

Jigsaw technique – A novel method of teaching biochemistry to medical undergraduates

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ABSTRACT

Background: Cooperative learning is a method of education in which the learner is responsible not only for his learning but also for the learning of others. The jigsaw strategy is an efficient way to learn the course material in a cooperative learning style. **Objectives:** The objectives of the study were (1) to compare jigsaw learning technique with traditional teaching in medical undergraduates for teaching biochemistry. (2) To assess the gain in knowledge by students by both the techniques. **Materials and Methods:** It was a Quasi-experimental study. Of 150 first MBBS students, thirty six were randomly assigned to the jigsaw group and rest were treated as control group. A pre-test was administered to both the groups. The study group was taught by jigsaw technique for 4 weeks. At the same time, control group received traditional teaching. Post-test was administered to both the groups 2 weeks after the completion of the study. **Results:** Both the groups scored significantly high in post-test as compared to pre-test. No difference was found in pre-test scores of two groups. Post-test scores of jigsaw group were significantly more than that of the traditional method group. **Conclusion:** Jigsaw method is more effective than traditional method for teaching biochemistry to medical undergraduates.

KEY WORDS: Jigsaw; Traditional; Medical; Metabolic; Biochemistry

INTRODUCTION

There has been a shift in medical education, from passive teacher centred learning to active student centred learning.^[1,2]


Cooperative learning is the greatest innovation in education. In this students learn within small groups with a common aim to be fulfilled by discussing and cooperating with their peers. In this way each student is responsible for learning of his own along with all the group members.^[3-7]

One of the methods in cooperative learning is Jigsaw [Figure 1].

The Jigsaw method helps the students to learn effectively in a cooperative environment. As students work together in a group, Jigsaw encourages development of basic skills like listening and Empathy amongst the students.^[8] Jigsaw process requires equal contribution in academic activity from each member of the group. Thus one succeeds when the group succeeds.

The prevalence of communicable as well as non-communicable diseases is rapidly increasing in the developing nations. According to WHO, metabolic syndrome is an aggregate of different metabolic abnormalities which has become a worldwide epidemic. With nearly 45 million coronary heart disease (CHD) patients and about 50.8 million diabetics in the country, it is being projected that in the near future, India will have the largest number of cardiovascular disease burden in the world.^[9]

The purpose of this study was to determine the effectiveness of the Jigsaw technique while comparing it with the traditional

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Figure 1: Jigsaw puzzle

lecture-based learning of Metabolic syndrome in first MBBS students.

Specific Objectives

The specific objectives of the study were as follows:

1. To compare jigsaw learning technique with traditional teaching in medical undergraduates for teaching biochemistry
2. To assess the gain in knowledge by students by both the techniques.

MATERIALS AND METHODS

Study Design

Quasi-experimental study was carried out in Shri Vasant Naik Government Medical College, Yavatmal, MH, India.

Institutional Ethical Committee (IEC) and Consent

IEC approval was obtained. Voluntary participation of students was sought and written informed consent was obtained.

Study Procedure

Of 150 1st year MBBS students, 36 students by systematic random sampling method were allocated to the jigsaw group and rest students to the control group. Specific learning objectives for teaching metabolic syndrome were framed and approved by subject experts. Learning objectives for study group and control group were kept same. Pre-test/post-test questionnaires on metabolic syndrome were designed and validated by subject experts.

The study was carried out for 4 weeks (2 h in each week). The pre-test was given to both the groups. The study group was taught by jigsaw technique and control group by routine didactic lecture for same hours at the same time. Each week activities for jigsaw group were as follows.

1st week

Jigsaw group students were randomly allocated to 6 main groups named as M, E, T, A, B, and O. Each group consisted of 6 members. Students were randomly number coded as 1–6 in each group (e.g., for M group it was M1, M2, M3, M4, M5, and M6).

Main groups presented in puzzle form. Each student in the main group was allotted one subtopic and study material was provided. Students with the same number code in main groups were allotted the same subtopic [Figure 2].

Expert groups presented in puzzle form as per Figure 3. Students with the same number code were grouped as expert group.

2nd week

Students with the same number code were categorized as the expert groups (e.g.: M1, E1, T1, A1, B1, O1, and formed one expert group).

Topics assigned to the expert groups were as follows:

- M1, E1, T1, A1, B1, and O1: Epidemiology of metabolic syndrome
- M2, E2, T2, A2, B2, and O2: Underlying risk factors and metabolic syndrome
- M3, E3, T3, A3, B3, and O3: Pathophysiology of metabolic syndrome
- M4, E4, T4, A4, B4, and O4: Diagnostic criteria of metabolic syndrome
- M5, E5, T5, A5, B5, and O5: Biochemical investigations in metabolic syndrome
- M6, E6, T6, A6, B6, and O6: Consequences of metabolic syndrome and treatment.

Students in expert groups discussed their topics interactively; this was followed by a brief presentation by all the six expert groups, on their respective subtopics. Expert groups presented their topics using self-made charts and powerpoint presentations and role plays [Figures 4 and 5].

3rd week

Students returned to their main groups and taught the respective subtopics to the other members of main group.

4th week

All main groups were given clinical scenarios which were discussed by students in their group and then with the group teacher. During these 4 weeks, the teacher served as the facilitator for the students and answered their queries.

In the traditional group, the topics were taught by didactic lecture and the case-based scenarios were discussed through lectures. The post-test was conducted 2 weeks after the completion of the study for both the groups.

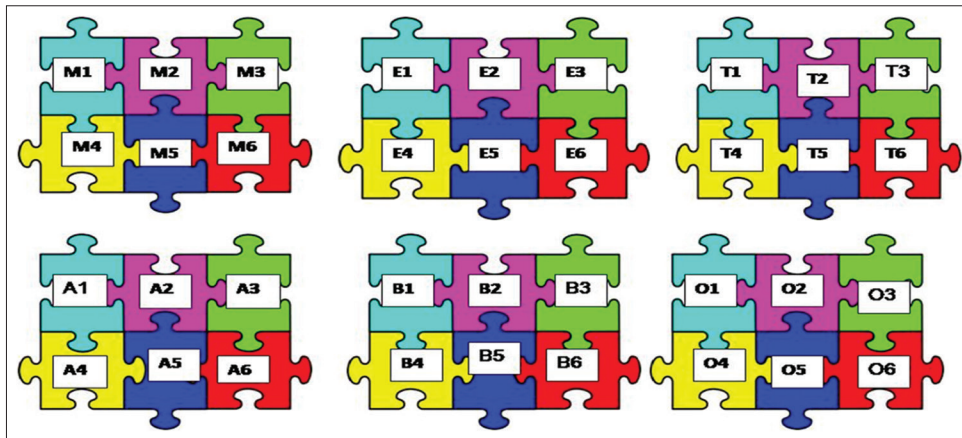


Figure 2: Main groups presented in puzzle form

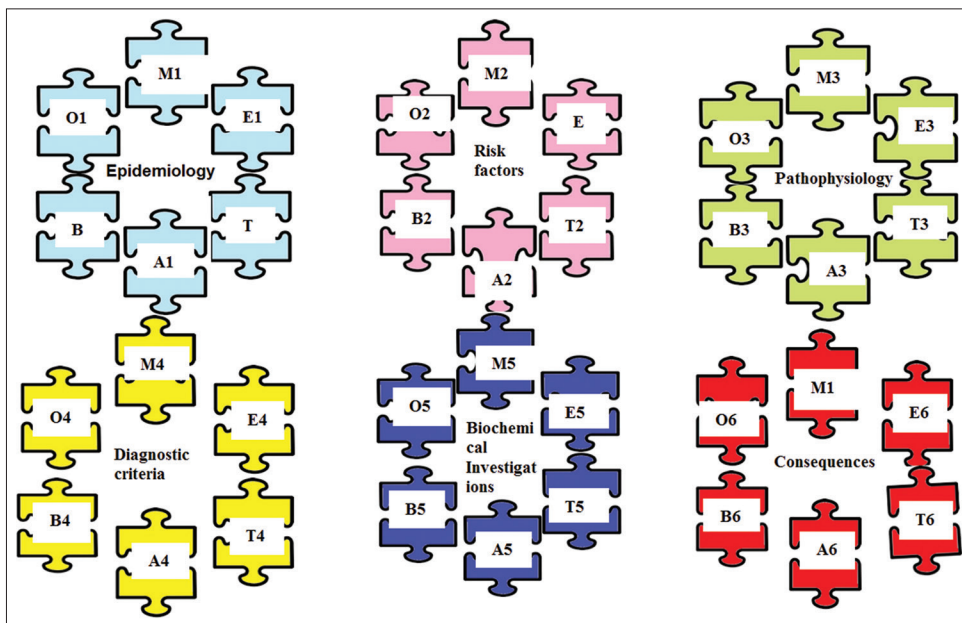


Figure 3: Puzzle form for expert groups

For ethical reasons, the traditional group was also exposed to cooperative learning method after post-test.

RESULTS

Paired *t*-test shows both jigsaw and traditional groups scored statistically high in post-test than pre-test [Table 1].

Independent *t*-test comparing the scores of jigsaw and the traditional group was carried out. In pre-test, there was no significant difference in scores of traditional and jigsaw group [Table 2]. Jigsaw group scored significantly more in the post-test as compared to traditional group.

Paired *t*-test showed post-test scores in jigsaw and traditional group to be highly significant than pre-test.

Unpaired *t*-test showed no difference between pre-test of jigsaw and traditional group. Jigsaw group scored significantly more in the post-test than traditional group.

DISCUSSION

Medical council of India has introduced Competency based undergraduate curriculum for the Indian Medical graduate from 2019, in which it has emphasized on Self directed learning, ATCOM and Early clinical exposure (Medical Council of India 2018). Present study focused on, incorporating all these methods of competency based medical education by using, Jigsaw technique of cooperative learning method for teaching metabolic syndrome, to first year MBBS students. In this study, both Jigsaw and traditional groups scored statistically high in post-test than pre-test. Jigsaw group scored significantly more in post-test as compared to traditional group.

The results of present study are in accordance with Sagsoz *et al.*^[10] who reported no difference in Jigsaw and traditional lecture in pre and post-test scores. Prashanti *et al.* reported that post-test revealed significant difference between the two groups as students in the experimental group enjoyed greater



Figure 5: Expert groups presenting their subtopic



Figure 4: Students studying in expert group

success by helping each other, as well as a greater exchange of information, than they had experienced in traditional teacher centred lectures.^[11]

Bertucci *et al.*^[12] reported that cooperative learning promoted higher achievement and greater academic support from peers than did individualistic learning. Sanie *et al.* reported that the Jigsaw technique helped in improving nursing students, self regulated learning and academic motivation.^[13] Bogam *et al.*^[14] have mentioned that Jigsaw methodology can make significant gain of knowledge in medical students regarding Diabetes Mellitus type-2.

Walker *et al.*^[15] reported that jigsaw method of peer teaching is an educational and enjoyable way to teach.

Strength of Study

Jigsaw gives each student the opportunity to teach their subtopic to their peers in small group. From students point of view, more than 50 % of students felt that they enjoyed Jigsaw, as they had an opportunity to hear others view points about the topic, which made the learning interesting.

Limitations

Long term retention was not tested.

Table 1: Pre-test versus post-test comparison within the groups

Groups	Pre-test mean (SD)	Post-test mean (SD)	P-value
Jigsaw group	1.69444 (0.8558)	4.4722 (1.3624)	<0.0001
Traditional group	1.66666 (0.95618)	3.2777 (1.7665)	<0.0001

SD: Standard deviation

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

Groups	Pre-test mean+(SD)	P-value	Post-test mean+(SD)	P-value
Jigsaw group	1.69444 (0.8558)	0.8970	4.4722 (1.3624)	0.002
Traditional group	1.66666 (0.95618)		3.2777 (1.7665)	

SD: Standard deviation

CONCLUSION

Jigsaw technique of teaching is more effective than traditional method of teaching Biochemistry to Undergraduates. Teaching Biochemistry through Jigsaw can make the subject more interesting as compared to traditional teaching.

REFERENCES

- Kalra R, Modi JN, Vyas R. Involving postgraduate's students in undergraduate small group teaching promotes active learning in both. *Int J Appl Basic Med Res* 2015;5:S14-7.
- Doymus K. Teaching chemical equilibrium with the jigsaw. *Res Sci Educ* 2008;38:246-60.
- Shabani H. Educational Skills (Methods and Techniques of Teaching). Tehran: Samt Press; 2014. p. 347-62.
- Gillies RM. The effects of cooperative learning on junior high school students during small group learning. *Learn Instr* 2004;14:197-213.
- Johnson DW, Johnson RT, Stanne MB. Cooperative Learning Methods: A Meta-analysis; 2000. Available from: <https://www.researchgate.net>. [Last accessed on 2019 Aug 01].
- Sharan Y. Cooperative learning for academic and social gains: Valued pedagogy, problematic practice. *Eur J Educ* 2010;45:300-13.
- Zakari E, Iksan Z. Promoting cooperative learning in science and mathematics education: A Malaysian perspective. *Eur J Math Sci Technol Educ* 2007;3:35-9.
- Schreyer Institute for Teaching Excellence, Penn State, 301 Rider Building II University Park, PA 16802. Available from: <http://www.schreyerinstitute.psu.edu>. [Last accessed on 2019 Jul 15].
- Available from: <http://www.neocardiabcare.com/what-WHO-says.htm>. [Last accessed on 2015 Jul 10].
- Sagsoz O, Karatas O, Turel V, Yildiz M, Kaya E. Effectiveness of jigsaw learning compared to lecture-based learning in dental

- education. *Eur J Dent Educ* 2017;21:28-32.
11. Eachempati P, Kumar KS, Ismail A. Cooperative Learning through Jigsaw Classroom Technique for Designing Cast Partial Dentures a Comparative Study. United Kingdom: MedEd Publish; 2017.
 12. Bertucci A, Johnson DW, Johnson RT. Influence of group processing on achievement and perception of social and academic support in elementary inexperienced cooperative learning groups. *J Educ Res* 2012;105:329-35.
 13. Sanaie N, Vasli P, Sedighi L, Sadeghi B. Comparing the effect of lecture and jigsaw teaching strategies on the nursing students' self-regulated learning and academic motivation: A quasi-experimental study. *Nurse Educ Today* 2019;79:35-40.
 14. Bogam RR, Khan AS. Jig saw technique: An interactive approach to sensitize medical students in Saudi Arabia about Type 2 diabetes mellitus. *J Educ Technol Health Sci* 2016;3:107-10.
 15. Walker S, Olvet DM, Chandran L. The Jigsaw Technique of Peer Teaching and Learning: An Efficient and Enjoyable Teaching Strategy in Medicine. Vol. 6. United Kingdom: MedEd Publish; 2015. p. 14.

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