

## Original Research Article

# Jigsaw puzzle to teach anatomy to first year MBBS students

Seema Gupta\*, Anshu Soni, Sonia Singh, Hitant Vohra

Department of Anatomy, Dayanand Medical College and Hospital, Ludhiana, Punjab, India.

**Received:** 24 August 2019

**Accepted:** 27 September 2019

**\*Correspondence:**

Dr. Seema Gupta,

E-mail: [seemagarg09@gmail.com](mailto:seemagarg09@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Anatomy provides a platform of knowledge indispensable to all the branches of medicine. Students have to learn many new concepts and tongue-twisting terminologies, making this subject difficult to comprehend. It has been seen that a range of innovative, proactive, simple, hands-on approach strategies can achieve maximum student engagement and help them learn. Aim is to take students from the traditional view of anatomy as a subject that require surface learning (rote learning, memorization) to one that can lead to deep learning through understanding. Keeping all this in mind a study was planned to develop an innovative method of teaching anatomy to 1st year MBBS students.

**Methods:** The diagrams of sagittal and horizontal sections of the brain were selected, marked and cut into jigsaw pieces. Students were given an incomplete jigsaw puzzle and a set of questions. The answer to these questions helped them complete the puzzle. Perception of students who consented to participate in the study was noted.

**Results:** Out of 98 students who participated in the study 61.2% wanted to participate in similar activities in future in anatomy and 57.1% felt that it helped them in understanding the topic. For 52.1% it was a useful self-learning tool and for another 48.9% students solving the puzzle was a challenging experience.

**Conclusions:** Jigsaw puzzle is an efficient way for students to become engaged in their learning. It maximizes interaction and establishes an atmosphere of co-operation and respect for other students and improves learning.

**Keywords:** Anatomy, Innovative method, Jigsaw puzzle, Medical education, Medical student

### INTRODUCTION

Anatomy has been the keystone of medical education for hundreds of years. It provides a platform of knowledge indispensable to all the branches of medicine. Students have to learn many new concepts and tongue-twisting terminologies, making this subject difficult to comprehend. The students find this dull and labor-intensive subject concentrating their effort on memorizing list of names. As a result, anatomy teacher faces inherent and contextual challenges trying to make the subject not only simple but also interesting. A major paradigm shift in education has been to move from teacher centered to learner centered approach. The focus is on student and teachers merely act as facilitators or

supporters.<sup>1,2</sup> There is a drift in the professor's role from sage on the stage to guide on the side and helping students manage.<sup>3,4</sup> Creating an environment in which students can learn effectively and efficiently becomes the pre-requisite.<sup>5</sup> It means that teachers teach understanding how students learn. It is important to teach them not only the anatomical facts but also learning skills that will serve them throughout their student and professional lives. It has been seen that a range of innovative, proactive, simple, hands on approach instead of didactic lecture can achieve maximum student engagement and help them learn. Small group activities promote deeper understanding; encourage problem solving, participation and develop interpersonal and social team working.

Crossword puzzles, hidden messages, word scrambles, word searches have always motivated students. These have been used to develop problem solving skills and foster logical thinking.<sup>6,7</sup> It makes the students alert, increase their concentration, expands creativity and help in improving cognitive and analytical skills. Jigsaw puzzle helps in development of visual-spatial processing skills.<sup>8</sup> The visual spatial and critical thinking are often cited as goals of active learning and represents underpinning of the spirit of science. The visual cues required that the student form a mental picture of how an image should look like.<sup>9</sup> Cheating, after all, can't complete a puzzle! It either works or fits or it doesn't. So, puzzles teach students to use their own minds to figure out how to solve problems and think in a logical way. As students work on a puzzle, they often develop a strategy to solve the puzzle faster and more efficiently. For instance, they may do all the edge pieces first, or sort all the pieces into piles. This helps students to achieve small goals as a means towards a larger goal. On the other hand, looking at the images constantly helps practice visualization, which is again good aid for learning. It also requires student participation and interaction. Apart from this student feel personal responsibility for learning and enormous sense of accomplishment when they have completed the puzzle.<sup>10,11</sup> Mastering a challenge builds a confidence to take on subsequent challenges. Solving jigsaw puzzles in groups would fall within the broad domain of active learning. It is more student-oriented rather than teacher-oriented approach.

Keeping all this in mind, a project was designed to increase their engagement in Anatomy course and improve their cognitive skills. Students will become more self-directed in their learning and have a high level of long-term anatomy knowledge. Aim is to take students from the traditional view of anatomy as a subject that require surface learning (rote learning, memorization) to one that can lead to deep learning through understanding. In other words, the ability to place information into a broad, big picture which help them in treating patients. Principle goal for the study was to support and assist first-year students to develop their knowledge and learning in Anatomy by interactive activity and to produce lifelong self-directed learners. Aim and objectives are to develop an innovative method of teaching anatomy to 1<sup>st</sup> year MBBS students, to introduce jigsaw puzzle as teaching-learning tool in anatomy and to assess perception of students in understanding anatomy better by using jigsaw puzzle.

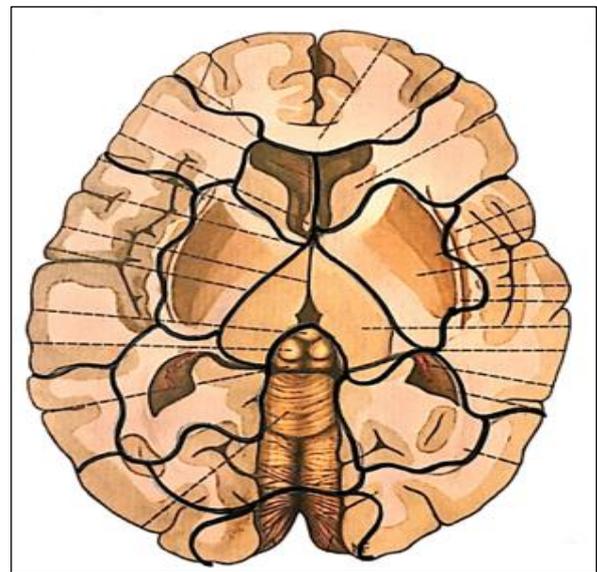
## METHODS

### *Planning the activity*

After the approval from the administration and Institutional Ethics Committee the activity was planned in the department of Anatomy, Dayanand Medical College and Hospital, Ludhiana.

A core group was made, and faculty was sensitized to the jigsaw puzzle. After the discussion about the sessions, puzzle and the questions to be asked were finalized by the group. The activity was then included in the schedule. A total of two sessions were conducted in the Brain region. Each session was of two-hour duration.

The diagrams of sagittal and horizontal sections of the brain were selected. The diagram selected (horizontal section) was marked and cut into jigsaw pieces (Figure 1). This way one jigsaw puzzle was made by a professional photographer. Each puzzle piece had a question. The questions related to anatomy like blood supply of the internal capsule, applied anatomy, arbor vitae, or nuclei of thalamus, boundaries of the lateral ventricles were designed for each piece.<sup>10</sup> jigsaw puzzles and questions set were made. Similarly, another puzzle and question set were made for other sagittal section of brain.



**Figure 1: Jigsaw puzzle of horizontal section of brain.**

### *Implementation of the activity*

Out of 100 students a total number of 98 students participated in the study. The students were divided into 10 groups. 8 groups had 10 students each and two groups had 9 students each.

The students were sensitized and explained about the puzzle in detail.

Each group was given an incomplete jigsaw puzzle and a set of questions. The students were asked to answer these questions. The students discussed the questions and collectively answered the questions. Single missing piece was provided each time the students answered the question. The students who answered all the questions, got all the pieces of the puzzle and were able to complete the puzzle.

**Data Collection and Data analysis**

Voluntary informed consent was taken from the students. All the students who consent to participate in the study were requested to fill a questionnaire regarding their perceptions about the jigsaw puzzle. The questionnaires contained both close-ended (using a 5-point Likert scale as a response scale ranging from 1=strongly agree to 5=strongly disagree) and open-ended questions to elicit their perceptions regarding the use of jigsaw puzzle as a teaching learning method in anatomy.<sup>12</sup> The answers to the questions were analyzed quantitatively. Qualitative analysis of open-ended questions (reflections) was done and suggestions were noted.

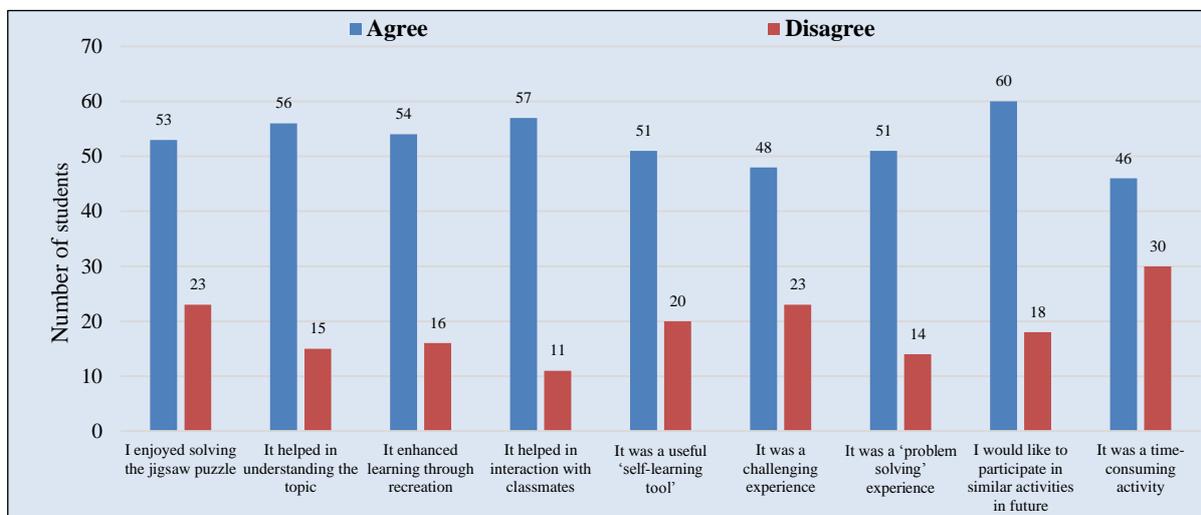
**RESULTS**

Out of the batch of 100 MBBS students in first year, 98 students participated in the study. Two students did not give their consent to participate so they were excluded

from the study. In our study 54% students enjoyed solving the puzzle and 23.4% did not enjoy it (Table 1). Solving the jigsaw puzzle was a challenging experience for 48.9% students, 21.4% disagreed and only 2% strongly disagreed to it (Table 1). Perception of 55.1% students in our study was that solving a puzzle enhanced their learning through recreation, but 16% students did not feel the same (Table 1). For 52.1% it was a self-learning tool and for 57.1% answering the questions and solving the puzzle helped them in understanding the topic. For 52% students, it was a problem-solving experience but 1% strongly disagreed to it. 60% wanted to participate in similar study in future (Figure 2). 47% felt that it was a time-consuming activity, 22.4% were neutral about it and 30.5% did not feel it to be a time-consuming activity. The questionnaire had one open ended question asking for the student’s suggestions on jigsaw puzzle. The answers were analyzed, and themes generated were that most of the students enjoyed doing puzzle. Seventy-three students wanted more of these types of innovative activities along with lectures.

**Table 1: Students’ perception for jigsaw puzzle (in percentage) (n=98).**

Questionnaire item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I enjoyed solving the jigsaw puzzle	17.3	36.7	22.4	21.4	2.0
It helped in understanding the topic	8.2	48.9	26.5	12.2	3.0
It enhanced learning through recreation	16.3	38.8	28.6	15.3	1.0
It helped in interaction with classmates	28.6	29.6	30.6	9.1	2.0
It was a useful ‘self-learning tool’	13.3	38.8	27.5	17.3	3.0
It was a challenging experience	17.3	31.6	27.5	21.4	2.0
It was a ‘problem solving’ experience	19.4	32.6	33.7	13.2	1.0
I would like to participate in similar activities in future	31.6	29.6	20.4	15.3	3.0
It was a time-consuming activity	18.4	28.6	22.4	17.3	13.2



**Figure 2: Students’ feedback for jigsaw puzzle.**

Thirty-five felt that these sessions should be done in small groups. The students who did not find it to be a challenging experience suggested that the difficulty level of the puzzle can be increased by making difficult puzzles with more pieces. Another perception of students was that these types of activities can be planned in the beginning of academic session when the students were comparatively free. Another group felt that having such activities in the beginning of the session will increase their interaction with their batch mates and will help them bond with each other.

## DISCUSSION

Anatomy is a fact-filled subject. Students often find it difficult to understand concepts in Anatomy. Problems in recalling names during viva-voce of Anatomy are a routine observation by faculty. The learning of anatomy should be less of a chore and more of a pleasurable experience. Active learning strategies in Anatomy may overcome these problems. Self-directed learning promotes active learning and develops critical thinking.

Authors used jigsaw puzzles in Anatomy as a self-learning tool to promote active learning. This study concludes that the jigsaw puzzle is a useful self-learning tool. Effectiveness of this intervention was evident from students' acceptability towards this innovation. More than 60% students wanted to participate in similar activities in future. In a similar study by Rodenbaugh HR, et al, who used jigsaw puzzle in teaching physiology concluded that it facilitates active learning. They concluded that jigsaw puzzles are fun and challenging to solve and that they enhanced the knowledge provided in traditional lectures.<sup>9</sup> 52.1% of the total students in our study felt that it was a good self-learning tool. The educational games have proven to keep the students engaged and help in developing interest in the subject.<sup>13,14</sup> The games used in teaching-learning process helps the students in discussing concepts with each other, resolve doubts and promotes better understanding. Additionally, the use of active learning methodology has shown positive results, considering students' performance.<sup>15</sup>

Sawant and Shaheen in the year 2015 in discussing various approaches for teaching Anatomy concluded that the approach which promote learning by 'doing' helps in making the subject enjoyable, leading to deeper learning and long-term retention. Our study also showed that, to 57.1% students it helped in understanding the topic. It is felt that proper utilization of newer techniques with traditional learning methods will certainly enhance the understanding.<sup>16</sup> Jigsaw puzzle promote development and understanding of visual-spatial relationship. The visual cues form a mental picture of the problem and help in long term retention of memory. Thus, can be used to retain and grasp a volatile and difficult subject like Anatomy.

Professor Diaz in a survey found that 83% of health sciences students thought that practical, innovative approaches assisted their deeper understanding of

Anatomy, 81% thought they assisted their long-term memory of anatomy, and 82% reported that the learning and memory skills they acquired in anatomy have been useful in other subjects.<sup>17</sup>

Students have transferred this review strategy to other classes and the peer teachers developed and expressed an interest in it as an adjunct teaching tool.

Jigsaw puzzles provide an engaging, motivating, inspiring and enjoyable experience therefore can be used as adjunct teaching tool utilizing the dissection hall time.

Although preparing topic-specific jigsaw puzzles is somewhat time consuming, the advantage is that this intervention is easy to implement. Tutorials and small group teaching can be conducted using this intervention.

Future research in this area may be directed at determining the impact of jigsaw puzzles on concept building in undergraduate medical education. Studies on the learning outcome, learning styles of students who prefer this, use of puzzles at different levels of medical education and methods to create puzzles that stimulate critical thinking are needed.

### **Outcomes: What this study adds**

The students enjoyed the interactive activity and more than 60% students wanted to participate in similar activities in future. These innovative activities can be part of the curriculum and can promote active learning.

Limitations of this study time constraint was the major limitation of the study. Vast syllabus, jam-packed schedule keeps the student busy throughout. As a result, students, do not get time for such activities.

The cost of jigsaw puzzle was another issue for we got it printed by a professional photographer, but that limitation can be overcome by using a cardboard, pasting the picture on it and then cutting the pieces.

## CONCLUSION

Jigsaw puzzle is an efficient way for students to become engaged in their learning. They solve a particular problem in groups giving importance to all the members in the group. It maximizes interaction and establishes an atmosphere of co-operation and respect for other students. It reduces the competitive attitudes amongst the students. Students feel an enormous sense of accomplishment when they have completed the puzzle. Mastering a challenge builds a confidence to take on subsequent challenge.

The active learning methods should be emphasized in new curriculum in which the students play the main role in learning. Active learning is based on principle that when students do something, they learn it better than if

they hear about it. Using this technique, the complex diagrams and relations in anatomy can be memorized in a playful way. After implementation, the attitude of students towards learning difficult things will change. The student will become active learners who seek to understand complex subject matter and are better prepared to use this knowledge to new problems and settings. A self-directed approach to learning will stimulate lateral thinking and promote creativity. A problem-solving approach will improve and help them solve real life problems.

## ACKNOWLEDGEMENTS

Author acknowledge the guidance and help provided by my colleagues in the department of anatomy of dayanand medical college and hospital, without whom this project would have been impossible to complete. Author also thank the 1<sup>st</sup> year students who participated in the project enthusiastically. Most importantly Author is very grateful to their Acme faculty and colleagues for their patience and unrelenting support throughout.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

- Spencer JA, Jordan RK. Learner centred approaches in medical education. *Brit J Med.* 1999;318(7193):1280-3.
- Ludmerer KM. Learner-centred medical education. *New Engl J Med.* 2004;351(12):1163-4.
- King A. From sage on the stage to guide on the side. *Coll teach.* 1993;41(1):30-5.
- Saulnier BM. From "sage on the stage" to "guide on the side" revisited: (un)covering the content in the learner-centred information systems course. *Info Syst Ed J.* 2009;7:3-10.
- Dornan T, Hadfield J, Brown M, Boshuizen H, Scherpbier A. How can medical students learn in a self-directed way in a clinical environment? Design based research. *Medi Educat.* 2005;39(4):356-64.
- Bailey CM, Hsu CT, DiCarlo SE. Educational puzzles for understanding gastrointestinal physiology. *Adv Physiol Educ.* 1999 27(6):1-18.
- Odenweller CM, Hsu CT, DiCarlo SE. Educational card games for understanding gastrointestinal physiology. *Adv Physiol Educ.* 1998;20:78-84.
- Richardson JT, Vecchi T. A jigsaw-puzzle imagery task for assessing active visuospatial processes in old and young people. *Behav Res Methods Instrum Comput.* 2002;34:69-82.
- Rodenbaugh HR, Lujan HL, Rodenbaugh DW, DiCarlo SE. Having fun and accepting challenges are natural instincts: jigsaw puzzles to challenge students and test their abilities while having fun! *Adv. Physiol Educ.* 2014;38:185-6.
- Vallerand RJ, Bissonnette R. Intrinsic, extrinsic, and amotivational styles as predictors of behavior: a prospective study. *J Pers.* 1992;60:599-620.
- Vallerand RJ, Pelletier LG, Blais MR, Brière NM, Senecal CB, Vallières EF. The academic motivation scale: a measure of intrinsic, extrinsic, and amotivation in education. *Educ Psychol Measur.* 1992;52:1003-17.
- Likert R. A Technique for the Measurement of Attitudes. *Archi of Psychol.* 1932;140:1-55.
- Cardozo LT, Miranda AS, Moura MJ, Marcondes FK. Effect of a puzzle on the process of students' learning about cardiac physiology. *Adv Physiol Educ.* 2016;40:425-31.
- Marcondes FK, Moura MJCS, Sanches A, Costa R, de Lima PO, Groppo FC, et al. A puzzle used to teach the cardiac cycle. *Adv Physiol Educ.* 2015;39:27-3.
- Nicholson LL, Reed D, Chan C. An interactive, multi-modal Anatomy workshop improves academic performance in the health sciences: a cohort study. *BMC Med Edu.* 2016;16:7.
- Sawant SP, Rizvi S. Teaching anatomy to undergraduate students. *Int J Anat Res.* 2015; 3(3):1212-15.
- Diaz CM, Woolley T. Engaging Multidisciplinary First Year Students to Learn Anatomy Via Stimulating Teaching and Active, Experiential Learning Approaches. *Med Sci Edu.* 2015;25(4):367-76.

**Cite this article as:** Gupta S, Soni A, Singh S, Vohra H. Jigsaw puzzle to teach anatomy to first year MBBS students. *Int J Res Med Sci* 2019;7:4161-5.