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INTRODUCTION AND EVALUATION OF JIGSAW METHOD OF LEARNING FOR UNDERGRADUATE STUDENTS

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Abstract

Background - There has been a shift in medical education, from passive teacher centered learning to active student centered learning. The 'SPICES' model of medical curriculum recommend a paradigm shift from teacher centered to student-centered learning. Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. The Jigsaw method is a form of cooperative learning, in which students are actively involved in the teaching-learning process. **Aim & Objectives**: To introduce active learning methodology, i.e. "Jigsaw Technique" in undergraduate medical education in Community Medicine and assess the effectiveness and student's perception to it. **Methodology**: Undergraduate medical students of second years MBBS having clinical posting in the department of Community Medicine were study participants. Brief introduction was given to the students and faculty for the Active Learning methods (ALM) and they were sensitized to jigsaw technique which is one of the important methods of ALM by video presentations and pictures. Intervention in the form of "Jigsaw" as teaching learning method was introduced. The pretest and post-test were conducted and feedback was collected from the students. **Results**: Paired *t*-test showed post-test scores in jigsaw and traditional small 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. The feedback from the students revealed that the Jigsaw method is a healthy way of interacting with peers, making learning interesting & effective. Majority were found the method very helpful, interesting, and motivating, having the opinion that all the major topics should be taught by this method. **Conclusion**: Traditional method of teaching learning needs to be complemented by interactive method like Jigsaw to facilitate learning among medical students. Active teaching methods are emphasized in new curriculums in which students play the main role in learning. Jigsaw is one of the most important teaching methods. It improves teamwork and interpersonal communication, thinking, and problem-solving skills. Jigsaw technique of teaching is more effective than traditional method of teaching Community Medicine to Undergraduates.

Keywords: Jigsaw technique of teaching, Active Learning methods (ALM), undergraduate students, Interactive teaching.

Introduction: There has been a shift in medical education, from passive teacher centered learning to active student centered learning.[1,2] The 'SPICES' model of medical curriculum recommends a paradigm shift from teacher centered to student-centered learning.[3] The Medical Council of India (Vision 2015) also emphasizes self-directed learning and encourages learner centric approaches. Active engagement of learners has shown to improve long-term retention of acquired knowledge.[4] Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning.[5] The Jigsaw method is a form of cooperative learning, in which students are actively involved in the teaching-learning process.[6,7] The jigsaw classroom is a research based cooperative learning technique invented and developed in the early 1978s by Aronson *et al.* at the University of Texas and the University of California, as in a jigsaw puzzle, each piece, each student's part is essential for the completion and full understanding of the final product[8,9] Jigsaw technique is a form of cooperative and collaborative learning strategy which is extensively used in all levels of education. It allows students to actively participate in learning process. The Jigsaw technique is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the jigsaw puzzle.[10]

Aim: To introduce active learning methodology i.e "Jigsaw Technique" in undergraduate medical education and assess the student and faculty response to it.

Objectives: (I)To conduct jigsaw method on challenging topics of Community Medicine for second year students.(II) To train the faculty for jigsaw method. (III) To compare the performance of II MBBS students using jigsaw and traditional small group teaching. (IV) To obtain the students perception for this newer teaching methodology in Community Medicine.

Methodology: Study design: Experiential interventional design (Kirkpatrick level -2), **Place of study**: MG medical College, Jaipur. **Study participants**: phase II undergraduate medical students, **Ethical consideration**: Approval from institutional ethics committee was taken. Data collected from the students who were given consent. Data collected was unlinked and anonymous. **Sample size**: Phase II MBBS students having clinical posting in Community Medicine (n=32). **Data collection tool**: Was done with the help of structured questionnaire and likert's scale after piloting. **Inclusion criteria:** All phase II medical students having clinical posting in Community Medicine and all the faculties of Community Medicine Department. **Exclusion criteria**: Nil

Method of data collection: Undergraduate medical students of the second years, have one month clinical posting in the department of Community Medicine were the study participants. Students posted for the month of September 2021 was allocated to the jigsaw group (group2) and students posted in the month of October 2021, to the control group (group1). Brief interaction was held with the students for the introduction to Active Learning methods (ALM) and students were sensitized to Jigsaw technique which is one of the important methods of ALM by video presentations and pictures. A verbal consent was taken from the students.

Then the sensitization session with the faculty members of Department of Community Medicine was held, wherein the faculty was introduced to the concept of ALM and the proposed student intervention, i.e., jigsaw technique through video presentation and pictures.

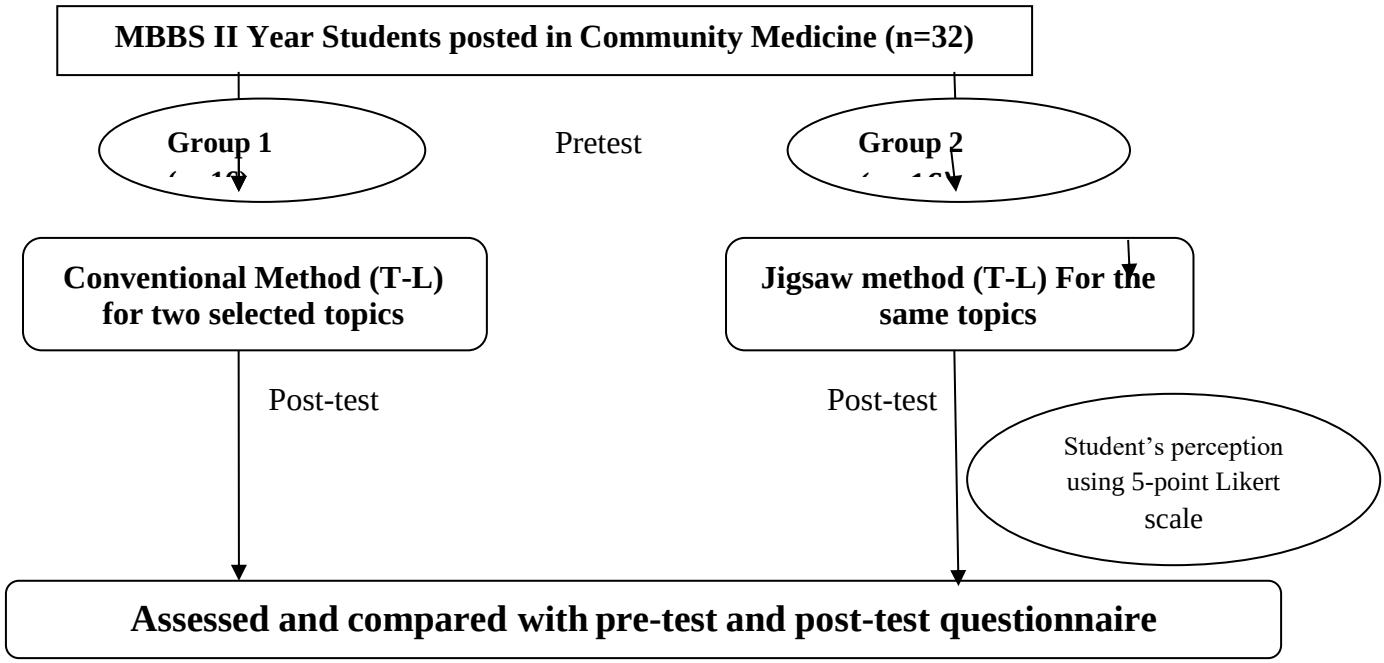
Pretest, posttest questionnaire in the form of MCQs with the help of subject expert were made and feedback forms for the students were designed and validated.

Specific learning objectives for teaching of two challenging topics of Community Medicine were framed. Two topics chosen (for two sessions) for study were one is "Hospital acquired infections and Universal precautions" and the second topic was "Immunization and Cold chain equipments". Learning objectives for study group and control group were kept same.

For Jigsaw teaching we made 4 groups of students (16 students posted for clinical posting), as Home group (each of 4 students). Specific name was given to each of the group (Group A, B, C and D). One student from each individual home group was taken to form different Expert groups. Topics chosen for applying for the Jigsaw teaching were divided into sub topics. Each expert group were assigned with one facilitator and taught one subtopic in detail using appropriate teaching learning tools, also instructions were given to the students of expert group

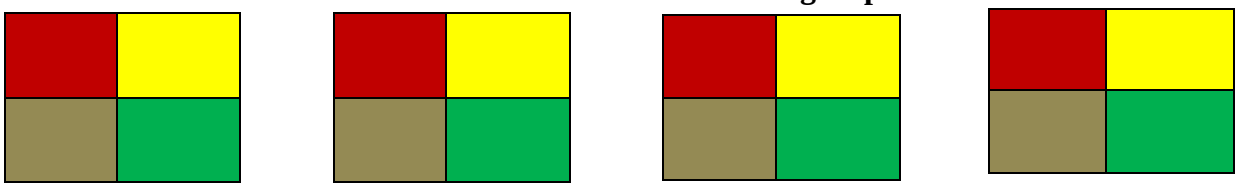
to refine their knowledge about the given subtopic using all the available resources and clearing their doubts, if any, from the facilitator. The expert group then returns to their home group and explained & presented their subtopic and helps the peers to understand the topic with the help of available resources. In the control group, the topics were taught by small group traditional teaching method. Both the groups were instructed to fill pre-test questionnaire prior to session (annexure 1).
After completion of the study protocol, students' in-depth understanding regarding these topics was judged by post-test questionnaire. The students were asked to provide their feedback through administration of a pre-validated questionnaire in the form of Likkert's scale (annexure 2).
Statistical analysis: The data was entered in 'Microsoft Office Excel Sheet' and pre and post test scores were statistically analysed by using 'Paired t test' within the group and 'Independent *t*-test' applied to compare pre and post test scores between the groups. A feedback with a five point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) was taken from the students in the form of questionnaire to record their experiences, perception, and attitude about the ALM (jigsaw).

Flowchart depicting the methodology



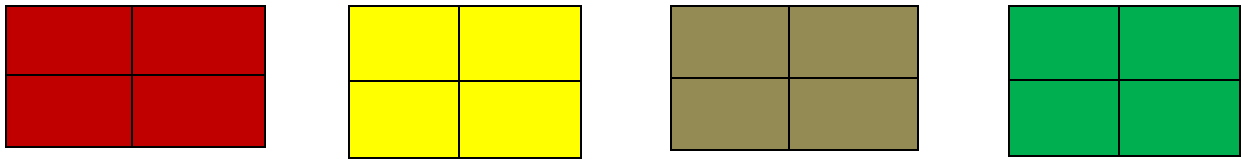
Jigsaw co-operative learning strategy

Phase 1: Students meet in Home group



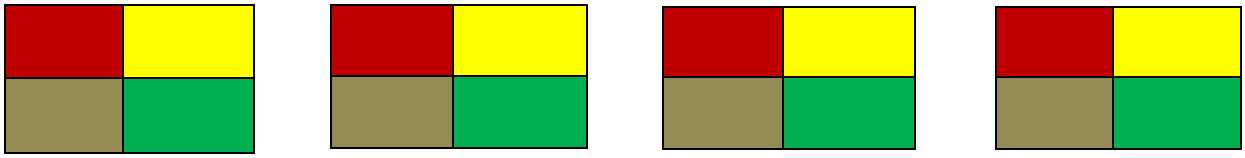
Home group1 **Home group2** **Home group3** **Home group4**

Phase 2: Students meet in Expert group



Expert group1 **Expert group2** **Expert group3** **Expert group4**

Phase 3: Students return to home group to discuss with each other



Home group1 **Home group2** **Home group3** **Home group4**

Results:

Table 1: Comparison of scores of both sessions of Traditional small group teaching

		N	Mean	SD	t	P -value
Session 1	Pre Test	16	2.56	0.82	33.6	$p < .001.$
	Post Test	16	12.18	1.55		
Session 2	Pre Test	16	2.25	1	38.3	$p < .001.$
	Post Test	16	12.56	1.36		

In small group teaching, the pre-test score in sessions 1 and sessions 2 was 2.56 and 2.25 with standard deviation of 0.82 and 1 respectively. The post test scores in session 1 and 2 were 12.18 and 12.56 with standard deviation of 1.55 and 1.36 respectively. On application of paired t test, there is highly statistically significant improvement in post test scores in comparison to pre test scores in both sessions 1 and 2 of traditional small group teaching [Table 1].

Table 2: Comparison of scores of both sessions of Jigsaw teaching

		N	Mean	SD	t	P -value
Session 1	Pre	16	2.93	0.77	30.5	$p < .001.$
	Post	16	15,75	1.34		
Session 2	Pre	16	2.62	0.72	38.3,	$p < .001.$
	Post	16	16.37	1.55		

In Jigsaw teaching, the pre-test score in sessions 1 and sessions 2 was 2.93 and 2.62 with standard deviation of 0.77 and 0.72 respectively. The post test scores in session 1 and 2 were 15.75 and 16.37 with standard deviation of 1.34 and 1.55 respectively. Paired t test shows that there is highly statistically significant improvement in post test scores in comparison to pre test scores in both sessions 1 and 2 of Jigsaw teaching [Table 2].

Table 3: Pre-test comparison between the groups

		N	Mean	SD	t	p
Session 1	group 1	16	2.56	0.82	1.33719	0.098
	group 2	16	2.93	0.77		
Session 2	group 1	16	2.25	1	1.45682	0.078
	group 2	16	2.62	0.72		

In small group teaching (group1), the pre-test score in sessions 1 and sessions 2 was 2.56 and 2.25 with standard deviation of 0.82 and 1 respectively. In Jigsaw teaching (group 2) the pre-test score in sessions 1 and sessions 2 was 2.93 and 2.62 with standard deviation of 0.77 and 0.72 respectively. Independent *t*-test comparing the scores of jigsaw and the traditional small group teaching was carried out. In pre-test, there was No significant difference in scores of traditional and jigsaw group [Table 3].

Table 4: post-test comparison between the groups

		N	Mean	SD	t	p
Session 1	group 1	16	12.18	1.55	6.9695	$p < .001.$
	group 2	16	15,75	1,34		
Session 2	group 1	16	12.56	1.36	7.4177	$p < .001.$
	group 2	16	16.37	1.55		

The post test scores in session 1 and 2 were 12.18 and 12.56 with standard deviation of 1.55 and 1.36 respectively in small group teaching (group1), The post test scores in session 1 and 2 were 15.75 and 16.37 with standard deviation of 1.34 and 1.55 respectively in Jigsaw group (group2). Independent *t*-test comparing the scores of jigsaw and the traditional small group teaching was carried out; Jigsaw group scored significantly more in the post-test than traditional group [Table 4].

Table 5: Perception of students towards Jigsaw

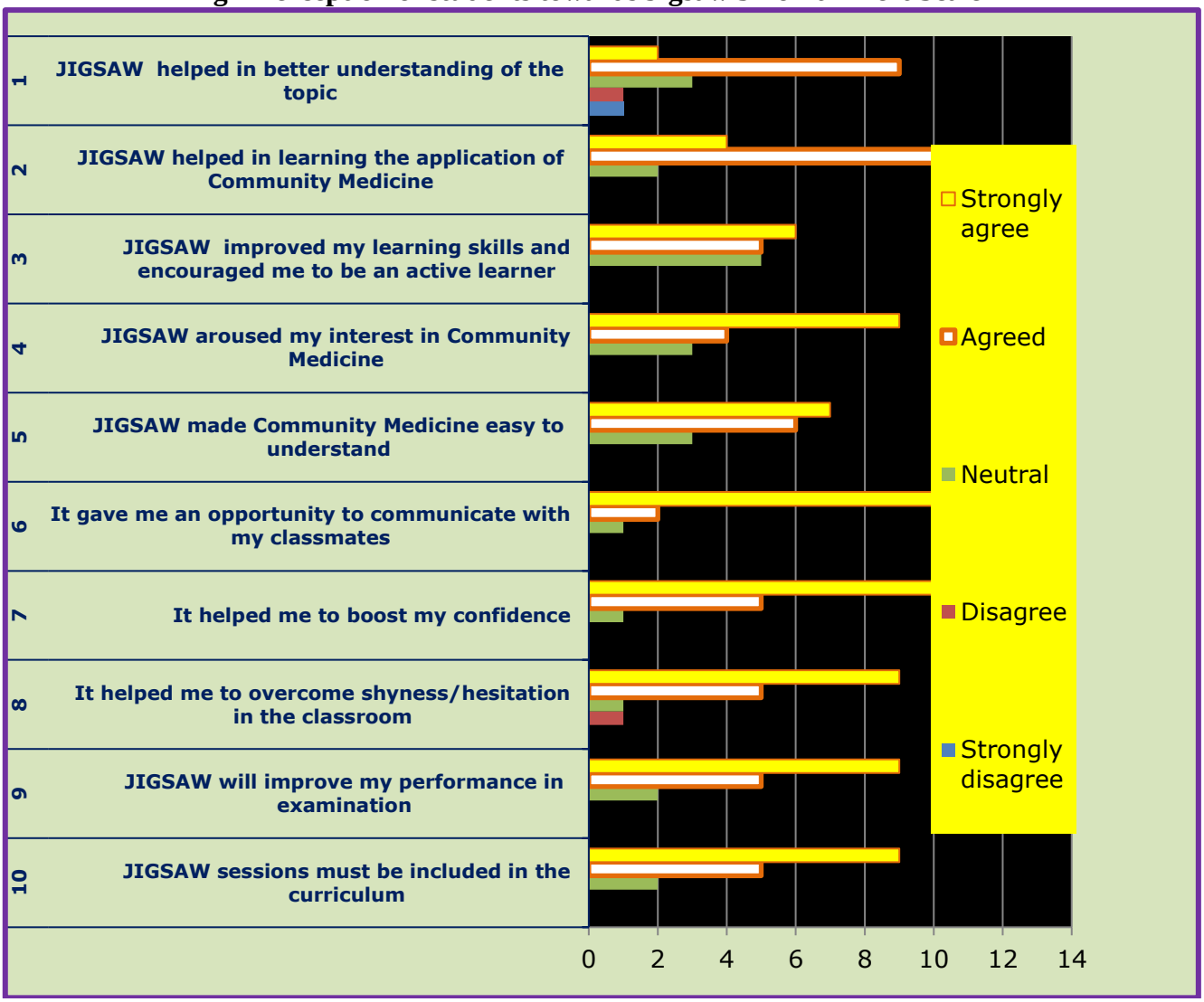
(5 Point Likert Scale with 5= strongly agree and 1 = strongly disagree)

Perception towards Jigsaw	Strongly Disagreed	Disagreed	Neutral	Agreed	Strongly Agreed
	1	2	3	4	5
1. Jigsaw helped in learning the application of Community Medicine	0 (0%)	0 (0%)	2 (12.5%)	10 (62.5%)	4 (25%)
2. Jigsaw helped in better understanding of the topic	1 (6.25%)	1 (6.25%)	2 (12.5%)	9 (56.25%)	2 (12.5%)
3. Jigsaw improved my learning skills and encouraged me to be an active learner	0 (0%)	0 (0%)	5 (31.25%)	5 (31.25%)	6 (37.5%)
4. JIGSAW aroused my interest in Community Medicine	0 (0%)	0 (0%)	3 (18.75%)	4 (25%)	9 (56.25%)
5. JIGSAW made Community Medicine easy to understand	0 (0%)	0 (0%)	3 (18.75%)	6 (37.5%)	7 (43.75%)
6. It gave me an opportunity to communicate with my classmates	0 (0%)	0 (0%)	1 (6.25%)	2 (12.5%)	13 (81.25%)
7. It helped me to boost my confidence	0 (0%)	0 (0%)	1 (6.25%)	5 (31.25%)	10 (62.5%)
8. It helped me to overcome shyness/hesitation in the classroom	0 (0%)	1 (6.25%)	1 (6.25%)	5 (31.25%)	9 (56.25%)
9. JIGSAW will improve my performance in examination	0 (0%)	0 (0%)	2 (12.5%)	5 (31.25%)	9 (56.25%)
10. JIGSAW sessions must be included in the curriculum	0 (0%)	0 (0%)	2 (12.5%)	5 (31.25%)	9 (56.25%)

After completion of the study protocol, the perception of students was assessed by taking a questionnaire based feedback on 5 point Likert Scale [Table 5]. 62.5 % students were agreed and 25% were strongly agreed that Jigsaw helped in learning the application of Community Medicine. Maximum i.e.56.25% students agreed that Jigsaw helped in better understanding of the topic, While 12.5% were neutral and only 6.25% students were disagree. 37.5% students strongly agreed that, Jigsaw improved their learning skills and encouraged them to be an active learner, while 31.5% were agree and neutral with the fact. 56.25% students were strongly accepts that Jigsaw aroused

their interest in Community Medicine and 43.75 % says Jigsaw made Community Medicine easy to understand.81.5% students strongly and 12.5% agreed that it gave them an opportunity to communicate with their classmates.62.5% students strongly agreed that It helped them to boost their confidence and helped them to overcome their shyness/hesitation in the classroom. More than 50% of the students strongly believe that Jigsaw will improve their performance in examination and Jigsaw sessions must be included in the curriculum. The study observed high satisfaction scores of students towards different aspects of learning the topic, on a five point Likert scale [Fig 1].

Fig 1 Perception of students towards Jigsaw 5 Point Likert Scale



Discussion: The primary objective of teaching in medical education is the development of clinical competency and training successful and empowered graduates with professional competency so that they can use knowledge for problem solving in their careers. MCI vision 2015 envisages that the Indian Medical Graduates will have the necessary competencies (Knowledge, Skills and Attitudes) to assume his or her role as health care providers. Hence the modifications have been made in the existing curricula to accommodate the aspirations of the defined goals, competencies and greater emphasis on cooperative learning. Present study focused on, incorporating Active Learning Methods (ALM) of competency based medical education by using, Jigsaw technique of cooperative learning method for teaching some of the topics of Community Medicine, to second year MBBS students It included Group discussion, Peer teaching and presentations of the learned topic, in front of their peers . 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 small group

teaching. This could be because jigsaw method allowed active learning with active participation of all the students, it ensured that all the subtopics were covered and in a sequential manner and the teacher as a facilitator addressed the queries whereas traditional small group teaching were engaging yet could not ensure involvement of all the students and coverage of all the subtopics thereby affecting the results.

The results of present study are in accordance with Prashanti *et al*. reported that post-test revealed significant difference between the two groups as students in the experimental group enjoyed greater success by helping each other, as well as a greater exchange of information, than they had experienced in traditional

teacher centered lectures.[11] Bertucci *et al*. reported that cooperative learning promoted higher achievement and greater academic support from peers than did individualistic learning.[12] Study by Swathi A et al[13] (2017) found that it helped students to develop interpersonal skills, positive attitude, self-confidence, logical thinking and ability in solving problems. However, time management and participation by only half the students are the challenges in implementing jigsaw. These findings too are comparable to our study findings in terms of developing communication skills and boosting self-confidence.

Study by Nagendra M (2017) found that the students enjoyed this experience; it helped them to overcome hesitation & shyness and enhance their cognitive skills. We too found the similar results in terms of the above parameter in the feedback received from the students[14]. According to Vinod kumar et al the evaluation of the Jigsaw method of teaching by Kirkpatrick evaluation framework suggests that Jigsaw is an effective teaching-learning tool and has an impact on the learning outcome among the students and is acceptable to them[15].

Conclusion: Today active teaching methods are emphasized in new curriculums in which students play the main role in learning. Jigsaw is one of the most important teaching methods. It improves teamwork and interpersonal communication, thinking, and problem-solving skills. In addition, it can promote learning among undergraduate students Jigsaw technique of teaching is more effective than traditional method of teaching Community Medicine to Undergraduates. Teaching Community Medicine through Jigsaw can make the subject more interesting as compared to traditional teaching

Further recommendations: More and more faculty should be trained to incorporate innovative and interactive teaching learning methods to teach medical education

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.

The jigsaw methods bring an effective education tool to the medical curriculum, allowing for peer discussion of a large amount of material in a short period of time. Furthermore, students are given the opportunity to become an "expert" in one of the areas and are challenged to teach their topic to other students who have no prior knowledge of that topic.

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