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Jigsaw method as an effective co-operative learning method to understand biochemistry concepts for First year MBBS students

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ABSTRACT

The jigsaw technique is a method of cooperative learning which makes the students depend and help each other in acquiring knowledge. This technique divides the class into groups to work on small problems with the purpose of collaborating into a final outcome. Jigsaw method is simple, comfortable to adopt and easy to implement. Jigsaw method facilitates active learning without traditional lecturing. It is a peer teaching method as an attempt to shift from a teacher to the learner-centred paradigm. The main aim of the study is to develop cooperative learning by using of Jigsaw technique among the 1st year medical students for learning concepts of biochemistry. And to determine the effectiveness of the Jigsaw technique by post-assessment of their knowledge of biochemistry. A total of 100 medical students were recruited and their pre-knowledge on the concepts of biochemistry was assessed. The students were trained by using the Jigsaw technique and their post knowledge was assessed. In our present, around 28 students in the pretest scored below 60% marks and only 4 students in the post-test scored below 60%, indicating that there was a remarkable improvement in the scores of these students. And also 85 students scored above 80% marks. Jigsaw technique contribute to a better understanding of the concepts, facilitates active learning, problem-solving, improves analytical skills and logical thinking, enhances communication skills among students.

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INTRODUCTION

The jigsaw technique is a method of cooperative learning which makes the students depend and help each other in acquiring knowledge. This technique divides the class into groups to work on small

problems with the purpose of collaborating into a final outcome. Elliot Aronson was one of the early inventors of the jigsaw method. He explains that the jigsaw approach creates a cooperative classroom rather than a competitive one (Aronson *et al.*, 1978). Jigsaw method facilitates active learning without traditional lecturing (Woods, 2019). It is a peer teaching method as an attempt to shift from a teacher to a learner-centred paradigm. Jigsaw is a facilitative form of teaching that does not involve any lecturing. In the cooperative classroom (Moore-West *et al.*, 1990; Walker *et al.*, 2015; Kumar *et al.*, 2017), the students achieved success as a consequence of paying attention to their peers, asking good questions, helping each other, teaching each other (Aronson *et al.*, 1978). Peer teaching also promotes communication, teaching and leadership skills (Johnson, 2002; Krych *et al.*, 2005; Cate and Durning, 2007). The present study was done to

implement jigsaw technique as a cooperative learning technique among 1st-year MBBS students and to determine the effectiveness of Jigsaw technique by assessment of pre and post-test scores of their knowledge regarding biochemistry concepts.

MATERIALS AND METHODS

The present study was done among 1st MBBS students of the academic year 2019-20 at Department of Biochemistry, Apollo Medical College, Hyderabad, India, during the hours allotted for small group discussions (SGD).

Research design

The present study was a cross sectional study. Out of 100 students joined in the 1st year MBBS, 93 were present on the day of study and 7 were absent. Assessment of knowledge on biochemistry concepts was done by pre & post test using a questionnaire. The students were given liberty to participate in the study voluntarily.

Inclusion criteria

First year MBBS students, both male and female, between the age group of 18-21 years.

Exclusion criteria

1. First year MBBS Students who were not present on that day
2. 2nd,3rd,4th MBBS students and interns.

We have selected the topic glycogen storage disorders(GSDs) to teach the 1st year MBBS students by using the jigsaw technique. Six cases of different types of GSDs were prepared along with the objectives and were distributed to all the students one day prior to the jigsaw session. The students were divided into two batches and the study was conducted in two separate classrooms simultaneously for convenience. On the day of the Jigsaw session, the students pre-knowledge on GSDs was evaluated by pre-test, which includes 10 multiple-choice questions (Figure 1). The questions were about the different types, enzyme defects and clinical manifestations of GSDs. First, the students were divided into small groups of 6 individuals (i.e., jigsaw groups) (Figure 2). And each student in the jigsaw group was assigned to one case. The students were allowed to read about the case for 10 minutes so that they will become familiar with their topic. Now they form a small group of other students who have the same topic (i.e., expert groups) for 10 minutes (Figure 2). The students in the expert group can discuss the key points amongst themselves and clarify their

understanding of the concepts regarding the common case given to them. Then they were instructed to go back to their jigsaw groups to present their case. By this time each one of the student in the jigsaw group has knowledge about one case and each one of the six cases were discussed by a peer to all other members of jigsaw group over a period of 30 minutes. The teacher acts as a facilitator and will ensure the participation of all the students creating a positive, comfortable environment. After completion of the discussion, the student's knowledge was again assessed answering the by post-test.

Table 1: Number of students and marks obtained in Pre and Post test

Marks	Number of students obtained in pre test	Number of students obtained in post test
1	1	0
2	2	0
3	4	0
4	4	0
5	5	4
6	12	0
7	11	4
8	15	10
9	22	20
10	17	55

Table 2: Comparison of means and SD of pre and post test scores

	Pre-test	Post test	P-value
mean	7.473	9.225	<0.0001
SD	2.21	2.23	

Statistical analysis

The mean and standard deviation of the pre and post-test scores were calculated. The statistical significance between the pre and post-test means were calculated by Paired t-tests. A p-value less than or equal to 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Out of 100 students,93 were present for the study. Out of them, 42% male and 49% were females (response rate 93%). The scores obtained by the number of students were shown in Table 1 and Graph 1. The highest scores obtained in the pre-test were 10, and the lowest were 1. Similarly, the top scores achieved by the students in post-test were 10 and lowest scores were 5. Only 4 students scored

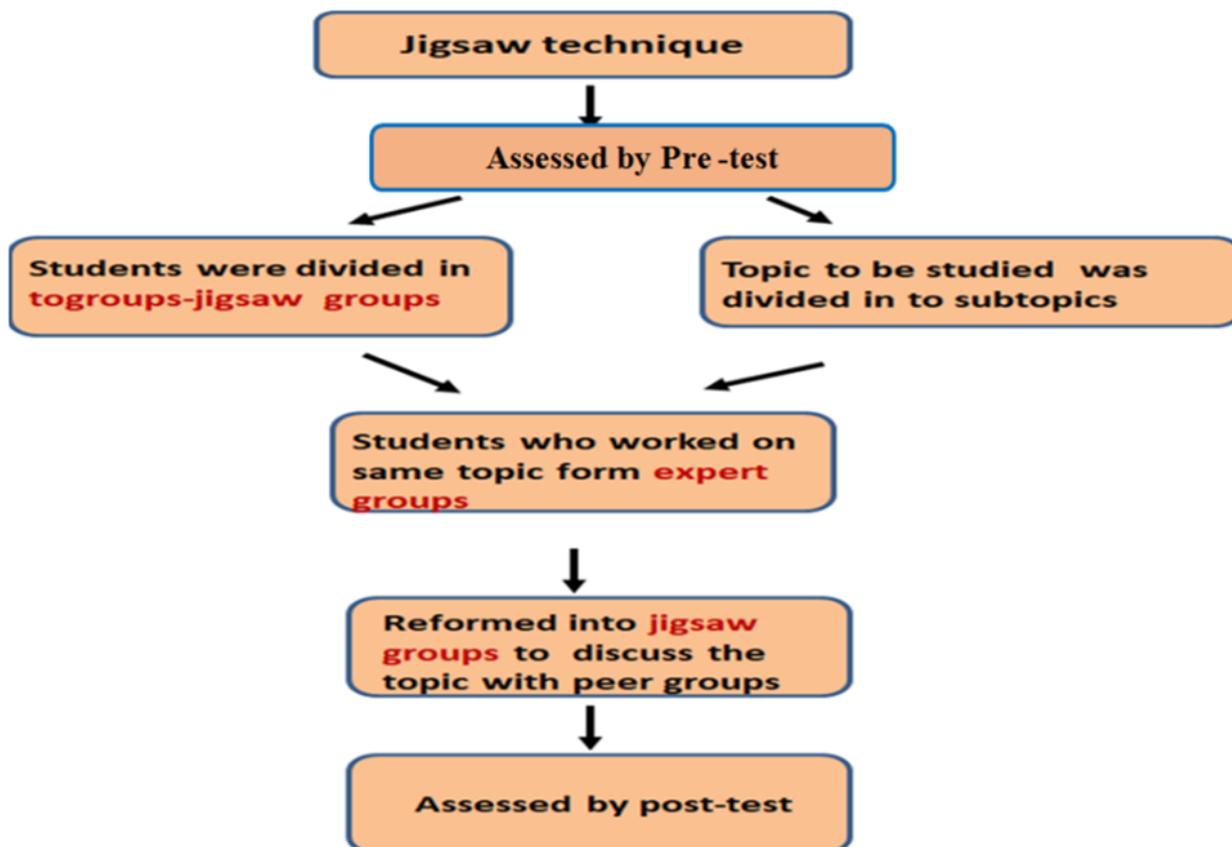


Figure 1: Description of the Jigsaw technique

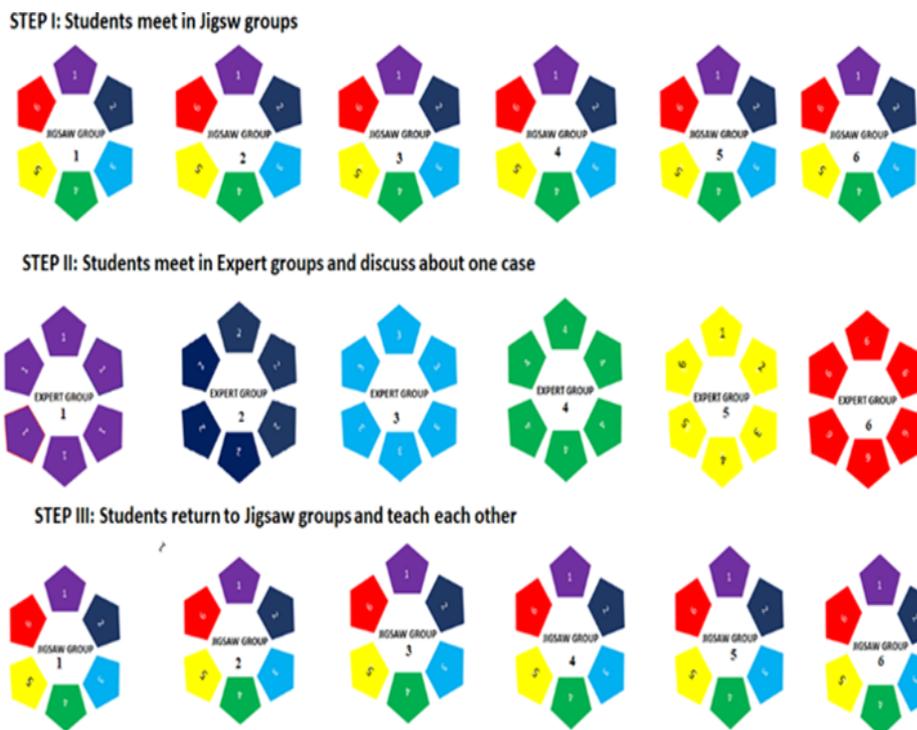
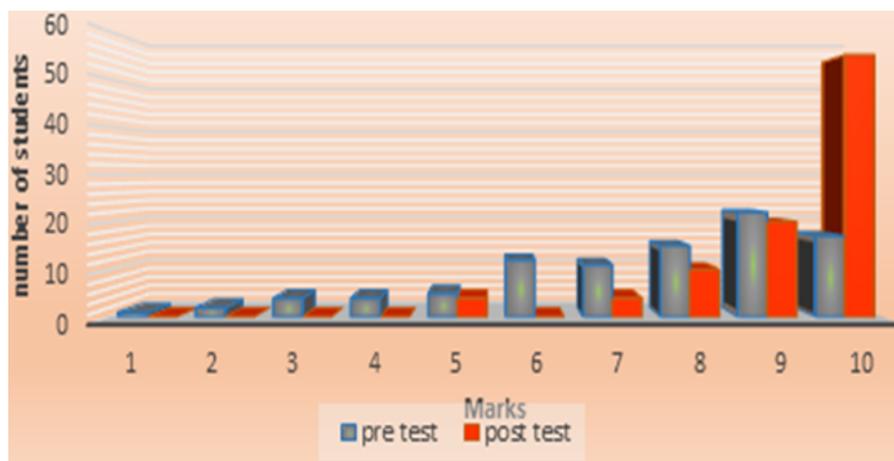
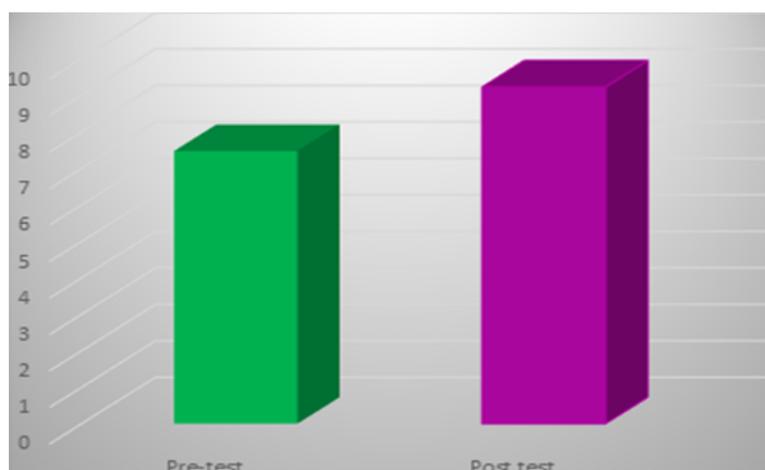


Figure 2: Jigsaw Diagram



Graph 1: Number of the students and marks obtained in Pretest and Post test



Graph 2: Comparison of means of Pre and Post test scores

less than 6/10 (60%) marks and more than 85 students scored 8/10 (85%) (Table 1 and Graph 1). The Pre test mean and SD were 7.473 ± 2.21 and the post test mean and SD were 9.225 ± 1.23 . There was a significant increase in the mean values of post – test compared to the mean values of pre – test $P \leq 0.0001$ (Table 2 and Graph 2).

In cooperative learning, students help each other and work together for a common goal. As it is based on teamwork and the groups involve high and low performers, it is the responsibility of each student of the group to ensure that all the other students of the group become thorough about the concepts discussed in expert groups (Melinamani *et al.*, 2017). Teacher, who plays the role of facilitator, should be cautioned that cooperative learning must be monitored appropriately, focusing on interdependence among group member (Melinamani *et al.*, 2017). The present study was done to witness the Jigsaw technique as an effective way of cooperative learning method. In our present study around 28 stu-

dents in the pretest scored below 60% marks and only 4 students in the post test scored below 60%, indicating that there was a remarkable improvement in the scores of these students. This shows that by using the Jigsaw technique, the below average students could pick up the biochemistry concepts easily. At the same time, there was also an increase in the number of students who obtained more than 80% marks as 85 students scored above 8/10 (80%) marks. Out of these 85 students, 55 participants scored 10/10 (100%). It gives an idea that there was an enhancement in the efficiency of more number of students also. In our study, there was a significant increase in the means of post test scores compared to pre test scores ($P < 0.0001$). In some of the studies done on dental and medical students, it was observed that there was no difference in traditional lecture based and jigsaw method in pre and post test scores (Sagsoz *et al.*, 2017; Puppalwar and Jambhulkar, 2019). A study on nursing students also demonstrated a significant difference in pre and post test means (Nusrath *et al.*, 2019). Similar

studies done on medical students to teach anatomy, biochemistry and microbiology also showed a better understanding of the topics (Kapila et al., 2017; Gupta et al., 2019; Swathi and Rajkumar, 2017). In another study conducted on residents regarding the knowledge of otitis media, there was an increase in the pre- to post-session exam scores. This shows that the Jigsaw technique is an effective way of peer group learning method to teach medical students.

CONCLUSION

Jigsaw technique can contribute to a better understanding of the concepts, problem-solving, improves analytical skills and logical thinking, enhances communication skills, develops positive approach makes learning easy for the students. Jigsaw technique was helpful for the students to understand the competencies of biochemistry.

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Conflict of Interest

There are no conflicts of interest.

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