

Original Research Article

INTRODUCTION OF JIGSAW AS A TEACHING LEARNING METHOD AND COMPARISON WITH DIDACTIC LECTURE AT A MEDICAL COLLEGE IN WESTERN INDIA

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ABSTRACT

Background: Jigsaw is one of the cooperative teaching learning methods with emphasis on active participation of students. Traditional didactic lectures remain largely the predominant teaching method in undergraduate medical education, but they are teacher-centred and encourage passive learning. Jigsaw method engages students actively and reported to improve conceptual understanding, critical thinking and communication skills. However, evidence on the use of jigsaw in pathology teaching is limited. This study was therefore undertaken to introduce jigsaw as a teaching-learning method for Phase II MBBS students in the Department of Pathology, to compare its effectiveness with didactic lecture in terms of academic performance, and to assess the perceptions of students and faculty regarding this method.

Materials and Methods: A quasi-experimental study was conducted among second-phase MBBS students in the Department of Pathology after IEC approval. Four topics of comparable difficulty were selected. Pre-validated MCQ questionnaires were used for pre-/post-tests and feedback. Total 72 students participated in the study. They were allocated to study (Jigsaw) and control (didactic lecture) groups based on roll numbers, with crossover in subsequent sessions. Quantitative data (pre- and post-test scores) was analysed to assess the effectiveness of Jigsaw method. Qualitative data about students and faculty perception was collected by using prevalidated questionnaire (5-point Likert scale and open-ended responses). Long term retention was tested after one month.

Results: Pretest scores revealed comparable baseline knowledge for both the groups. Post-test scores were significantly higher ($p < 0.05$) in the Jigsaw group than in the didactic lecture group. Long-term retention was also significantly better with the Jigsaw method. Student feedback indicated high acceptance of the method.

Conclusion: This study demonstrates that the Jigsaw method is more effective than didactic lectures in enhancing immediate learning outcomes and long-term knowledge retention. Positive student perceptions re-enforce the method's ability to promote active participation, deeper understanding, communication skills and critical thinking.

Keywords: Jigsaw, didactic lecture, Active learning, student-centric methods.

INTRODUCTION

The introduction of Competency-Based Medical Education (CBME) has brought about a fundamental

shift in teaching-learning strategies for medical students. The approach is predominantly student-centric, emphasizing active learner participation rather than the traditional teacher-centric model.

Active engagement of students enhances deeper understanding, improves long-term retention of knowledge, and positively influences academic performance.^[1] A wide array of teaching–learning methods are used to actively involve students. Cooperative learning is one such method, in which a team of learners works together, with everyone contributing to completing assignments and solving problems. It allows students to coordinate with team members, share knowledge, develop critical thinking, become good listeners, and take responsibility for their own learning, which aids concept building and long-term knowledge retention.^[2]

The Jigsaw method is one of the cooperative learning techniques.^[3] Participants are divided into groups (expert groups), and each group is given a set of learning objectives to prepare together through discussion. Participants are then rearranged into new groups, each containing at least one member from every expert group. Members of the new group subsequently teach each other the topic they had prepared.^[4,5] This method works efficiently with minimal facilitation, the facilitator's role being to monitor student preparation and topic coverage and to maintain a smooth flow of discussion.^[6] It requires effective time management, as planning and implementing this activity takes more time compared to traditional didactic lectures.^[7] The Jigsaw method enhances communication skills and critical thinking and leads to a deeper understanding of the subject.^[8] The original Jigsaw method was introduced by Aronson in 1978 to promote cooperation among students from varied backgrounds.^[9] Since then, considerable research has been conducted across various educational settings — including primary and secondary schools, and nursing, pharmacy, and medical education — with evidence showing that the Jigsaw method is an effective teaching–learning tool.^[10-13]

With this background, the present study was designed to introduce active learning strategies for selected topics in Pathology, with the aim of enhancing conceptual clarity, critical thinking, and student interest in the subject. Most previous studies in the literature have assessed only immediate learning gains, whereas the present study also assessed long-term retention of knowledge, adding value to the existing evidence. This intervention is being introduced for the first time at our institute and is expected to motivate other departments to adopt student-centric, interactive teaching methods as well.

Aim and Objectives

Aim: Introduce jigsaw as a method of teaching learning and assess its effectiveness in comparison with didactic lecture.

Objectives

1. To introduce jigsaw as a teaching learning method for second phase MBBS students in department of pathology.
2. To compare the academic outcome of Jigsaw method with traditional didactic lecture for its effectiveness.

3. To evaluate the perception of students and faculties about Jigsaw method of teaching learning by using structured feedback questionnaires.

MATERIALS AND METHODS

Quasi experimental study was conducted in department of Pathology for second phase MBBS students after obtaining clearance from the Institutional ethics committee. Written informed consent was obtained from all the participants. Total 72 students participated in the study.

Inclusion Criteria

All students of second phase MBBS students in the department of pathology were included after getting informed consent. For analysis of results students having 100 percent attendance for the sessions were included.

Exclusion Criteria

Students who did not give informed consent were excluded.

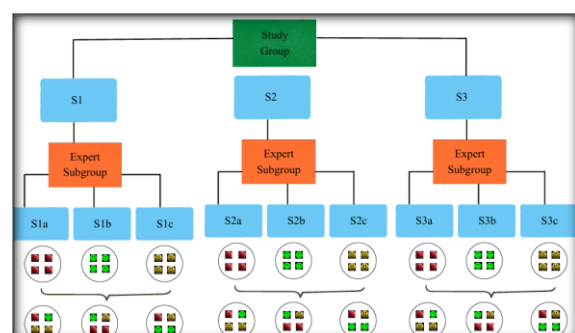
Total sessions: 4 (2 hours / session)

Pre session planning: Orientation of the faculties about the concept and methodology of jigsaw was done. Four topics with comparable difficulty level were selected. Subtopics and specific learning objectives for each topic were framed. Pre-test & post-test questionnaire consisting of single best response type MCQs for each topic was prepared and reviewed by two faculties from the department for clarity and alignment with learning objectives. Student and faculty feedback questionnaire was prepared after thorough literature search and was reviewed for Face and Content validity by members of Medical Education Unit and faculty members of our department.

Sampling technique: Students were divided according to the roll number in study and control groups. Study group was further divided in 3 small groups (S1, S2, S3) by systematic random sampling. Study group learned the topic by Jigsaw method while didactic lecture was conducted for the control group.

Intervention (Jigsaw method) –

Study group was divided in three small groups – S1, S2, S3 (12 students in each group). Each small group was assigned a separate facilitator and activity was conducted in separate demonstration rooms simultaneously.



Each small group was subdivided into 3 subgroups as expert groups; 4 students in each subgroup as (S1a, S1b and S1c) --- (S3a, S3b, S3c). These subgroups were allotted subtopics with specific learning objectives for the study. They prepared the topic thoroughly by referring to resource material and discussion with fellow members and wherever needed assigned facilitator. They were given sufficient time (30-40 min) for this activity. After this 1-2 students from each subgroup (expert group) were mixed to form three new groups which will have members from each sub groups like (S1a1, S1b1, S1c1), (S1a2, S1b2, S1c2), (S1a3, S1b3, S1c3). Members from new groups taught each other the subtopics which they have learned in the first part. Thus, at the end of session all the students studied the entire topic. At the end important points were summarized by the facilitator.

All three study groups i.e. S1, S2 and S3 followed the similar method.

The control group learned the topic by traditional didactic lecture. Cross over of study and control groups was done for next session.

Session 1 - Study group (N- 36) - Jigsaw method

Control group (N- 36) - Didactic lecture

Session-2 - Cross over was done

Control group (36 students)- Didactic lecture

Study group (36 students)- Jigsaw method

Similar pattern was followed for conducting other two sessions so that all students got the equal chance to participate in the study (twice).

After one month, MCQ based test was taken for each topic for assessment of long term retention of knowledge.

Data collection - Quantitative and Qualitative data were collected.

Quantitative data - Assessment was done by taking pre and post-test for both the groups.

Comparison of post-test scores of two groups was used to assess the effectiveness of the Jigsaw method. Comparison of test scores of two groups taken after one month was used to assess the long-term retention. Qualitative data - Perceptions from students and faculties were collected by internally validated and pre-tested questionnaire. It included both close ended questions using a 5-point Likert scale and open-ended questions.

Statistical analysis -

Quantitative data analysis -

1. Pre and post-test scores within each group were analysed using paired t-tests to evaluate knowledge improvement for both the groups.
2. Independent t-test was applied for comparing the outcomes between the study and control groups to assess the effectiveness of Jigsaw method.

The data was analysed with IBM SPSS 20.0 New York, Armonk software at a significance level of $P < 0.05$.

Qualitative data analysis - Responses on the Likert scale with regard to statements were analysed in number and percentage and open-ended questions were analysed by thematic analysis.

RESULTS

A total 72 second MBBS students participated in the study. All of them were not having any prior experience with the jigsaw method.

Table 1: Pre-test versus Post-test comparison within the groups by paired t-test

Group	N	Pre-test score Mean $\pm$ SD	Post-test score Mean $\pm$ SD	P-value
Topic 1 – Necrosis				
Study Group (Jigsaw Method)	36	3.944 $\pm$ 1.689	8.56 $\pm$ 1.045	<0.001
Control Group (Didactic lecture)	36	3.950 $\pm$ 1.532	7.687 $\pm$ 1.230	<0.001
Topic 2 – Intracellular accumulations				
Study Group (Jigsaw Method)	36	5.782 $\pm$ 1.953	8.285 $\pm$ 1.126	<0.001
Control Group (Didactic lecture)	36	5.909 $\pm$ 2.021	7.454 $\pm$ 1.787	<0.001
Topic 3 – Pathologic calcification and pigment disorder				
Study Group (Jigsaw Method)	36	4.24 $\pm$ 1.921	8.242 $\pm$ 1.275	<0.001
Control Group (Didactic lecture)	36	4.05 $\pm$ 1.894	7.454 $\pm$ 1.175	<0.001
Topic 4 – Healing and repair				
Study Group (Jigsaw Method)	36	4.121 $\pm$ 2.023	7.238 $\pm$ 1.985	<0.001
Control Group (Didactic lecture)	36	3.325 $\pm$ 1.778	6.051 $\pm$ 2.339	<0.001

*Statistically significant $P < 0.05$

Results of paired t-test show that both the methods helped in enhancing the knowledge of participants.

Table 2: Pre-test versus post-test comparison between the groups by independent t-test

Groups	Pre-test score Mean±SD	P-value	Post-test score Mean±SD	P-value
Session I				
Group I (Jigsaw method) (N= 36)	3.944±1.689	0.889	8.56±1.045	0.010
Group II (Didactic lecture) (N=36)	3.950±1.532		7.687±1.230	
Session II				
Group I (Jigsaw Method) (N=36)	5.782±1.953	0.930	8.285± 1.126	0.044
Group II (Didactic lecture) (N=36)	5.909±2.021		7.454±1.787	
Session III				
Group I (Jigsaw Method) (N=36)	4.242±1.921	0.753	8.242±1.275	0.023
Group II (Didactic lecture) (N=36)	4.050±1.894		7.454±1.175	
Session IV				
Group I (Jigsaw Method) (N=36)	4.121±2.023	0.083	7.238±1.985	0.025
Group II (Didactic lecture) (N=36)	3.325±1.778		6.051±2.339	

*Statistically significant $P < 0.05$

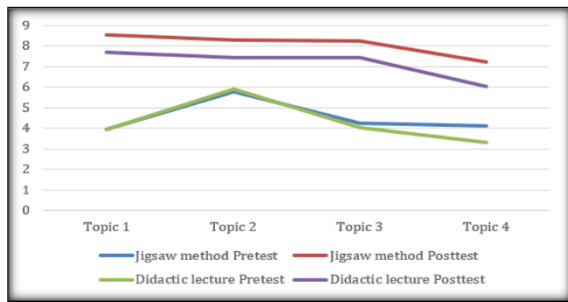


Figure 1: Comparison of pre and post-test scores of jigsaw and didactic lecture

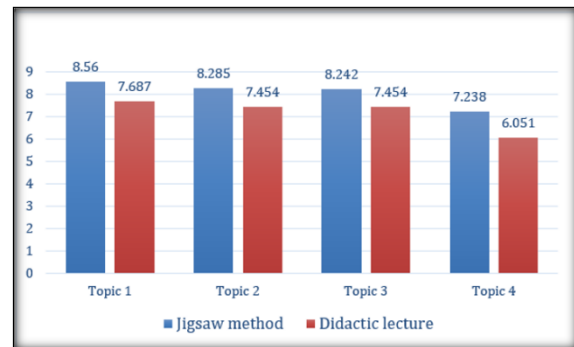


Figure 2: Comparison of post test scores of jigsaw and didactic lecture.

[Table 2] presents the results of an independent t-test that compares the scores of the jigsaw and traditional lecture groups. There was no statistically significant difference in pre-test scores between the Jigsaw and Didactic Lecture groups ($P > 0.05$) for all sessions), indicating comparable baseline knowledge. In contrast, post-test scores demonstrated significantly higher performance in the jigsaw group compared to the didactic lecture group ($P < 0.05$) in every session.

Table 3: Comparison of post-test scores for effect sizes

	Study group (Jigsaw method) Mean±SD	Control group (Didactic lecture) Mean±SD	Cohen's d value
Topic 1	8.56±1.045	7.687±1.230	0.77
Topic 2	8.285±1.126	7.454±1.787	0.56
Topic 3	8.242±1.275	7.454±1.175	0.64
Topic 4	7.238±1.985	6.051±2.339	0.55

[Table 3] shows consistently higher post-test scores in the jigsaw group across all four sessions, with moderate to large effect sizes (Cohen's d ranging

from 0.55 to 0.77), indicating a meaningful educational advantage over didactic lectures.

Table 4: Long term retention comparison between the groups by independent t-test

	Test score (Mean ± SD)		P value
	Study group (Jigsaw method)	Control group (Didactic lecture)	
Topic 1	7.606 ± 1.970	6.454 ± 1.938	0.008
Topic 2	7.35 ± 1.263	6.423 ± 1.361	0.037
Topic 3	8.354 ± 1.050	7.677 ± 1.275	0.031
Topic 4	7.00 ± 1.845	6.026 ± 2.104	0.046

*Statistically significant $P < 0.05$

For all topics, students in the Jigsaw group consistently achieved higher mean test scores, and the differences were statistically significant.

Table 5: Students perception about Jigsaw method (N=72)

Students responses	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)
The methodology and objectives of session were well explained	19.4	61.1	18.1	1.4	0
The jigsaw method was useful in enhancing my understanding of the topics	19.4	61.1	18.1	1.4	0
I found the jigsaw method helped me acquire more knowledge compared to traditional teaching methods.	29.2	54.2	12.5	4.2	0
The jigsaw method encourages me to actively participate in my learning.	33.3	61.1	4.2	1.4	0
The jigsaw method helped me in reducing hesitation in the class	19.4	48.6	25.0	7.0	0
It helped me in bonding with my peers and teachers.	12.5	59.7	23.6	4.2	0
The jigsaw method improves my communication skills .	22.2	54.2	16.1	7.0	0
The jigsaw method enhances my critical thinking skills	18.1	54.2	26.3	0	1.4

I find the jigsaw method enjoyable and engaging compared to traditional teaching methods	29.2	61.1	5.6	4.2	0
I would prefer to have jigsaw method of teaching for few more topics	34.7	52.8	6.9	5.6	0

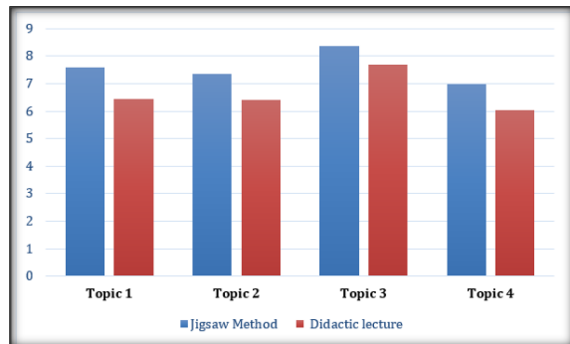


Figure 3: Comparison of retention test scores

Student perceptions of the Jigsaw teaching method were largely positive. A large majority (80.5%) agreed that the methodology and session objectives were well explained. Most students felt that the Jigsaw method enhanced their understanding of the topics (80.5%) and helped them acquire more knowledge than traditional teaching (83.4 %). High levels of agreement were also observed for the method's ability to promote active participation

(94.4%) and reduce hesitation in class (67.5%). More than two-thirds of students felt that the approach improved bonding with peers and teachers (68%) and supported development of communication skills (76.4%). Additionally, many perceived improvements in critical thinking (72.3% agreement). The Jigsaw method was found to be enjoyable and engaging by 90.3% of respondents, and 87.1% expressed a preference for using it for additional topics.

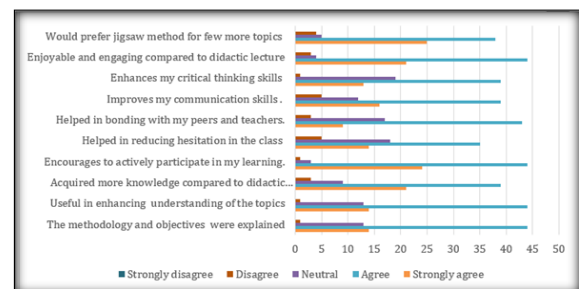


Figure 4: Students perception about Jigsaw method.

Table 6: Students response to open ended questions (N-72)

Questions	Thematic analysis of responses
1. What was good about this activity?	A) Learning experience - -Active learning , - Self learning - Better learning by teaching others - Better way than monotonous lectures - More interactive - It was fun learning topic wise and testing our memory ability. - New way of learning , enjoyed the activity B) Conceptual clearing - - Better understanding of concepts or topic by discussing it with the group members. - Self understanding was enhanced C) Skill improvement - - Critical thinking skill improved - Improvement in communication skill. - able to develop some teaching skills D) Group Dynamics - -Group study was very helpful - Increased interaction with colleagues helped in group development . E) Increased retention of knowledge
2. What can be improved in this methodology?	A) Methodology -Time consuming, time management can be improved. -Give some more time to learn the topics. - Include video explanation - Some sort of explanation of the topic should be done to clear the doubts of students in the later sessions. B) Assessment- Can include writing sessions for assessment

Table 7: Faculty perception about Jigsaw method (N-21)

	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)
1.Jigsaw method is effective in promoting a deeper understanding of the material by students.	23.8	61.9	14.3	0	0
2. Jigsaw method helps in improving collaboration among students	42.8	52.4	4.8	0	0
3. This teaching method encourages critical thinking skills in students.	28.6	61.9	9.5	0	0
4. The Jigsaw method enhances student engagement	47.6	52.4	0	0	0
5. Improved communication skills among students using the Jigsaw method.	38.1	57.1	4.8	0	0

6. I would prefer using the Jigsaw method over traditional lecture-based teaching	9.5	52.4	38.1	0	0
7. I think that the Jigsaw method could be improved with additional strategies or modifications	9.5	66.7	23.8	0	0
8. I find it challenging to manage classroom dynamics during Jigsaw activities.	9.5	47.6	28.6	14.3	0
9. I feel that the time given for jigsaw method was sufficient	4.8	66.7	28.6	0	0
10. I think additional resources (e.g., guides, workshops) on the Jigsaw method would be helpful.	19	71.4	9.5	0	0

Similar to students, majority of faculty(85.7%) agreed that jigsaw method promotes deeper understanding of topic. More than 90 % agreed that it keeps students engaged and improve their communication and critical thinking skills. About 60

% faculties faced challenge of managing classroom dynamics and time during jigsaw. 90 % of them suggested training workshop for faculties will improve its implementation.

Table 8: Faculty responses to open ended questions (N=21)

Questions	Responses
1. Did you face any difficulties?	A) Pre session preparation- - More planning is required, - time consuming - difficulty with complex topics(hard to divide) - Require more faculty B) Student related - Uneven participation of students, slow learners get difficulty affecting outcome - Incomplete understanding of topic by students - Some students face difficulty in communicating the knowledge with peers.
2. Suggestions to improve Jigsaw sessions in future:	A) Methodology related - - Number of students per group to be capped. - Proper planning of class involving multiple faculties. - Can add some creative ideas like quiz, poster presentation, debates to engage students and for assessment. B) Training- Orientation session for students and sensitisation session for facilitators

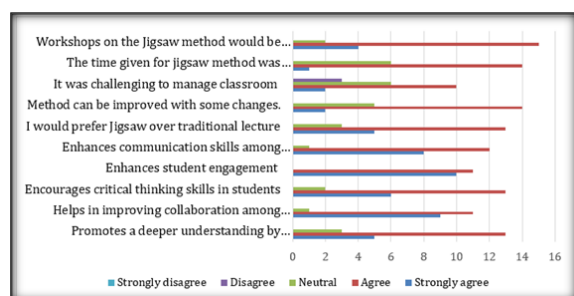


Figure 5: Faculty perception about Jigsaw method

DISCUSSION

The introduction of Competency-Based Medical Education (CBME) in 2019, along with its subsequent revisions, has brought a paradigm shift in medical education, making it more learner-centric, patient-centric, and outcome-oriented. In addition to knowledge, Indian medical graduates are expected to possess skills such as effective communication, teamwork, critical thinking, and lifelong learning, enabling them to function effectively as physicians of first contact and remain globally relevant. Achieving this goal requires students to be actively involved and to take responsibility for their own learning. Many innovative teaching-learning methods have been used to promote active student involvement and enhance learning effectiveness; the Jigsaw method is one such technique that promotes collaboration among students.^[3]

In the present study, both the Jigsaw method and traditional didactic lectures produced a significant improvement in students' immediate knowledge across all four pathology topics [Table 1], confirming that both methods are effective in improving short-term learning outcomes — likely due to active engagement during sessions and reinforcement of key concepts. However, when post-test scores were compared between the two groups, students taught using the Jigsaw method consistently outperformed those taught using didactic lectures across all sessions [Table 2]. This may be attributed to the active participation, cooperative peer-assisted learning, and greater time for learning afforded by the Jigsaw method, which enhanced understanding and conceptual clarity compared to passive didactic lectures. Studies conducted across departments such as physiology, community medicine, biochemistry, and anatomy have similarly shown that the Jigsaw technique improves understanding, promotes deeper learning, and enhances critical thinking and academic performance compared to conventional didactic lectures.^[8,14-21]

Long-term retention scores [Table 3] revealed that students in the Jigsaw group scored significantly higher across all four topics compared to the didactic lecture group ($p < 0.05$). This suggests that the collaborative, learner-centred design of the Jigsaw technique supports better consolidation and recall of knowledge over time — a finding echoed by other studies attributing improved retention to collaborative learning, peer discussion, and

knowledge sharing.^[17,18,22] Overall, these results support the effectiveness of active, participatory learning strategies in promoting better academic performance.

In addition to improved academic performance, student perceptions strongly favoured the Jigsaw approach [Table 4]. Most students felt that the Jigsaw method deepened their understanding of the topic and facilitated better knowledge acquisition compared to traditional didactic lectures. Students reported that peer discussion and teaching one another helped clarify concepts, resolve doubts, and build deeper understanding — consistent with other studies highlighting the role of collaborative learning in knowledge acquisition.^[8,15-25]

About two-thirds of students agreed that the activity helped them overcome shyness or hesitation and improved their communication with peers. They also reported higher levels of active participation during sessions and acknowledged improvements in communication skills, critical thinking, and peer interaction. The Jigsaw method also fostered a sense of collaboration and bonding among students, as well as between students and faculty. Many students described the learning experience as enjoyable and engaging, and expressed interest in similar activities for additional topics. These findings align with previous studies demonstrating the effectiveness of the Jigsaw technique in improving teamwork, communication skills, and boosting learner confidence and engagement.^[8,10,14-16] Some students found the activity time-consuming — likely faster learners, given that relatively short and easy topics were chosen for what was essentially a pilot project at our institute.

Similar to students, most faculty members perceived the Jigsaw method as effective in promoting deeper understanding by actively engaging students and enhancing collaboration, aligning with previous studies showing that cooperative learning strategies foster interactive environments and reduce passive learning common to traditional lectures. Faculty also perceived improvements in students' critical thinking and communication skills, attributing these to opportunities for discussion and peer teaching — key components of the Jigsaw process.^[10,23,26] However, faculty feedback also identified challenges, including the additional time and manpower required for planning and implementation. Similar observations have been reported elsewhere, with the Jigsaw technique described as resource-intensive and difficult to implement within limited curricular timeframes, particularly for complex topics that are hard to divide into discrete subunits.^[16,17,25]

Another notable difficulty was uneven student participation, likely due to slow learners struggling to grasp the topic within a short time frame, or communication barriers. Previous studies have similarly highlighted that variability in learner engagement and peer-teaching quality can influence outcomes, particularly when students are unfamiliar with the methodology.^[16]

Faculty suggestions for improvement included capping group size, involving multiple facilitators, and incorporating creative elements such as quizzes and poster presentations to improve engagement and assessment. Orientation sessions for students and sensitization programs for facilitators were also recommended. Prior studies support this, showing that adequate training improves participation, confidence, and the overall effectiveness of Jigsaw sessions.^[16,17]

Overall, the present study demonstrates that the Jigsaw technique not only enhances immediate learning but also leads to better long-term retention through active student engagement. Most previous studies have not examined the effect on knowledge retention, making the present study particularly valuable. Didactic lectures remain useful for presenting basic content but are less effective in sustaining engagement and promoting deeper learning. The consistently higher performance and favourable perceptions associated with the Jigsaw method suggest that it would be beneficial to incorporate it into regular teaching of pathology, and potentially other subjects, for select topics.

CONCLUSION

- This study demonstrates that the Jigsaw method of cooperative learning significantly improves immediate learning outcomes and long-term knowledge retention.
- Positive student perceptions highlight the method's ability to promote active participation, deeper understanding, communication skills, critical thinking, and learner engagement.
- Collectively, these findings encourage the incorporation of the Jigsaw technique in undergraduate medical education to improve both academic performance and the learning experience.

Limitations: Assessment was only MCQ based limiting it to only recall, missing the higher order cognitive assessment and other collaborative learning outcomes. Further studies are required to identify specific loopholes in the implementation of this method and to explore feasible solutions tailored to different educational settings.

Recommendations: Faculty orientation and training workshops about the innovative teaching learning methods should be organised which will guide them to use these methods more frequently.

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