Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/647ret77

"JIGSAW LEARNING VS. TRADITIONAL LECTURES: ENHANCING KNOWLEDGE ACQUISITION AND RETENTION IN MBBS STUDENTS"

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Abstract

Background and Aim: Medical education is continuously evolving, with increasing emphasis on active learning strategies to enhance student engagement and knowledge retention. The jigsaw method is a structured cooperative learning technique where students become experts in specific topics and then teach their peers, fostering collaboration, deeper understanding, and critical thinking. In contrast, traditional didactic lectures follow a passive learning approach, where students receive information without direct engagement. While lectures remain a cornerstone of medical education, their effectiveness in long-term knowledge retention and critical thinking skill development is often debated. This study compared the effects of the jigsaw learning method and traditional lectures on knowledge acquisition, retention, and critical thinking skills in first-year MBBS students.

Materials and Methods: A six-month crossover study was conducted with 100 first-year MBBS students. The students were divided into two groups, each exposed to both learning strategies. Four educational sessions were conducted: two using the jigsaw method and two using traditional didactic lectures. Immediately after each session, students completed multiple-choice questionnaires (MCQs) to assess knowledge acquisition. The same MCQs were administered again four weeks post-session to measure knowledge retention. Additionally, student perceptions of both teaching methods were collected through a five-point Likert scale survey, evaluating engagement, satisfaction, and perceived learning effectiveness.

Results: Statistical analysis demonstrated a significant advantage of the jigsaw method in long-term knowledge retention. The jigsaw group showed consistently higher scores in the follow-up MCQ

assessments compared to the traditional lecture group ($t(98) = 3.21$, $p < 0.01$; Cohen's $d = 0.92$, 95% CI [0.41, 1.42]). A repeated measures ANOVA indicated a significant main effect of time ($F(3, 96) = 4.13$, $p < 0.01$, $\eta^2 = 0.08$), suggesting that knowledge retention declined over time in both groups but at a slower rate in the jigsaw group. Additionally, a significant time-group interaction ($F(3, 96) = 3.51$, $p < 0.05$, $\eta^2 = 0.06$) highlighted that the jigsaw method was more effective in maintaining knowledge over time. The linear mixed-effects model further reinforced these findings, revealing a significant random slope effect ($p < 0.01$), demonstrating that individual learning trajectories varied but consistently favored the jigsaw approach.

Furthermore, student perceptions reflected a positive attitude towards the jigsaw method. The Likert scale responses indicated that students found the jigsaw method was more engaging (mean score: 4.3/5), improved their critical thinking skills (4.1/5), and reported greater confidence in retaining knowledge (4.4/5). In contrast, traditional lectures received lower engagement scores (3.2/5) and were perceived as less effective in promoting deeper understanding (3.5/5).

Conclusion: The findings of this study indicate that the jigsaw method enhances knowledge retention, fosters critical thinking, and increases student engagement compared to traditional lectures. Given the positive outcomes, incorporating cooperative learning techniques like the jigsaw method into medical education curricula can provide a more interactive and effective learning experience. This study highlights the potential of active learning strategies to improve educational outcomes in MBBS students, suggesting a shift towards student-centered pedagogical approaches.

Keywords: Collaborative Learning; Critical Thinking; Jigsaw Method; Medical Education.

Introduction

Medical education has undergone significant transformations in recent years, emphasizing innovative teaching methods that promote active learning, critical thinking, and problem-solving. Traditional didactic lectures, long a cornerstone of medical education, are increasingly supplemented by more interactive and engaging approaches [(1)].

The jigsaw method is a cooperative learning strategy that promotes student engagement and collaboration. In this approach, a class is divided into small groups, with each student assigned a specific topic or section of the material to learn. In a collaborative learning environment, students first study their assigned materials. After this initial phase, they meet with peers from other groups, forming expert groups focused on their subject matter. This collaboration allows them to deepen their understanding before returning to their original groups to share insights [(2)]. This method not only fosters active participation and accountability but also enhances motivation. By teaching others, they reinforce their knowledge, improving long-term retention and understanding. Furthermore, the jigsaw method strengthens critical thinking and problem-solving skills by encouraging students to synthesize information, draw connections between different concepts, and communicate their ideas effectively.

Biochemistry, a cornerstone of medical education, demands deep conceptual understanding and strong retention. The jigsaw method enhances both by engaging students as active participants—learning from peers while reinforcing their knowledge as teachers [(3,4)] This approach transforms the instructor from a lecturer to a mentor, fostering active learning [(5,6)]. First developed by Elliot Aronson in 1978, the jigsaw method is a cooperative learning strategy that has been widely studied, but, despite its potential, it remains underutilized in medical education, particularly among first-year MBBS students [(7)]. Concerns regarding its implementation in large classrooms contribute to its limited adoption [(8,9)]. Nonetheless, the method's advantages, including enhanced collaboration and student engagement, make it a promising alternative for medical educators [(10)].

Material and Methods

A six-month crossover study (July–December 2023) was conducted with first-year MBBS students in the Department of Biochemistry at a Medical college in Punjab. The study was approved by the institution's research board and ethics committee.

Sample Size: Using Open Epi software (80.0% confidence interval and power), with assumed mean scores of the jigsaw (9.75 ± 0.799) and didactic lecture (10.07 ± 0.85) groups, the required sample size was 50 students per group [(11)].

Methodology: A crossover design was employed, involving 100 students who participated in four sessions. They were divided into two groups: the Jigsaw Group participated in four 90-minute collaborative jigsaw sessions, while the Control Group attended traditional didactic lectures. Students were first assigned to parent groups (10 per group) and given specific learning objectives (LO). Those with the same LO formed expert groups to analyze key concepts before returning to their parent groups to teach their assigned topics. Faculty facilitated discussions without direct instructions.
Assessment Methods: Immediate Post session test was conducted right after each session to evaluate initial knowledge acquisition. A follow-up test (late post-session test) was administered four weeks later to measure long-term retention of the subject. The student Feedback was also gathered through a validated Likert-scale questionnaire in Google form to assess their learning experience and engagement. Analysis was done by

1. Independent Samples t-test: to measure the difference in mean performance between two independent groups.
2. Effect sizes reported: Cohen's d, η^2((Eta-squared), and 95% CIs.
3. Repeated measures ANOVA: to assess how students' performance changes over time and to evaluate whether the learning method influences this change.
4. Linear mixed-effects model for time-group interactions.

Results

The jigsaw group consistently outperformed the control group in long-term knowledge retention. The t-test results showed that the jigsaw group had significantly higher long-term retention scores ($t(98) = 3.21$, $p < 0.01$, Cohen's $d = 0.92$, 95% CI [0.41, 1.42]).
The t-value represents the greater difference between the two group means. Cohen's d values showed a large effect size (meaning the jigsaw group had higher retention scores). The linear mixed-effects model also depicted a significant random slope effect ($p < 0.01$), indicating the way participants retained knowledge wasn't uniform—some improved at different rates (fig a).
ANOVA: A significant main effect of time ($F(3, 96) = 4.13$, $p < 0.01$, $\eta^2 = 0.08$) and a time-group interaction ($F(3, 96) = 3.51$, $p < 0.05$, $\eta^2 = 0.06$) confirmed learning differences (fig.b). The higher F-value tests signify that retention scores changed over time with a stronger effect. $\eta^2 = 0.06$ (moderate effect), meaning that the jigsaw and control groups retained knowledge differently over time.
Regarding the student feedback evaluated on a Likert scale, it was reported that 82.2% reported improved retention with the jigsaw method. (Figure c).

Fig: a The graph illustrates the knowledge retention scores of the Jigsaw and Control groups over different time points.

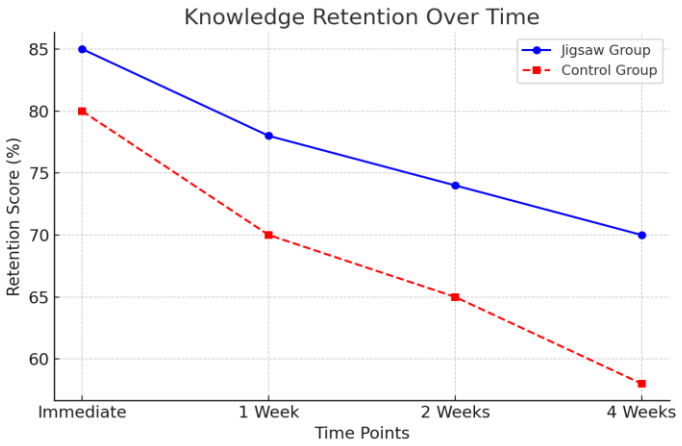


Fig: b The bar chart displays the Cohen's d effect sizes comparing Jigsaw and Control groups for immediate and long-term retention.

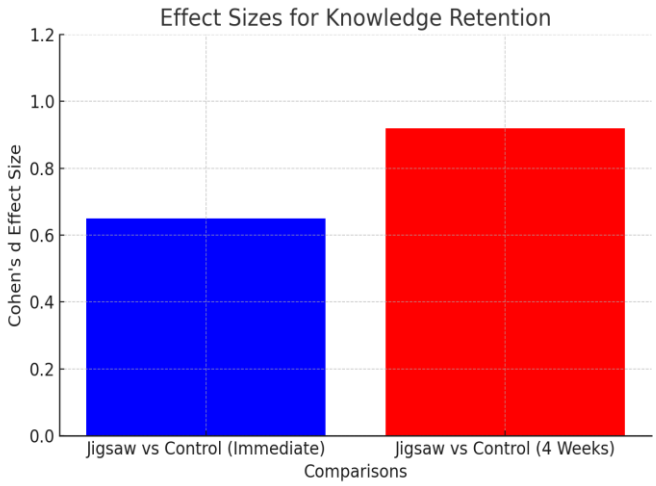
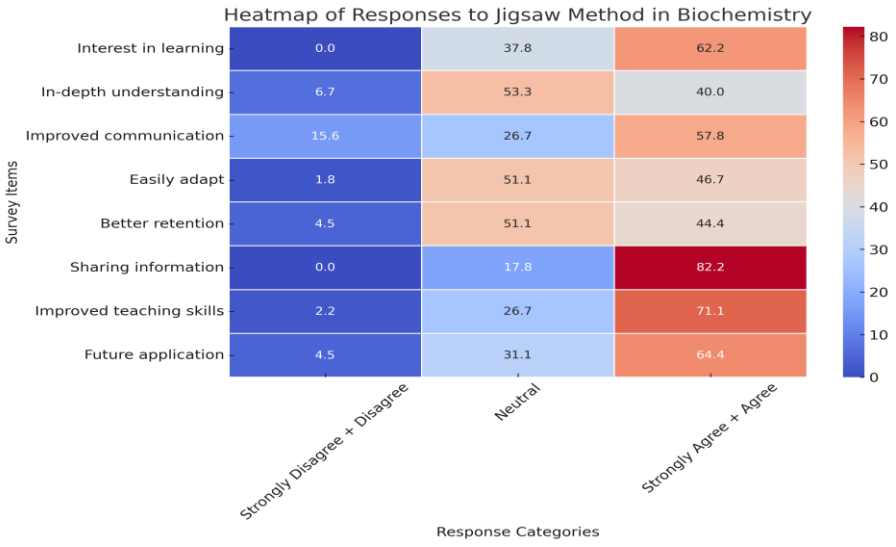


Fig: c The graph represents the distribution of responses across different survey item.



Discussion

This study's findings reinforce that the jigsaw method led to superior long-term retention compared to traditional lectures. The mixed-effects model revealed individual differences in knowledge retention over time. The decline in retention scores observed in the control group highlights the advantage of active learning over traditional didactic lectures. These results align with previous research by Pai et al., which demonstrated that self-directed learning significantly improves knowledge retention in first-year MBBS students [13].

Similar conclusions were reported by Nusrath et al. and Nair et al., who found that collaborative learning enhances student performance [14,15] Additionally, Moin and Majeed's research corroborates these findings, showing that students engaged in the jigsaw method exhibit better comprehension and recall over time compared to those in traditional lecture-based settings [16]. Studies by Johnson and Johnson, as well as Tanel and Erol, further support that cooperative learning fosters long-term academic achievement more effectively than conventional methods [17,18]

Beyond improving knowledge retention, the jigsaw method cultivates essential collaborative skills, crucial for interdisciplinary teamwork in healthcare [19]. Future research should investigate how these skills translate into clinical performance and patient outcomes, further validating the method's role in medical education.

Future Directions:
- Investigate clinical performance outcomes.
- Explore longitudinal growth curve modeling to assess knowledge retention beyond four weeks.

Acknowledgment: I am thankful to the students and department who helped a lot in completing the sessions successfully.

Conclusion

The jigsaw method enhances knowledge retention, critical thinking, and student engagement. It is a statistically robust and pedagogically valuable alternative to traditional lectures in MBBS education.

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