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ORIGINAL RESEARCH

Jigsaw Classroom: Perceptions of Students and Teachers

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Abstract

Background Various innovative teaching methods have been designed in an attempt to provide millennial students an interactive and stimulating learning environment. A jigsaw method is one such form of cooperative learning that enables students to develop critical-thinking and ability for effective communication and promotes positive student attitudes toward their own learning. The present study was thus undertaken to introduce a jigsaw-based cooperative learning method and to understand the perception of the students and faculty.

Methodology This was a cross-sectional study conducted among second year MBBS students. Students were randomly divided into 10 parent groups, with 10 students each. The topic was divided into 10 subtopics. Each student in the parent group was allotted a sub-topic. The students who were given the same sub-topic assembled to form an expert group. They interacted and discussed the subtopic. Students finally returned to their parent groups for peer teaching and presentation. A validated questionnaire was used to gather students and faculty feedback. Descriptive statistics were used to analyze responses to the Likert scale questions. Qualitative data was analyzed using thematic analysis.

Results The present study included 95 s year MBBS students. Majority (81%) students agreed that this teaching learning method enhanced their communication skills. Seventy-five percent of the students agreed that the activity helped in overcoming shyness and hesitation in the class. Overall the faculty also agreed that the jigsaw method was helpful for the students.

Conclusions Cooperative learning like jigsaw facilitates learning allowing student-student discussion, improving communication and teaching skills.

Keywords Jigsaw · Interactive teaching · Self-directed learning · Student-centered · Innovative teaching

Introduction

Medical learning is a complex process. According to the "Social Constructivism Theory" by Vygotsky, learning is significant when learners create basic knowledge by themselves through interaction, collaboration, and group work. As per Vygotsky, a lifelong process of development is dependent on social interaction and that social learning actually leads to cognitive development [1]. In the traditional lecture-based teaching format, the majority of interactions are teacher-centered. The students remain passive with minimal opportunities for students to work together and take responsibility for their learning outcomes [2]. Teaching and learning strategies are undergoing modifications. Medical educators are exploring more innovative approaches to teaching and learning so that medical graduates develop the key competencies to deliver socially responsive health care [3]. Many institutions have moved away from the traditional lecture-based strategies to explore more modern and possibly more effective approaches. Cooperative learning is one of the modern methods that have been used as an alternative to address the unique needs of millennial learners. Jigsaw learning is one such form of cooperative learning educational tool proposed by Aronson E et al. which is influenced by theory given by Vygotsky. This learning approach is based on constructivism focus on interactive learning [4], and is shown to enhance the motivation, communication skills, and performance of students and improve the social relationship between them [5]. In this, a group of students work in small groups with a set of learning objectives to reach a common goal [6]. The jigsaw technique (Fig. 1) involves dividing up parts of the topic or problem (like puzzle pieces). Subsequently, groups of students are assigned topics to become "experts" in one area of the problem and afterward teach the knowledge they have learned to peers in their group [6]. This student-centered cooperative learning approach enables students to work within their team in a mutually dependent manner; however,

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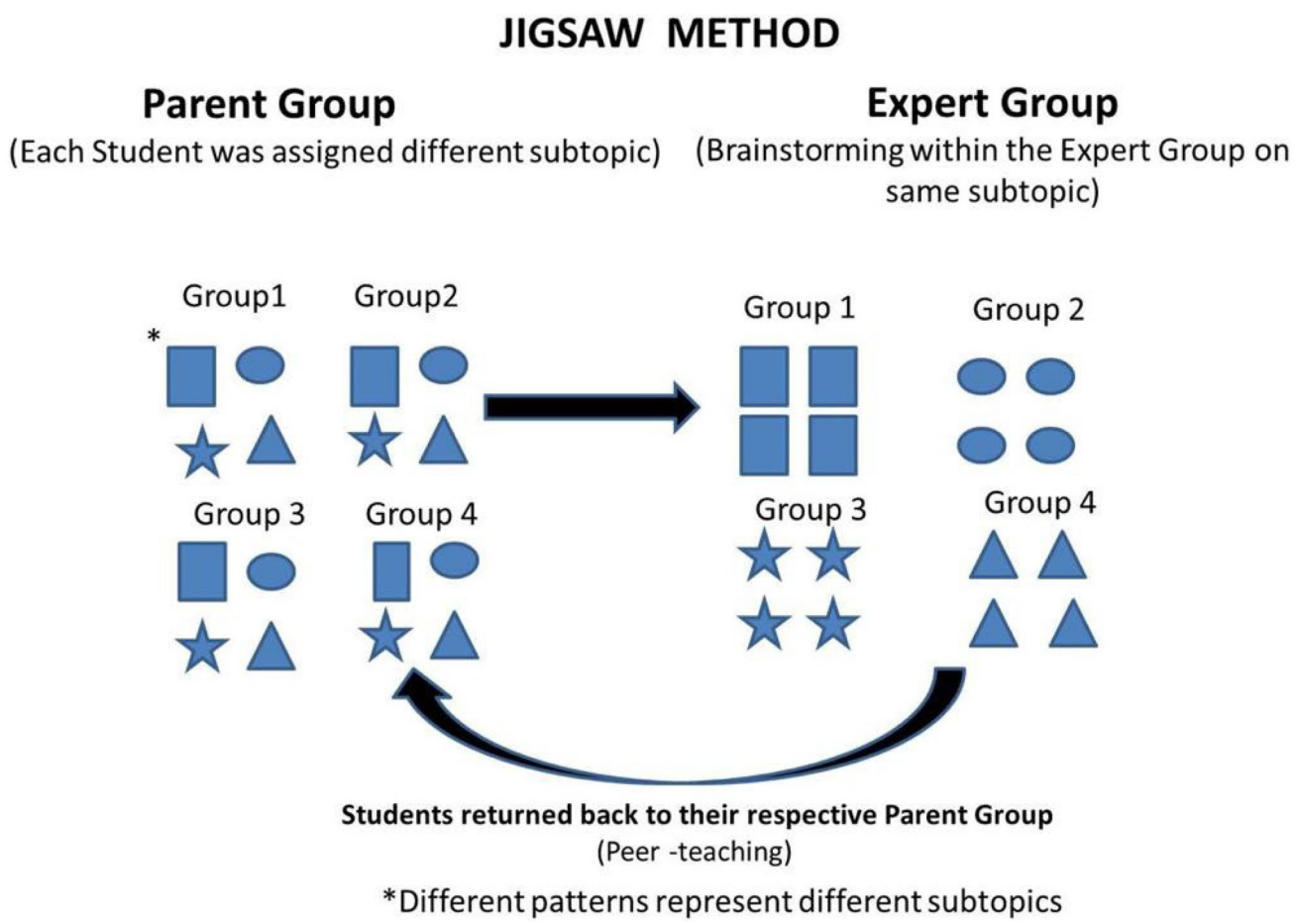

Fig. 1 The jigsaw method

each individual is held accountable for the content and peer teaching. Several authors have confirmed that when the focus shifts from the individual to the group, individual learning is enhanced, not diminished [4, 7]. It is a useful strategy that enables a group of learners to cover several topics simultaneously within a specified time period. The method focuses on fellow learners' cooperation, minimizes competitiveness in the learning environment, and improves teamwork and communication [6]. Although the jigsaw method has been used successfully in medical education, some studies report students' perceptions to be mixed; however, the data are limited [8]. The present study aimed to introduce a jigsaw-based cooperative learning method for teaching pharmacology and collect data regarding the perceptions of the students and faculty.

Methodology

The cross-sectional study was conducted in the Department of Pharmacology after obtaining clearance from the Institutional Ethics Committee (GIMS/IEC/HR/2021/09, dated 22-01-21). The study participants were Phase 2 MBBS students. The participants were assured that participation in the study was voluntary, and they were informed regarding the anonymity and confidentiality of their responses.

Faculty facilitators had a training session before the activity. The plan and objectives of the study were discussed before the study began. Facilitators then explained the process and the objectives of the Jigsaw technique to the students.

Four sessions were planned for the activity. The learning materials for the sessions were organized. The entire class was randomly divided into 10 home groups, or "parent groups," consisting of 10 students each. These groups were numbered "1 through 10." The topic selected for the activity was hypertension. The topic "Hypertension" was divided into ten sub-topics as follows:

1. Classification of hypertension, JNC guidelines for hypertension
2. Angiotensin Converting Enzyme inhibitors in Hypertension
3. Alpha blockers in Hypertension

4. Beta blockers in Hypertension
5. Calcium channel blockers in Hypertension
6. Central sympatholytics in Hypertension
7. Adrenergic Neuron Blockers in Hypertension
8. Diuretics in Hypertension
9. Vasodilators in Hypertension
10. Drugs used for treatment of hypertension in emergency/urgency and pregnancy

Each student in the home group was assigned one sub-topic. Each student then studied the content of his or her study material (session 1). In session 2 (60 min), learners split from their home groups to join members of other home groups who had been given the same sub-topics to form an "expert group." The expert group members worked together for an hour to discuss the key points among themselves and clarify their understanding of the concepts regarding the common topic. In session 3 (60 min), the students from the expert group rejoined their home group and provided a summary of the key points related to their content to other team members. Finally, in session 4 (120 min), one student from each home group was randomly selected and asked to present the given sub-topic. The peers were encouraged to ask questions. A previously validated and published questionnaire was used to take feedback from the students. It comprised both closed-ended and open-ended questions [9]. For closed-ended questions, responses were collected using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). The second part of the questionnaire consisted of three open-ended questions regarding the usefulness, hindering, and facilitatory factors of the jigsaw technique.

For obtaining faculty feedback, a predesigned questionnaire was identified through literature review [10]. The questionnaire was reviewed critically by the members of the medical education unit. Open feedback was used to modify and optimize the questionnaire. The questionnaire was then pilot tested. The final questionnaire comprised of 10 closed-ended questions and two open-ended questions. At the end of the session, clinical vignette-type multiple-choice question (MCQ)-based assessment was conducted to objectively support the positive outcome of the activity. There were a total of fifteen clinical vignette-type multiple-choice questions which covered all the sub-topics.

Statistical Analysis

Descriptive statistics were used and data were expressed as a percentage. Median scores were calculated for the responses to the Likert scale questions. Analysis of responses to the open-ended questions was conducted using thematic analysis. The student's responses were independently reviewed by two authors (DC, BB). The analysis process involved reading through all written responses and highlighting the main ideas in each phrase. The highlighted portions of the text were reviewed to develop codes that described the nature of their content. The codes were compared and after repeated discussions, the team reached a consensus over the codes. The final codes were organized under themes that summarized all the responses collected. These were then reviewed by all authors and finalized.

Observations and Results

In the present study, 95 of the 100 s year MBBS students enrolled participated in all sessions and responded to the feedback questionnaire yielding 95% response rate (mean age - 19.7 ± 1.3 years). Six faculty members participated in the activity.

Table 1 Students' responses to feedback questionnaire

Questions	Strongly disagree *n* (%)	Disagree *n* (%)	Neutral *n* (%)	Agree *n* (%)	Strongly agree *n* (%)	Median
The activity increased comprehension	3 (3.1)	6 (6.3)	20 (21.1)	51 (53.7)	15 (15.8)	4
The activity enabled in-depth coverage of topic	5 (5.3)	12 (12.6)	14 (14.7)	49 (51.6)	15 (15.8)	4
The activity helped in enhancing communication skills	4 (4.2)	1 (1.1)	9 (9.5)	57 (60)	24 (25.3)	4
A thorough discussion on the topic increased analytical ability	2 (2.1)	12 (12.6)	12 (12.6)	51 (53.7)	18 (18.9)	4
The activity helped in overcoming shyness and hesitation in the class	2 (2.1)	6 (6.3)	12 (12.6)	49 (51.6)	26 (27.6)	4
This form of exercise should be incorporated for all the topics in pharmacology	14 (14.7)	21 (22.1)	25 (26.3)	21 (22.1)	14 (14.7)	3
The activity ingrained teaching skills in the participants	0 (0)	6 (6.3)	13 (13.7)	56 (58.9)	20 (21.1)	4
You are confident that this knowledge could be applied in clinical practice	1 (1.1)	10 (10.5)	22 (23.2)	49 (51.6)	13 (13.7)	4
The exercise was enjoyable	1 (1.1)	12 (12.6)	15 (15.8)	46 (48.4)	21 (22.1)	4
This is an effective way of learning	4 (4.2)	15 (15.8)	16 (16.8)	45 (47.4)	15 (15.8)	4

Table 2 Students' responses to open ended questions

Questions	Codes	Themes	Representative comments
Jigsaw is useful to you	Better comprehension & retention Innovative way Improved communication skills Improved confidence Collaborative learning	Innovative way improving understanding, retention of concepts, Interpersonal Skills	"It helps in better understanding and retention of the pharmacological concepts" "Improved my concepts" "It was a very creative way" "It helps to overcome the fear of speaking in front of others" "It is somewhat useful, friends explain in their own language so we understood" "It helped me to build team efforts because everyone tried his or her best to understand his topic and put maximum efforts to make others understand" "Teaching my friends built my confidence and cleared concepts" "Teaching someone makes me remember the topic well"
What were the hindering factors during the activity	Time consuming Group organization Uninterested students	Time Constraint, group arrangement and Students Hesitancy as hindering factors	"A bit time consuming" "There were a little bit problems arranging the groups" "Some students were absent" "Not All were interested in participation actively so it was a bit uncomfortable" "Lack of interest in some students"
What were the factors that facilitated learning during the activity	Peer teaching Active discussion	Active participation facilitated learning	"When we teach someone, we are stimulated and learning is enhanced" "We had to read and then explain to other. I find this more effective" "Peers encourage and motivate the other during the process" "It was fun to discuss the topic in group"

Among the responders, 71% were male and 29% were female. The majority (81%) of students agreed that this teaching-learning method enhanced their communication skills. Three-fourths (75%) of the students agreed that the activity helped in overcoming shyness and hesitation in class. Sixty-six percent of students felt that the jigsaw method is a creative way to enhance understanding. The responses of the students to the close-ended questions are shown in Table 1.

The average score on the MCQ test was 11/15 (73.3%), ranging from 53 to 100%.

Students were asked open-ended questions about perceived usefulness, hindering, and facilitatory factors for the activity. Students felt active discussions and peer teaching facilitated learning during the activity, while group organization, seating arrangement, lack of interest, and more time consumption were the major hindering factors. The student's responses are given in Table 2.

The faculty agreed that it was an interesting and effective way of teaching; however, a greater number of faculty is required for its execution. They agreed that this method involves active participation of students and increased their confidence. The responses of the faculty to close-ended questions are shown in Table 3. In the response to the open-ended questions, faculty were of the view that this activity-based learning is an effective way wherein faculty act as a guide and facilitate the students in the classroom. Faculty also highlighted the effectiveness of student-centered approach. Another view shared by faculty was that the majority of students actively participated in the activity and learned from each other. As per the view of one of the faculty, students can learn better in a friendly environment where they can interact with each other. They can learn better by listening and talking to their friends. One major hindrance according to the faculty was the lack of active participation by some of the students which can dampen the enthusiasm of other students. All faculty members believed that it is more time-consuming and needs good planning beforehand.

Table 3 Faculty responses to feedback questionnaire

Questions	Neutral *n* (%)	Agree *n* (%)	Strongly agree *n* (%)
Jigsaw is more interesting than traditional teaching	0	5 (83.3)	1 (16.7)
Jigsaw is a good method for peer assisted learning	0	3 (50)	3 (50)
Jigsaw increased student's participation	0	3 (50)	3 (50)
Jigsaw activity was enjoyable for students	0	2 (33.3)	4 (66.7)
Jigsaw activity needs more number of faculty	0	3 (50)	3 (50)
I recommend this method to be used in other department	2 (33.3)	3 (50)	1 (16.7)
Students were thoroughly engaged in discussion during the activity	0	3 (50)	3 (50)
Jigsaw increased confidence	1 (16.7)	2 (33.3)	3 (50)
Is an effective method for teaching	0	2 (33.3)	4 (66.7)
Jigsaw can be used for teaching other topics in pharmacology	1 (16.7)	3 (50)	2 (33.3)

Discussion

Many innovative educational strategies have been used to make teaching and learning more interactive. The jigsaw technique is one such cooperative learning method that has been shown to improve student motivation and increase the enjoyment of the learning experience. It has been shown to promote positive student attitudes toward their learning, enhance supportive relationships between peers, and develop self-esteem [11]. In this study, we assessed the effectiveness and perception of students and faculty regarding the jigsaw method to teach pharmacology. The results of the present study show that the students believed that the jigsaw technique increased their understanding of the topic. Students reported that they learned more when they were involved in cooperative learning activities by making explanations to and taking explanations from peers. This finding supports those of other studies which show that the jigsaw method helps enhance students' understanding by learning together and discussing in a safe learning environment [11, 12, 13]. Findings regarding a positive perception about jigsaw activity are also objectively supported by the MCQ test score.

Studies have also demonstrated that fun and enjoyment play a role in adult learning. Methods incorporating greater use of fun and enjoyment motivated adult learners to participate in learning with enthusiasm and helped in the absorption of learning [14]. The majority of the students in the present study found that learning through jigsaw was an enjoyable experience. This finding is consistent with the results of other studies [11, 12].

Students found this method to be an effective way of learning and liked working with their peers. Similar to the present study, the jigsaw technique has been acknowledged as an effective way of learning [8, 15]. The responses of the students suggested that the activity helped overcome shyness and hesitancy in speaking in front of others. The quote of one of the students "It helps to overcome the fear of speaking in front of the class" is suggestive of the same. Evidence from the literature shows that the jigsaw method provides an opportunity for introverted students to come forward, overcome their hesitation, participate, and perform their roles in groups [9, 10, 16, 17].

The students perceived that this method improves analytical skills. This is consistent with the findings of Nusrath et al. [16]. The jigsaw method makes learning more interesting, encouraging students' accountability in the learning process which is necessary to develop skills in problem-solving. Exchanging information during the discussion with other students in a group helps students improve their higher-level thinking skills. Majority of students in the cooperative learning group valued group discussion and information exchange among group members. Students reported that working in a team and teaching their peers helped them in understanding the importance of the participation of each team member in accomplishing the tasks. Students become "experts" in one of the areas and are challenged to teach their topic to their peers. The responsibility of each member in a group is to make sure that other group members also learn the concepts [2, 18]. Students help one another to achieve shared goals. This sense of responsibility in teaching peers helps students to be active in exploring learning material and become more independent in their learning [19, 20]. The findings of the present study encompass the social benefits of cooperative learning which are consistent with the results of other studies [11, 21]. Another feature of this method is that both high achievers and low achiever students come together. As the activities demand teamwork, there is a transfer of knowledge in an atmosphere of cooperation. The jigsaw method has been shown to enhance cooperation, and students see each other as collaborators and not as competitors. Such type of learning promotes greater long-term achievement as compared to individual learning. This is evident from the results of previous studies where retention test scores were found to be significantly improved in the jigsaw group [4, 22]. In our study, students expressed that they were able to learn many topics in a specified time. By using this unique cooperative learning strategy, multiple topics can be introduced in a specified space of time [20, 23]. Walker and coworkers have also concluded

that the jigsaw method adds to the existing education tool in the medical curriculum, allowing for peer discussion of a large amount of study material in a short period [24].

In the present study, students reported that "Not all were interested in participating actively so it was a bit uncomfortable" and there was a lack of interest in some which they considered being the hindering factors for the activity. Similar to our finding, Nusrath et al. also reported that the non-cooperation of some students during the activity can affect the success of the group [16].

The faculty views on jigsaw activity were very encouraging. The study indicated that faculty also holds positive views about this method. They quoted that the jigsaw method is an effective way of cooperative learning. Some of the comments were "They can learn better by listening and talking to their friends." "Students can learn better in a friendly environment where they can interact with each other."

Similar results are evident from the responses of the faculty in the study done by Soundariya K et al. Faculty opined that jigsaw promoted self-study, group discussion, and increased in-depth understanding [15]. Similar to prior studies done, faculty members agreed that the jigsaw technique is an interesting way of teaching which enhanced communication skills and increased active participation of students [10].

A few concerns about this method which both the faculty members and students mentioned were that this technique is time-consuming, and a lack of interest from some students can dampen the enthusiasm of the whole team. This finding is consistent with some previous studies. This method has been labeled to be time-consuming as it requires pre-classroom preparation and classroom preparation (arranging the groups) [16, 25].

Limitations

This was a pilot study where the jigsaw technique was introduced in our setting with one batch of students and a single topic. The feedback obtained was through a questionnaire which like all surveys is subject to response bias. The long-term impact of this learning method could not be assessed. The study was not designed to assess whether the jigsaw teaching method is superior to a traditional method. Furthermore, studies can be planned to compare this method with traditional teaching-learning strategy and assess the long-term retention of the knowledge gained through this method.

Conclusions and Recommendations

The jigsaw teaching method was successfully introduced in the setting of an Indian medical school. It contributed to a better comprehension of the concepts and improved communication and learning skills among the students. It proved to be an enjoyable learning experience for them. The jigsaw method, thus, adds another strategy to our existing armamentarium with the potential to fulfill the sense of autonomy and competence among students. Based on the feedback of the students and faculty, it is advisable to reduce the time duration for discussing within the expert group, more emphasis should be given to self-study and group discussion by the expert within the parent group. Groups should be organized in such a way that each group has a mixture of academically bright and not so bright students, extroverts, and introverted students. Group size can be reduced to 5 or 6 students to increase participation.

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Data Availability Data is available on request.

Declarations

Ethics Approval This study was approved by the Institutional Ethics Committee (approval no. GIMS/IEC/HR/2021/09 dated 22–01-21).

Informed Consent Consent was obtained from all the students for participation in the study.

Conflict of Interest The authors declare no competing interests.

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