RESEARCH PAPER

Introduction of Jigsaw classroom for teaching Biochemistry to MBBS students

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ABSTRACT

Background:Since There Is A Demand Of Paradigm Shift Of Teacher Centered Teaching Methods To Student Centered Learning Methods, In The Current Scenario Of Medical Education By Nmc, Introduction Of Jigsaw Method In Classrooms, Will Make The Students Self-Directed, Active Learners. Jigsaw Technique Is A Cooperative Learning Method In Which A Topic Is Divided Into Sub Topics (Jigsaw Pieces).

Aim And Objectives:The Aim Of The Present Study Was Introduction Of Jigsaw Classroom Teaching To Facilitate Learning Of Biochemistry; To Measure The Outcome By Comparing Pre Test And Post Test Scores Of Mbbs Students And To Know Perceptions Of Students And Faculty About The Jigsaw Classroom.

Methodology:The Study Was Conducted In The Department Of Biochemistry At Mmimsr, Mullana After Approval By The Institutional Ethics Committee. A Pre-Test Questionnaire Was Designed And Validated By The Faculty And All Students Were Given The Pre-Test And Marks Were Recorded. 200 Students Were Divided Into 20 Groups Of 10 Students Each And Labelled A To T (Parent Groups). Within Each Parent Group, Numbers Were Assigned From 1-10 (A 1-10, B 1-10 And So On). Students With The Same Numeral From All 20 Groups Were Grouped Together (Expert Groups). These Expert Groups Were Assigned Subtopics For The Main Topic "Heme Breakdown And Jaundice" And They Discussed The Same With Peers And Became Experts. After A Week, Each Student Of Expert Group Returned To Their Parent Group And Presented The Sub Topic Learnt In Expert Group To Other Members Of Parent Group So That The Entire Group Had Complete Knowledge Of All The Subtopics Of The Main Topic. At The End Of This Jigsaw Approach, Post -Test Questionnaire Was Given To Students (Similar To Pre-Test) And Marks Were Recorded. The Outcome Was Measured Comparing The Pre-Test And Post-Test Scores By Paired Student "T" Test. $P<0.05$ Was Considered Statistically Significant. Feedback And Perceptions Of The Students And Faculty Regarding The Jigsaw Sessions Were Taken On Likert Scales.

Results:A Total Of 142 Students Participated In The Study (Absentees Were Excluded). Their Pre Test And Post Test Scores Were Compared. The Mean Pre Test Score Was 3.64 And Post Test Score Was 7.72. There Was Statistically Significant Difference Between The Pre Test And Post Test Scores ($P<0.05$). Feedback Was Taken From Students And Faculty In The Form Of Google Forms. The Students Were Positive About This Method Of Teaching And Learning That It Enhanced Their Communication Skills, Listening Skills, Teaching Skills And Confidence.

Conclusion:With a positive feedback from students and faculty, Jigsaw method can be incorporated in Biochemistry teaching along with didactic lectures. Along with achievement of learning goal, there is development of other soft skills. It encourages concept of cooperation rather than competition. Peer teaching and peer learning promotes teamwork and effective learning.

Keywords: Jigsaw, Classroom, Biochemistry, Mbbs, Students

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INTRODUCTION

Since there is a demand of paradigm shift of teacher centered teaching methods to student centered learning methods, in the current scenario of Medical Education by

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NMC, introduction of jigsaw method in classrooms, will make the students self directed, active learners. As the students are directly engaged with the material, they gain one of the most valuable skills – Self teaching. Also, it will help the faculty cover exhaustive syllabus of Biochemistry in a lighter way making learning fun.

Jigsaw technique is a cooperative learning method in which a topic is divided into sub topics (Jigsaw pieces). Students are divided into small groups known as Parent groups in which each student has a responsibility of learning a subtopic. Students with the same sub topics form groups known as Expert groups and discuss their sub topic in detail and become experts. Then they return to their parent group and each student teaches sub topic (jigsaw piece) learnt in Expert group to other students of their respective parent group completing the jigsaw puzzle.

There are limited studies on use of Jigsaw method in teaching Biochemistry. Some researchers have come up with this thought process in other subjects and have found the jigsaw tool as a means of improving academic performance, improving communication skills and ultimately making students active learners and teachers. In a study by Sharma S et al [1] it has been concluded that cooperative learning by jigsaw method improves understanding of boring topics by making them more interesting (Fig.1) . In a study by Bhandari B et al[2] where Jigsaw was used to teach Physiology of Respiration, students had stated that cooperative learning by jigsaw method enhanced their communication skills, enabled deep understanding and they enjoyed the experience and requested incorporation of this method for all topics.

In a study by Bhaskar V et al, [3] grades between pre and post tests of study group and control group implied that jigsaw method helped to improve knowledge gain and students felt the session helped improve their communication skills. A study by Uppal V et al [4] also revealed similar results and findings.

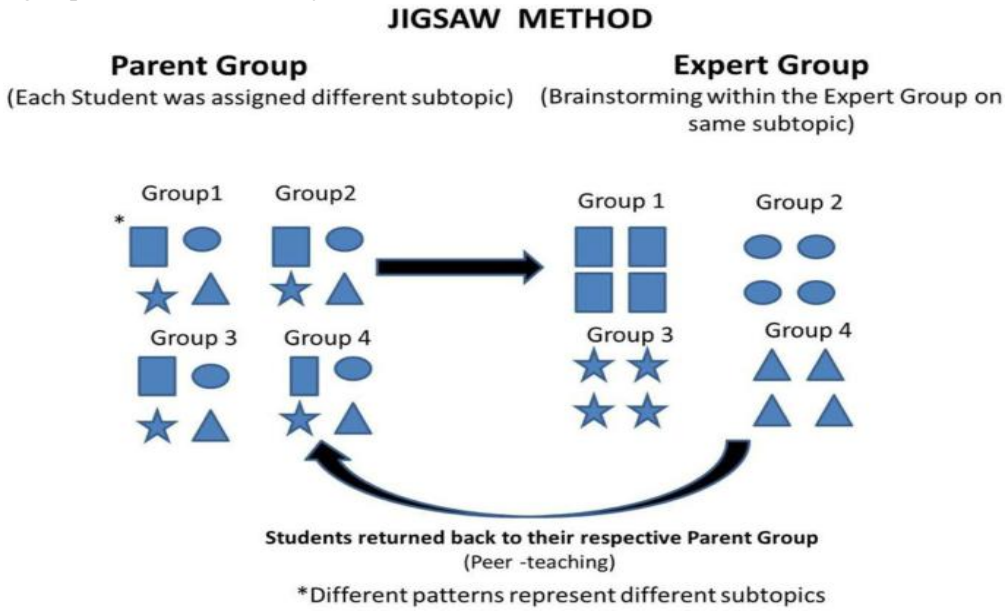

Figure 1. Jigsaw method of teaching in students

AIM AND OBJECTIVES:

1. Introduction of jigsaw classroom teaching to facilitate learning of Biochemistry
2. To measure the outcome by comparing Pre test and Post test scores of MBBS students.
3. To know perceptions of students and faculty about the Jigsaw classroom.

METHODOLOGY

The study was conducted in the Department of Biochemistry at MMIMSR, Mullana after approval by the Institutional Ethics Committee.

INCLUSION CRITERIA

All MBBS First year students, enrolled for the academic year (2023-24).

EXCLUSION CRITERIA

Students who were absent

STUDY PROCEDURE

The study design was briefed to the whole class before the incorporation of the jigsaw method and were given a weeks' time to prepare the topic. It was a prospective study.

A pre-test questionnaire was designed and validated by the faculty and all students were given the pre-test and marks were recorded.

PARENT GROUPS: 20 groups of 10 students each. The parent groups were named Group A, B, C, D and so on till T. Within each parent group, students were assigned numbers from 1-10 (A 1-10, B 1-10 and so on).

EXPERT GROUPS: Students with the same numeral from all 20 groups were grouped together like all 1s, 2s, 3s and so on. So there were 10 expert groups of 20 students each.

Each expert group was assigned one subtopic from the main topic " Heme Breakdown and Jaundice" and they discussed the same with peers and became experts. Then each student of Expert group returned to their parent group and presented the sub topic learnt in expert group to other members of parent group so that the entire group had complete knowledge of all the subtopics of the main topic.

At the end of this jigsaw approach, Post -test questionnaire was given to students (similar to pre-test) and marks were recorded.

Distribution of sub-topics to the Expert group.

Expert group 1: Breakdown of heme

Expert group 2: Jaundice and its clinical picture

Expert group 3: Classification of Jaundice

Expert group 4: Causes of Pre-hepatic Jaundice

Expert group 5: Causes of hepatic Jaundice

Expert group 6: Causes of Post – Hepatic Jaundice

Expert group7: Lab findings (blood & Urine) in Pre-Hepatic Jaundice

Expert group 8: Lab findings (blood & Urine) in Hepatic Jaundice

Expert group 9: Lab findings (Blood & Urine) in Post Hepatic Jaundice

Expert group 10: Genetic syndromes of Hyperbilirubinemia

The outcome was measured comparing the Pre-test and Post-test scores by paired student "t" test. $p<0.05$ was considered statistically significant. Feedback and perceptions of the students and faculty regarding the jigsaw sessions were taken on likert scales and were graded from strongly disagree=1 to strongly agree=5. The questions with open-ended responses were analysed manually to interpret students' response.

OBSERVATION AND RESULTS

A total of 142 students participated in the study (absentees were excluded). The pre test and post test scores were compared. The mean pre test score was 3.64 and post test score was 7.72 (Table 1). There was statistically significant difference between the pre test and post test scores ($p<0.05$). Feedback was taken from students and faculty in the form of google forms. 85.9 % students found this innovative technique interesting and had a view that it also enhanced their teaching skills, communication skills and was an effective way of learning. 81.7% students had an opinion that it promoted team work. 67.6% students were of the view that it could be used to teach other topics in Biochemistry (Table 2). Responses to open ended questions were also recorded and majority of students responded that the best part of the jigsaw method was that it made learning fun and interesting. Active participation and in depth study of the sub topics from their peers using different resources had a greater retention impact on their minds. The short comings were time consuming sessions, some disinterested students and absentees. Eight faculty members of Biochemistry department gave their feedback and all of them agreed that such innovative teaching learning methods should be a part of the curriculum. They agreed that in this method of teaching, student engagement was more and students learnt better. 87.5% would prefer to incorporate this method in their future teaching and were confident to integrate it effectively in their teaching (Table 3). All faculty agreed to the fact that such innovative teaching learning methods should be a part of the curriculum. They suggested plans for time management for such sessions.

Table 1: Academic Performances of Students before and after conduct of Jigsaw session

SCORES	MEAN	SD
PRE- TEST (n=142)	**3.64**	**4.46**
POST - TEST (n=142)	**7.72**	**2.5**

Table 2: Questionnaire for student responses on introduction of Jigsaw activity in Undergraduate teaching

		(5) Strongly agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
1.	Jigsaw classroom is an interesting innovative technique	37.3%	48.6%	12%	2%	0.1%
2.	Jigsaw method is an effective way of learning	27.5%	52.8%	12%	5.6%	2.1%
3.	It enhances your teaching skills	38.3%	46.8%	12.1%	1.8%	1%
4.	It enhances your communication skills	39.4%	45.8%	12%	1.7%	1.1%
5.	It promotes listening skills	37.3%	45.1%	14.8%	1.7%	1.1%
6.	It promotes team-work	38.7%	43%	12.7%	4.0%	1.6%
7.	It can be used to teach other topics in Biochemistry	31.7%	35.9%	23.2%	4.3%	4.9%

Table 3: Questionnaire for faculty responses on introduction of Jigsaw activity in Undergraduate teaching

		(5) Strongly agree	(4) Agree	(3) Neutral	(2) Disagree	(1)Strongly Disagree
1.	Level of engagement of students is more in jigsaw classroom than traditional lectures	25%	75%	-	-	-
2.	Students learn better with this Teaching Learning Method	25%	75%	-	-	-
3.	You will prefer to incorporate this method in your teaching in future	12.5%	87.5%	-	-	-
4.	You feel confident to integrate it effectively in your teaching	12.5%	87.5%	-	-	-
5.	Using innovative teaching methods is necessary	100%	-	-	-	-

DISCUSSION

The introduction of jigsaw classroom in teaching Biochemistry to MBBS first year students was found to

be effective. There was a statistically significant difference between pre test and post test scores of the students. The students showed active participation and took responsibility of self learning and teaching their fellows very enthusiastically. The role of teacher too showed a shift to that of a facilitator as there was no active teaching in the form of lecture. The students were positive about this method of teaching and learning that it enhanced their communication skills, listening skills, teaching skills and confidence. Findings similar to present study have been found in other studies [2][3]. It made learning interesting and fun. They gave the feedback that such interactive sessions should be encouraged for other topics in Biochemistry as well as in other subjects. Learning from fellows allowed them to comprehend the topic in depth and retention was better. This finding was similar to study by Doymus et al [5] who in their study also found that teaching their classmates improved students' understanding of the topic as it helped them to improve their understanding even further. There are studies on perceptions of students and faculty about jigsaw method of teaching. Azmin et al [6] and Bharti et al [2] in their respective studies noted the perceptions of jigsaw method by students and found that it was an effective method for gaining students' attention and involvement. The advantage of this method is that it requires fewer resources and similar such finding was reported by Appandraj et al. [7].

According to some studies, the major disadvantage was time consuming sessions and this finding was similar to present study [2].

LIMITATIONS

To establish the effectiveness of jigsaw method, long term effects on student learning and retention need to be studied. The findings on a single topic cannot be generalized. The time consuming sessions need proper planning.

REFLECTIONS

Jigsaw method allowed active participation of the students. Meticulous planning was done so the session came out to be a success. Time constraints need to be dealt with and other faculty engagement could have been better. More topics can be taught in Biochemistry and other subjects with this method along with didactic lectures to cover the curriculum effectively.

CONCLUSION AND IMPLICATIONS

With a positive feedback from students and faculty, Jigsaw methodology sessions can be incorporated in Biochemistry teaching. Along with achievement of learning goal, there is development of other soft skills. It encourages concept of cooperation rather than competition. Peer teaching and peer learning promotes teamwork and effective learning. While Jigsaw is a valuable teaching learning method, it is important to note that it cannot replace the didactic lectures. Instead, it can be incorporated in teaching along with traditional lecture methods.

Further research, including studies on the effectiveness of Jigsaw classroom on more topics in Biochemistry as well as other subjects, could provide a more comprehensive understanding of the impact of Jigsaw classroom on students' performance..

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REFERENCE

[1]. S. Sharma, S. Chauhan, M. Kaur, Introduction and Assessment of Jigsaw Method of Teaching on Challenging Topics in Physiology for First Year Medical Students, Int J Physiol 7 (2019) 238. https://doi.org/10.5958/2320-608X.2019.00178.1.

[2] M.B.M.M.S. 4R, S.A. 2. Bhandari B, Jigsaw Method: An innovative way of cooperative learning in Physiology., Indian J Physiol Pharmacal 61 (2017) 315–321.

[3] S. Chatterjee, S. Naik, S. John, H. Dabholkar, M. Balaji, M. Koschorke, M. Varghese, R. Thara, H.A. Weiss, P. Williams, P. McCrone, V. Patel, G. Thornicroft, Effectiveness of a community-based intervention for people with schizophrenia and their caregivers in India (COPSI): a randomised controlled trial, The Lancet 383 (2014) 1385–1394. https://doi.org/10.1016/S0140-6736(13)62629-X.

[4] V. Uppal, N. Uppal, Flipped jigsaw activity as a small group peer-assisted teaching learning tool in Biochemistry Department among Indian Medical Graduate: An experimental study, Biochemistry and

Molecular Biology Education 48 (2020) 337–343. https://doi.org/10.1002/bmb.21355.
[5] K. Doymus, Teaching Chemical Equilibrium with the Jigsaw Technique, Res Sci Educ 38 (2008) 249–260. https://doi.org/10.1007/s11165-007-9047-8.
[6] N.H. Azmin, Effect of the Jigsaw-Based Cooperative Learning Method on Student Performance in the General Certificate of Education Advanced-Level Psychology: An Exploratory Brunei Case Study, International Education Studies 9 (2015) 91. https://doi.org/10.5539/ies.v9n1p91.
[7] A. S, S. V, Varatharajan Sakthivadivel, Role of JIGSAW method of teaching in improving clinical diagnosis among final year medical students – A prospective observational study, Asian J Med Sci 12 (2021).44–49. https://doi.org/10.3126/ajms.v12i12.39080.
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