Understanding:** Several studies suggest that the act of teaching a concept to a peer forces the 'expert' student to process the information more deeply, leading to superior conceptual mastery.

➢ **Reduced Math Anxiety:** The supportive, peer-led environment inherent in Jigsaw reduces the pressure often associated with teacher-led traditional settings, contributing to lower math anxiety and a more positive affective domain towards the subject.

➢ **Improved Interpersonal Skills:** Beyond academic achievement, the technique is recognized for improving essential collaborative and communication skills among adolescents.

The consensus in the literature provides a strong empirical foundation for the current study, predicting that the collaborative, structured nature of the Jigsaw Technique will produce academic results superior to those obtained through conventional lecture-based methods.

Methodology

1. Research Design

This study employed a Quantitative Experimental Research Design using a Post-Test Only Control Group approach. This design is robust for determining cause-and-effect relationships by randomly assigning participants to either the treatment or control condition and comparing their outcomes.

2. Sample and Setting

The sample consisted of 40 students enrolled in Class 8 at a Government school in Kollam district of Kerala.

➢ **Experimental Group:** n=20 students were taught the selected mathematics units using the Jigsaw Technique.

➢ **Control Group:** n=20 students were taught the same mathematics units using the Traditional Lecture-Based Method.

The groups were established to be comparable in terms of pre-existing mathematical ability prior to the intervention.

October to December 2025   www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

Impact Factor
SJIF (2025): 8.019 | 1437

3. Research Tool and Intervention

Achievement Test: A standardized Mathematical Achievement Test, validated by subject experts and confirmed for reliability was used as the post-test instrument. This test measured the students' comprehension and mastery of the content taught during the experimental period.

Intervention: The intervention period lasted for 3 weeks.

➤ **Experimental Group:** The curriculum content was broken down into four interdependent segments, with students rotating through Expert Groups for mastery and returning to Home Groups for peer instruction.

➤ **Control Group:** The same curriculum content was delivered by the teacher using standard instruction, lecture, and conventional problem-solving exercises.

4. Data Analysis

The collected post-test scores were analyzed. Descriptive statistics (Mean and Standard Deviation) were computed to summarize the achievement levels of both groups. An independent samples t- test was conducted to determine if the observed difference between the main course of experimental and control group was statistically significant at the 0.05 or 0.01 level of significance.

Results

The analysis aimed to test the study's hypothesis: that the Jigsaw Technique group would show significantly higher mathematical achievement.

1. Descriptive Statistics

Table 1 presents the mean scores and standard deviations for the Mathematical Achievement Test for both instructional groups.

Group	N	Mean Score ($\bar{X}$)	Standard Deviation (SD)
Experimental (Jigsaw)	20	16.00	3.20
Control (Traditional)	20	12.00	4.72
Total Sample	40	-	-

The Experimental Group, which utilized the Jigsaw Technique, achieved a substantially higher mean score (16) than the Control Group (12), suggesting a strong positive effect of the intervention.

2. Inferential Statistics (t-test)

An independent samples t-test was calculated to determine the statistical significance of the four-point mean difference. With $df = 38$ the results were as follows:

$$\text{Calculated t- value} = 3.14$$

The calculated t-value of 3.14 was compared against the critical t-value for df =38 at the 0.01 level of significance (two-tailed), which is 2.72.

Since the calculated t-value (3.14) is greater than the critical t value(2.72), the difference between the groups is statistically significant at 0.01 level of significance.

3. Summary of Findings

The results confirm the research hypothesis. The mean mathematical achievement score of the students taught using the Jigsaw Technique was significantly higher than the mean achievement score of the students taught using the Traditional Instructional Method. This indicates that the Jigsaw Technique is statistically superior to the conventional method for enhancing mathematical achievement at the secondary school level.

October to December 2025   www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

Impact Factor
SJIF (2025): 8.019 | 1438

Discussion of Results

The primary finding the significant superiority of the Jigsaw Technique group is highly consistent with research on active and cooperative learning models. This outcome can be attributed to several theoretical advantages offered by the Jigsaw structure:

1. **Individual Accountability:** Because each student must master a specific piece of the puzzle and then teach it, there is a built-in responsibility to learn the material thoroughly. This eliminates social loafing, which can be common in less structured group activities.

2. **Cognitive Elaboration:** The requirement to teach the material necessitates deeper cognitive processing, forcing the student to organize, synthesize, and clarify the content. This act of 'teaching to learn' solidifies understanding far more effectively than merely listening to a lecture.

3. **Active Engagement:** The technique transforms the classroom environment from a passive recipient setting to an active, collaborative workspace, fostering intrinsic motivation and reducing the perception of mathematics as an overwhelming subject.

The substantial t- value confirms that the mean difference of four points is unlikely to be due to chance, providing robust evidence for the Jigsaw Technique's causal efficacy.

Educational Implications

The findings of this study carry significant implications for secondary school mathematics educators and curriculum developers:

➢ **Shift in Pedagogy:** Schools and teachers should transition from predominantly lecture-based instruction to cooperative learning strategies like the Jigsaw Technique. This requires professional development focused on structuring complex content into interdependent modules suitable for the technique.

➢ **Holistic Skill Development:** The implementation of Jigsaw not only addresses mathematical achievement but also cultivates essential 21st-century skills such as effective communication, respectful disagreement, and peer mentorship, preparing students for future academic and professional environments.

➢ **Inclusivity:** Given that cooperative methods have often proven effective for students who struggle with traditional teacher-centric approaches, the Jigsaw Technique offers a more equitable and inclusive instructional path for diverse student populations.

CONCLUSION

Based on a rigorous experimental design and statistical analysis, this study concludes that the Jigsaw Cooperative Learning Technique is significantly more effective than the Traditional Instructional Method in enhancing the mathematical achievement of secondary school students. The robust evidence supports the adoption of Jigsaw as a transformative and high-impact pedagogical strategy for improving academic outcomes in mathematics.

Limitations

While the findings of this study robustly support the effectiveness of the Jigsaw Technique in enhancing mathematical achievement, the research is constrained by several limitations that merit consideration in interpreting the results and planning future studies.

➢ **Group Size Constraints :** The sample size of 40 students (20 per group) is relatively small. While the results were statistically significant, a larger, more diverse sample across multiple schools would be necessary to increase confidence in the broader applicability (generalizability) of the findings.

➢ **Time Resource Dependency** : Implementing the Jigsaw Technique required a specific, dedicated block of instructional time. The effectiveness reported may be partially due to the structured novelty and focused class time, which may not be replicable when teachers face typical curriculum pressures and time constraints in a standard school year

➢ **Subjective Peer-Teaching Quality :** The success of the Jigsaw Technique depends critically on the quality of the peer instruction provided by the student "experts." The study did not formally measure

October to December 2025   www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

**Impact Factor
SJIF (2025): 8.019**

1439

the consistency or pedagogical effectiveness of the students acting as teachers. Low achievement in some cases may be due to poor peer-teaching, not a failure of the overall Jigsaw model.

➢ **Teacher Resource Constraints and Subjective Preparation:** The implementation of the Jigsaw Technique requires significantly more preparation time from the instructor than traditional teaching. Specifically, the content must be carefully segmented, and individual Lesson Transcripts or materials must be meticulously designed to ensure interdependence and balanced difficulty. This required a subjective investment of time and resources by the teacher/researcher. A realistic limitation is that this level of dedicated, resource-intensive preparation may be unsustainable for a busy teacher covering an entire curriculum, suggesting that its large-scale, long-term application may be challenging without systemic institutional support.

Suggestions

Future research should address the following:

➢ Investigate the long-term impact of the Jigsaw Technique on mathematical retention and performance in subsequent academic years.

➢ Explore the effect of the Jigsaw Technique on related variables such as math anxiety, self-efficacy, and attitude towards mathematics.

➢ Conduct a comparative study of the Jigsaw Technique against other cooperative learning models (e.g., Student-Teams-Achievement Divisions, Team-Games-Tournament) to determine optimal strategy selection.

➢ Test the Method in Other Subjects to determine if the Jigsaw Technique's benefits are exclusive to mathematics or transferable across the curriculum, the method should be rigorously tested in other demanding secondary school subjects, such as Science or History. This will establish the technique's potential as a universally effective instructional tool

REFERENCES

1. Appiah, Joseph Below; Korkor, Sarah; Arthir, Yarhands Dissou, Obeng, Benjamin Adu (2022) Mathematics achievement in high schools, the role of the teacher-student Relationship, students' self-efficacy, and students' perception of mathematics, *International Electronic Journal of Mathematics Education,* 17(3), Em0688.

2. Jeppu, Ashok Kumar; Kavitha, Ashok Kumar & Sethi, Ahsan (2023) We work together as a group': implications of jigsaw cooperative learning, *BMC Med Educ,* 23, 734.

3. Johnson, D. W. & Johnson, R. T. (1999) Learning together and alone. Cooperative, competitive and individualistic learning (5th ed.), Allyn & Bacon, Boston, MA.

4. Ojekwu, Ifeoma Ngozichukwu & Ogunleye, Bam B. O. (2020) Effects of jigsaw learning strategy on science students performance and interest in Biology in selected schools in Rivers State, Nigeria, *Sapientia Foundation Journal of Education, Sciences and Gender Studies,* 2 (3), 325-334.

5. Phuntsho, Sonam; Gyeltshen, Tashi (2022) Effectiveness of jigsaw cooperative learning approach in mathematics: A study in a middle secondary school in Bumthang district, *Interdisciplinary Journal of Applied and Basic Subjects,* 2(4), 01-10. https://identifier.visnav.in/1.0002/ijabs-22d-07002/

6. Safkolam, Roswanna; Islami, R Ahmad Zaky El; Sari, Indah Juwita (2023) The Effects Of Jigsaw Technique on Learning Achievement And Retention of Science Teacher Students, *Shanlax International Journal of Education,* 11(3), 37–42.

****

October to December 2025   www.shodhsamagam.com
A Double-Blind, Peer-Reviewed, Referred, Quarterly, Multi Disciplinary and Bilingual International Research Journal

Impact Factor SJIF (2025): 8.019 1440