

## Active Learning Methodology – Jigsaw Technique: An Innovative Method in Learning Anatomy

### Abstract

**Introduction:** For years together, gross anatomy is taught by the traditional teacher-oriented teaching method, i.e., students have to attend the lecture classes followed by the dissection on cadavers. In general, most of the students find it difficult to understand and retain gross anatomy. Active learning (AL) has received considerable attention over the past several years and is often contrasted to the traditional lecture where students passively receive information from the instructor. Class time is also brief and precious, and the information we want to communicate to our students is also important. AL Methodology (ALM) by jigsaw technique encourages active student participation, maximizes their own and each other's learning, and improves their communication skills which can be applied beyond anatomy to their careers as future physicians. The aim of the study is to assess the effect of implementation of AL method as a learning tool on the learning and performance of 1<sup>st</sup>-year medical students. **Material and Methods:** The project was carried out in the Department of Anatomy comprising 150 first professional MBBS students. Sensitization session with students and faculty was done. Two topics already taught by traditional didactic lecture were chosen for the jigsaw technique. Effectiveness of learning experience was evaluated by the students and faculty through a prevalidated feedback questionnaire with a five-point Likert scale to record their experiences, perception, and attitude toward the ALM (jigsaw). **Results:** The findings of student's feedback on five-point Likert scale revealed that the students were in favor that ALM was helpful in improving the learning skills and major topics should be taught by this AL methodology. **Discussion and Conclusion:** The study results show that ALM jigsaw technique is an effective teaching method. ALM by jigsaw technique motivated and encouraged active student participation and discussions. Students and faculty both favored the use of ALM.

**Keywords:** Active learning, cooperative learning, jigsaw technique, peer learning, small group learning

### Introduction

Education is a light that shows the humankind the right direction to surge. The purpose of education is not just making a student literate but also add rationale thinking, knowledge, and self-sufficiency.<sup>[1]</sup> For most of the 20<sup>th</sup> century, it is not surprising that lecturing continued to be the most prevalent mode of instruction and an efficient way to transfer knowledge to the students.<sup>[2]</sup> Lecturing, of course, can be an effective way of delivering the information not easily available otherwise, but it is not the only way of engaging students in the information we are presenting.<sup>[3]</sup> For years together, gross anatomy is also taught by the traditional teacher-oriented teaching method. In general, most of the

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students find it difficult to understand and retain gross anatomy.<sup>[4]</sup> The explosion of knowledge to be learned by medical students, nonavailability of cadavers, decline in faculty, and the drastic curtailment of period from 1½ to 1 year have put curriculum, students, and faculty at premium.<sup>[5]</sup>

Hence, the need of the hour is to bring some change in our traditional teacher-oriented teaching system by making the students more active learner and also by making best use of their time to earn a medical degree. The Roman philosopher, Lucius Annaeus Seneca (4 BC–AD 65), advocated cooperative learning with a statement “Those who teach learn.” In addition to changing pedagogy, a variety of teaching strategies are now being implemented to promote active learning (AL). Hence, we should use a learning strategy that is

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Monika Lalit,  
Sanjay Piplani<sup>1</sup>

Departments of Anatomy and  
<sup>1</sup>Pathology, SGRDIMS and R,  
Amritsar, Punjab, India

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### Address for correspondence:

Dr. Monika Lalit,  
24, Lane 5, Gopal Nagar,  
Majitha Road,  
Amritsar - 143 001, Punjab,  
India.  
E-mail: [monika.lalit@yahoo.com](mailto:monika.lalit@yahoo.com)

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self-paced and mastery-based and boosts engagement and makes the lesson more comprehensible and memorable.<sup>[6]</sup>

Learning is further enhanced when it is more like a team effort as working with others often increases involvement in learning, improves thinking, and deepens understanding.<sup>[7]</sup> The notion of AL is not new and simply means having students engage in some activity that forces them to think about and comment on the information presented. “AL” teaching techniques are now increasingly entering the teaching repertoire to make larger classes interactive and one of the commonly employed techniques such as jigsaw technique.<sup>[3]</sup>

The jigsaw classroom is a researchbased 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.<sup>[8-10]</sup> Bykerk-Kauffman, 1995, stated that the “Jigsaw” method refers to a technique of breaking down a large concept into smaller pieces of information, in which small teams are responsible for becoming experts on their “chunk” and teaching this information to other teams.<sup>[11]</sup> It fosters the development of communication skills, teamwork, leadership, confidence and respect for peers, and in-depth understanding of course content that are vital to developing professionalism early in their medical careers.<sup>[12]</sup>

This study is an effort at exploring the use of AL methodology (ALM), i.e., jigsaw technique, as a motivational tool toward better learning so that the students analyze, synthesize, and evaluate information and discuss with other students.

## Aim and Objectives

### Aim

The aim of the study is to assess the effect of implementation of AL method as a learning tool on the learning and performance of 1<sup>st</sup>-year medical students.

### Specific objectives

- To introduce AL method (ALM) in learning anatomy
- To sensitize the faculty and students for ALM in learning anatomy
- To assess the student and faculty perception toward ALM by using feedback questionnaire as a tool.

## Material and Methods

The project was carried out in the Department of Anatomy comprising 150 first professional MBBS students and 7 faculty members.

### Planning

- Permission was obtained from the Ethical Committee, Principal/Dean of the SGRDIMS and R, Amritsar, and Head of Department to carry out the project

- Dissection hall was selected as venue for the project
- Two topics already taught by traditional didactic lecture were chosen for the jigsaw technique in consultation with other faculty members.

### Discussion with students and sensitization

- Brief interaction was held with the students in the dissection hall about the current studying pattern of the students and various methods of learning adopted by them
- Following this, the students were introduced to ALM and were sensitized to jigsaw technique which is one of the important methods of ALM by video presentations and pictures
- They were advised and encouraged to learn two topics of the abdomen (stomach and uterus and its supports, ovaries, and fallopian tubes) by this method besides their preferred learning method and judge if they found it more helpful than the learning methods, they were practicing.

### Discussion with faculty and sensitization

- The first session with the faculty members of Department of Anatomy was the sensitization session, wherein the faculty was introduced to the concept of AL methods (ALM) and the proposed student intervention, i.e., jigsaw technique (which is a small group teaching-learning activity) through video presentation and pictures
- A second session with the faculty members was held to apprise them of the results of student’s jigsaw technique assessment and the student feedback
- Out of seven faculty members, six participated in the study.

### Method of jigsaw technique<sup>[8-10]</sup>

- The project was carried out on 150 1<sup>st</sup>-year MBBS students who are already divided into A and B batches comprising 75 students each, out of which 132 appeared. The Batch A was then divided into 13 subgroups having 5 students each where every student in each group was assigned a number 1, 2, 3, 4, and 5
- The Batch B was also divided similarly into 13 subgroups having 5 students each and assigned a number 1, 2, 3, 4, and 5
- All these subgroups were named “Home Groups”
- After each student had a number, the home groups were broken apart, were reorganized by numbers allotted to them into new “Expert Groups.” Like all the ones, twos, threes, fours, and fives constituted expert groups, respectively [Figure 1].
- The topics of abdomen which were taught by didactic lectures, the same topics were then taught by jigsaw technique, for which the topics were divided into five subtopics
- Each expert group was assigned a specific subtopic related to the focus of overall topic

- The expert groups shared the ideas, searched the internet, consulted books in the library, and discussed the subtopic among themselves
- Then, the expert groups broke apart and returned to their original home groups. Each brought with them the knowledge gained (as expert group) and imparted to others
- Teachers acted as facilitators to monitor the development of the topic given to the students and answered their queries.

After completion of the topic by jigsaw, students' in-depth understanding regarding these topics was also judged by discussing the topics with students by focus group discussion (FGD).

### Focus group discussion

Focus Group Discussion (FGD) is the interaction between the facilitator and the group and also the interaction between the group members themselves. It was conducted in such a way that one student from each "Home Group" was randomly selected and asked to teach that particular topic to the whole class. The student was permitted to use chalk and board for the same. The students from the assembled group were also encouraged to ask questions from the presenter if they had any, at the end of the presentation. Thereafter, effectiveness of this learning experience was evaluated by the students through a prevalidated feedback questionnaire.

### Collection of feedback

#### Students feedback

- A feedback with a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) was taken from the students in the form of questionnaire to record their experiences, perception, and attitude toward the ALM (jigsaw) [Figure 2]
- FGD with respect to open-ended question was done with the students after taking the feedback to gather their opinions regarding their motivation toward using ALM (jigsaw) to learn anatomy.

#### Faculty feedback

- 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 faculty members in the form of questionnaire to record their experiences, perception, and attitude about the ALM (jigsaw) [Figure 3]
- This was followed by a FGD with the faculty with respect to open-ended questions to know their opinions about student's perception and performance with jigsaw and also suggestions regarding use of the jigsaw technique to learn new concepts in anatomy.

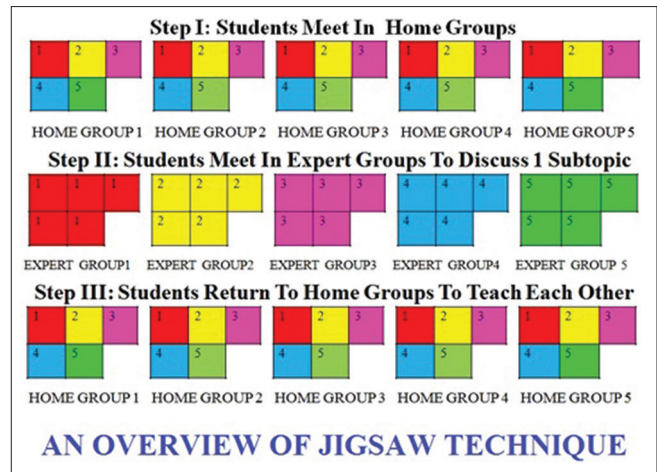


Figure 1: An overview of jigsaw technique showing formation of home groups and expert groups

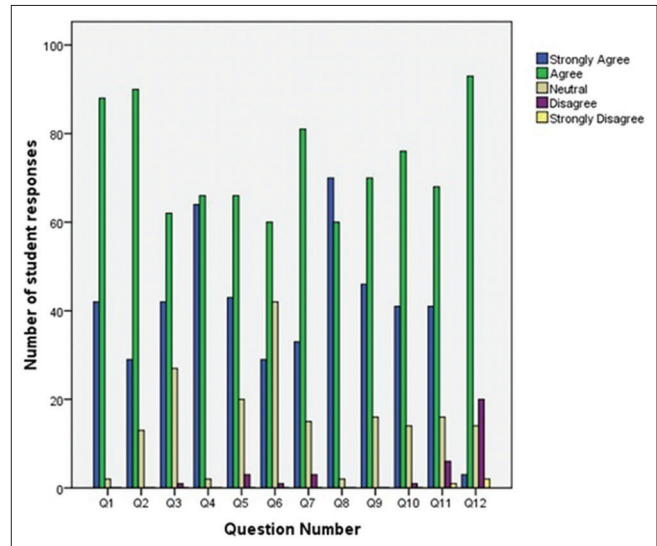


Figure 2: Bar chart showing student's questionnaire feedback response

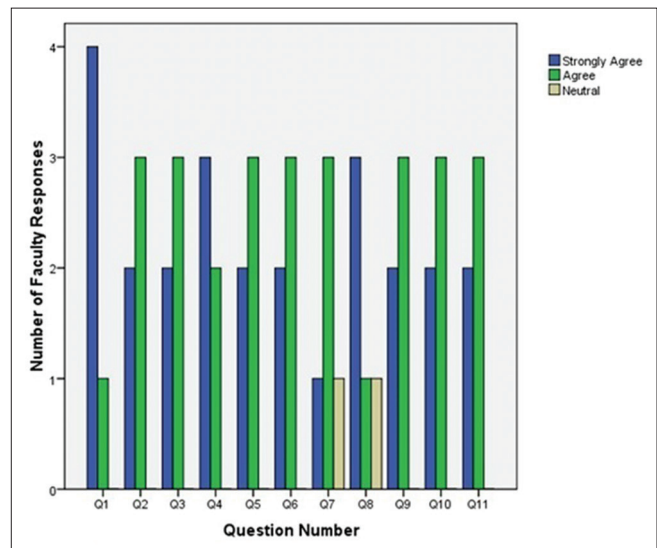


Figure 3: Bar chart showing faculty questionnaire feedback response



## Results

The results of the study are as under:

### Feedback from students

Evaluation and analysis of student questionnaire feedback responses was done by applying five-point Likert scale and shown using cluster bar chart [Figure 2].

The close-ended questionnaire response showed that the AL by jigsaw method was refreshing and encouraged active student participation, discussions, and gave clearer and in-depth understanding of the topic. Students were in favor that ALM was helpful in improving the learning skills, problem-solving abilities, and communication skills.

The following are some of the responses to the open-ended question in the student feedback questionnaire during FGD.

- Majority were of the opinion that all the major topics should be taught by this method
- Found the method very helpful, interesting, and motivating
- Active participation by each participant is a must. Even if one person is lacking and is not giving 100%, then whole home group suffers
- Should be practiced for every topic
- Some students knew and understood the topic, but they were not able to express themselves fully
- Good method if everyone does it with interest and commitment.

### Feedback from faculty

Evaluation and analysis of faculty questionnaire feedback responses was done by applying five-point Likert scale and shown by using cluster bar chart [Figure 3].

The followings are some of the responses to the open-ended question in the Faculty Feedback Questionnaire during FGD.

- With this method, students become good learners and stimulated to study in concentration
- Try to be perfect in front of their classmates. Hence, nice learning procedure
- Time-consuming
- Every student cannot be made active participant, as there are always some work shirkers and passive students
- Although feedback from faculty was also in favor of implementation of this method, paucity of time and less number of faculty were major hindrances in the implementation.

## Discussion

The stereotype of anatomy as endless memorization can cause students to approach dissection with a negative attitude. However, there are evidence that peer-assisted learning has contributed to enhance student's attention

and motivation to retain and explain anatomical knowledge.<sup>[13]</sup> We also know that individuals are likely to learn more when they learn with others than when they learn alone. AL, student-centered pedagogical approaches, put the focus on the learner. However, AL does not just happen, it occurs in the classroom when the teacher creates a learning environment that makes it more likely to occur.<sup>[14]</sup> There are reports that as a form of AL, the students perceived themselves as having a better understanding of course content, the multidimensional structure of the human body, and achieved better academic results.<sup>[13]</sup> In addition to its academic advantages, AL has been shown to produce numerous social and psychological benefits.

According to Slavin, a recent review of research found that AL boosts the development of critical-thinking skills and fosters social interdependence and support among students. Further, when compared with more traditional competitive or individualistic learning methods, it improves student's attitudes toward their subject area, improves relationships between students, and improves student retention.<sup>[15]</sup>

In delivering the anatomy curriculum, Vasan and DeFouw successfully implemented team learning to promote active, small group, inter-AL that allowed to introduce clinical vignettes to emphasize anatomical concepts.<sup>[16]</sup> Han *et al.* reported that most students believed that they learned more about, developed better attitudes toward, and acquired better skills, including communication in anatomy via peer-assisted than via faculty-led learning.<sup>[13]</sup> Koprowski and Perigo in their study have concluded that students strongly endorsed the cooperative technique with 84.8% of the opinion that the cooperative technique was superior to learning anatomy by the traditional method. About 12.1% preferred the traditional method and 3.1% did not prefer either method.<sup>[17]</sup>

The jigsaw technique was also successful in teaching the concepts involved in the clinical controversy and long-term and postacute care to medical students.<sup>[18]</sup> In a study, the findings showed that the students in the jigsaw group appreciated most working, discussing, and sharing information with others and also had greater long-term achievement than in the lecture group.<sup>[19]</sup> Dhage *et al.* mentioned in their study that through the proposed jigsaw activity, the most important learning goal is achieved simultaneously with development of other soft skills, and this AL technique is capable of providing both, awareness as well as platform to build skills and also the bonding between the students is found to be increased.<sup>[20]</sup>

Jigsaw is one of cooperative learning techniques, applied to boost student's motivation and stimulate student's activeness in learning the subject.<sup>[21]</sup> It has also been highlighted in a study that the active and engaging learning strategy can be used as an effective learning tool in anatomy where

students prepared the muscle presentations by utilizing their own creativity, curiosity, and intelligence.<sup>[22]</sup>

The present study also showed that the AL by jigsaw method was refreshing and encouraged active student participation and gave clearer in-depth understanding of the topics. The findings of student's feedback on five-point Likert scale revealed that the students were in favor that ALM was helpful in improving the learning skills and major topics should be taught by ALM. It is also documented that such AL methods are believed to improve critical thinking, problem-solving abilities, and information retention, thereby fostering lifelong learning skills among medical students.<sup>[23]</sup>

AL by Jigsaw method used in this study showed active participation by both faculty and students. In this study, the jigsaw technique motivated the students to try newer methods of learning, and they reported feeling benefitted from this change. Students were in favor that many more topics should be taught by ALM. Thus, AL by jigsaw technique is the instructional use of small groups, in which students work together to maximize their own and each other's learning, improve their communication skills, which can be applied beyond anatomy to their careers as future physicians.

Although time management was a big limitation as the topic which in routine is taught in 1 h lecture took around 4 h to complete because the students first read it themselves according to jigsaw technique, discussed their queries with the faculty, and then taught the home groups and finally the students were evaluated by the faculty. Another major limitation was that some of the students were not able to express themselves fully to their peers. On evaluation by the faculty, it became evident that they knew the content but because of their poor communication skills the home group also could not understand the topic fully.

As the students were first introduced to this kind of study, so the students participated with full enthusiasm. It motivated them to discuss even the minutest of queries, as they were then supposed to impart knowledge to their peers which otherwise go unattended in routine lecture.

### Limitation of the study

For this, a preset curriculum should be prepared where the students know beforehand what topic/subtopic they are supposed to be ready with on a particular day. Thus, the students can come prepared with the subtopic allotted to them, after teaching hours by the help of books, internet, library, and then follow the jigsaw technique the next day. This will lead to better time management.

### Conclusion

- The study results show that ALM jigsaw technique is an effective teaching method
- Jigsaw method used in this study was well received by both faculty and students

- Students found this method to be an interesting way of learning and were of the view that major chapters should be taught by ALM jigsaw
- Faculty also favored that ALM by jigsaw technique encouraged active student participation and can be used as a motivational tool toward better learning.

### Implications

ALM by jigsaw technique motivated and encouraged active student participation. Students and faculty both favored that ALM may be used as a part of teaching curriculum along with didactic lectures.

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### Conflicts of interest

There are no conflicts of interest.

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