Team-Based Learning: An Effective Teaching Learning Tool in Gross Anatomy for 1st Year Indian Medical Students

Dr. Bhavana S. Junagade*, Dr. Anjali S. Sabnis, Dr. Vrushali V. Kulkarni
Associate Professor, Professor, Assistant Professor
[1,2]Department of Anatomy, MGM Medical College, Kamothe, Navi Mumbai, Maharashtra, India
[3]Department of Community Medicine, Rajiv Gandhi Medical College, Thane, Maharashtra, India

*Corresponding Author:
Dr. Bhavana S. Junagade
Associate Professor, Department of Anatomy, MGM Medical College, Kamothe, Navi Mumbai, Maharashtra, India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

ABSTRACT

Team-based learning (TBL) is considered an active, student centric teaching learning method, especially for professional students. This study has examined effectiveness of TBL, in Anatomy for the 1st year medical students in India. The students have worked as 2 comparable groups for 2 TBL sessions, alternately acting as case and control group. TBL conduction was by standard format. All 3 tests, Individual & Group Readiness Assurance Tests and Group Application Problem, were considered for total score. The control group has solved same IRAT and GAP papers individually. Total scores in both TBL groups (10.32, 10.83) were significantly (p < 0.00001) higher than total scores in both corresponding control groups (8.35, 8.52). 97.45 % students have shown rise in their total scores irrespective of their level of individual scores. The study has found that students perform better as a team even while solving application problems requiring critical thinking. It has also been observed that the low achievers benefit more than the high achievers. In the analysis of the feedback about student's perceptions of TBL, 67.8 to 88.1% students have shown their liking for TBL. Students have liked the preparatory phase (84%) and question answer feedback part (82%) maximally. They also felt TBL taught them importance of team work and good communication skills. The study has thus shown that TBL is definitely a method to be used in large classes like anatomy, to help students understand the subject at the same time developing their soft skills to emerge as better professionals.

Keywords: Anatomy, Active teaching learning, Low achievers, Medical students, Student centric, Team-based learning

INTRODUCTION

Medical educators worldwide have known and accepted that, medical students, being future professionals, need something more from their learning environment than the traditional didactic sessions. More learner centric methods with active involvement of students are continuously being explored and analysed. As most of these methods require small group teachings, departments such as Anatomy, with large number of students, face problems of resources, like infrastructure and faculty. It has been correctly said by Vasan et al that, presently everyone expects teaching to be "efficient, effective and economical." Luckily for the teachers, Team-based Learning (TBL) addresses expectations of both students and administration. [1]

789

Team-based learning is an unique method of self-directed learning, where not only the students have to prepare in advance, but their individual preparation is tested on the session day. During session the students work in team, absorbing soft skills like team work, communication. They solve clinical or application based problem which helps develop their critical thinking.

All these are also taken care of when other methods are used like for example problem based learning. For some of these methods though, more resources are required. But in TBL large group of students, up to 100, can be handled by just one facilitator. A study by Annette Burgess et al agrees that TBL has 2 benefits over PBL. It requires less number of facilitators and at the same time provides smaller teams to work with, for students.[2] Another study has commented that the TBL method requiring less teacher student ratio may also help in overcoming the nonavailability of expert teachers in given subject.[3]

In TBL, at the end of the session there is feedback system in which students actively discuss answers of all the questions to which they were subjected, under guidance of the facilitator. This way TBL helps them to understand the topic completely and takes care of all their queries and misunderstandings.

TBL method of teaching was first developed and introduced in Business school by Larry Michaelsen in 1990s.[4] It made its way in to medical education in 2001. Since then many medical colleges have introduced it and found it to be useful especially in the preclinical subjects like Anatomy and Physiology.

So to be a part of the changing medical education scenario we decided to examine effectiveness of TBL method in Anatomy for the 1st year medical students. We also analyzed the perceptions of students about TBL through their feedback.

MATERIALS AND METHOD

The study has analyzed the data of 118 1st year medical students of 2018 - 19 batch, who had given written informed consent, in the Department of Anatomy at Mahatma Gandhi Mission's Medical College, Navi Mumbai, Maharashtra, India. The ethical approval was taken from the Internal Ethics Committee, MGM Institute of Health Sciences, Navi Mumbai, Maharashtra, India.

Based on their previous departmental test result, the students were categorized in to, the slow, medium and advanced learners. Then these 118 students were divided in to two groups, A and B having balanced proportion of all the types of learners. The anatomy of heart and thyroid gland were the 2 topics finalized for the TBL sessions. When group A did TBL session on one topic, group B acting as the control group, gave MCQ (Multiple Choice Question) test on the same topic. The MCQs were same as given to the group A for IRAT (Individual Readiness Assurance Test) & GAP (Group Application Problem). For second topic the groups crossed over.

TBL sessions were conducted as per standard guidelines except for the peer evaluation. For the TBL sessions, 14 teams were formed in each group with each team having 4 or 5 students. The teams comprised of representatives of both the genders and all the types of learners.

For the preparatory phase, students were provided with a topic, learning objectives and suggested reading material, 8 to 10 days in advance. On the day of TBL session one facilitator gave IRAT, comprising of 15 MCQs, to the group. After collecting the IRAT papers the students assembled as teams and solved GRAT (Group Readiness Assurance Test). After this the teams worked through GAP which had 5 MCQs based on clinical case from the topic. Entire session lasted for 2 hours including feedback discussion of the answer key done by teams under the guidance of the facilitator. For the score calculation out of 15, contribution of IRAT was 30%, GRAT 40% and GAP 30%. For the control group the score out of 15 was calculated with 70% from MCQ (same as IRAT) test and 30% from clinical case MCQs (same as GAP).

The feedback questionnaire, containing 21 questions, was given to the students. The questionnaire was divided in to 5 subsets, with each subset having 3 to 6 questions. 5 subsets were based on the preparatory phase, team work, actual tests conducted, conduction of session and

use of TBL in the future. Each question was graded as per Likert's 5 point scale ranging from 1 – strongly agree to 5 – strongly disagree. The questionnaire was validated from 3 medical teachers, 2 from external institutes, 1 from our own institute. All the chosen faculty was experienced in the field of medical education technology. Few changes suggested by them were incorporated in the questionnaire prior to the ethical clearance.

RESULTS

Total 43 males and 75 females, distributed in comparable proportion in 2 groups and aged 18 ± 1, were part of the study.

When the IRAT mean scores of both the groups (7.44, 8.26) were compared to the MCQ test mean scores of the corresponding control groups (7.13, 7.44), there was not a significant difference. But when the total scores in both TBL groups (10.32, 10.83) were compared with the total scores in both corresponding control groups (8.35, 8.52) notable difference was seen proving the impact of group discussions on the scores in TBL groups.

Also the mean scores of the Group Application problem (GAP) in TBL groups (13.32, 13.06) were much higher than in the control group (10.83, 10.93). The control group had done the exercise individually. For the higher learning skills, like clinical case solving, the scores thus were significantly better when students studied as a team than individually. (Table 1)

When the Paired t-test at 5% level of significance was applied to compare mean GRAT, GAP and total scores of the case group A & B with their respective mean IRAT scores, a significant rise in the scores was observed with p value less than 0.00001 for both, showing positive effect of the team-work on the students' performance. (Table 2)

When IRAT scores of all the students were compared with their individual total scores, 115 (97.45 %) students showed rise in their marks irrespective of their level of individual scores. It was observed that the low achievers or slow learners benefit much more than medium or advanced learners. (Table 3)

During individual team performance analysis, it was observed that out of the 28 teams, 25 teams had scored more in their GRAT as compared to average IRAT of all team members of each team. 2 teams had scored equal, while only one team had scored less. Team GAP score was always higher than average IRAT of all team members of any team.

Also average total score for team was higher than average IRAT of all team members, for all the teams except one. As the proportion of rise in marks was also not equal for all the teams, it showed that, team performance is a multifactorial entity and not just sum of its individual members.

Average total scores of 18 teams were higher than the marks of their team's highest IRAT scorer. But 10 teams have failed to score more than or equal to their highest scorer. This again has showed that team performance is not always dependent on or proportionate to its highest scorer. (Table 4)

For the assessment of the internal consistency of the feedback questionnaire, the Cronbach's alpha has been tabulated. The Cronbach's alpha value of 0.965 has shown an adequate level of the inner-item reliability and good consistency in the data received from feedback. Further analysis has found that deleting any of the question from the designed feedback form would not have any significant increment in the Cronbach's alpha value.

The statements have been scored on Likert type scale from 1 (strongly agree) to 5 (strongly disagree). All the students have strongly agreed on the acceptance of TBL, as is seen by 67.8 to 88.14 % acceptance (agree and strongly agree) for all the questions. (Table 5) The performance grading of the feedback using mean or median has also shown similar 60.17% to 84.7% acceptance of TBL as teaching learning tool.

The study of the subsets has shown a highest positive response to the phase 1 or preparatory phase of the TBL, where 80% students have felt motivated for self-study. In the subset of actual tests most (86%) have favored GAP and immediate question answer feedback. 78% students

have liked the TBL session conduction and noticed its value in understanding the subject. (Table 6) Its worthy of note here that 69% felt TBL was actually a challenge and has helped to bring out their best.

The question number 4.4 has brought forth that students perceive all the 4 components of TBL – preparation, tests, teamwork, immediate question answer feedback as important (Average 80.3%). It has also once again showed that the preparation (84%) and immediate question answer feedback (82%) were the most liked parts of the TBL. (Graph 1)

73% students have experienced the value of team work in studying, understanding and improving their communication skills. 74% students have recommended that TBL should become the part of the curriculum. (Table 6)

69 % students have preferred TBL to the traditional didactic sessions, while 68% felt that some topics can even be taught as TBL without a prior didactic lecture. (Table 5)

It has been noted that even though there was so much positive feedback for TBL, in response to question number 5.5, 51% students have still felt that they prefer to study individually than in a team. This may be because of their lack of exposure to academic team work till their entry in to medical course. (Table 5)

DISCUSSION

Students of 1st (Preclinical) year were introduced to TBL – a student centric teaching learning tool to overcome perceived drawbacks of traditional didactic way of teaching professional students. TBL was also chosen because it requires less resources, specially facilitators, at the same time giving all the benefits of active learning to the students. Even though it was a new, active, responsible mode of learning for students, the analysis of data showed TBL to be a good alternative, beneficial as well as enjoyable teaching learning tool for the medical students.

The comparison of IRAT mean scores of both the groups with the MCQ test mean scores of the corresponding control groups showed that both the groups were at par with each other

with respect to individual learner level. But the impact of group discussions became apparent when the total scores in both TBL groups (10.32, 10.83) were found to be much higher than the total scores in both the corresponding control groups (8.35, 8.52).

The higher mean scores of the GAP in the TBL groups (13.32, 13.06) with respect to the control groups (10.83, 10.93) also brought out the difference between group and individual study. Study as a team was seen to be more beneficial for higher, application type of learning. Another study has also expressed that the group discussion of case allows learning in depth.[1]

There was a significant positive effect on students' performance when they worked as team. This was clearly seen by the 'p' value of less than 0.00001 obtained while comparing the rise in scores between the mean GRAT, GAP and total scores of case group A & B with their corresponding mean IRAT scores. (Table 1 & 2)

When IRAT scores of all the students were compared with their individual total scores, it was observed that the low achievers or slow learners benefit more than the medium or advanced learners. While the students below 35 % showed a rise of 102 % in their scores the benefit reduced as the IRAT became higher, so that the students above 75 % showed only 3.7% rise in their marks. (Table 3) It has been evident that TBL enhances the outcomes especially for the low scorers in bottom 20%.[5]

In this study we have not analyzed effect on overall performance of the students. But many prior studies have found that TBL works mainly for low performing students. [6,1,7] One more study has found that, based on the examination scores, even though TBL improves all students, the bottom 25% students get the maximum benefit. [8]

Analysis of the individual team performance showed that as compared to the average IRAT of all the team members for any team, their team's GRAT (in 89.2%), GAP (in 100%) and the average total score for the team (in 96%) were higher. Only 7% teams (2) showed GRAT and 4% (1 team) showed average total score for

team equal to their average IRAT of all team members. 4% (1 team) had GRAT less than their average IRAT of all team members. (Table 4) A study has reported improved understanding in students, as a group, with 81% students showing higher GRAT scores compared to IRAT. They have also found 1 team, not doing better as a group, similar to the observation in the present study and they felt that such group will do better over time with more experience to work as a team. [9]

It was also very interesting to note that even though 64% teams had their average total scores higher than the marks of their team's highest IRAT scorer, 36% teams have failed to achieve this. Through these findings about teams it can be observed that the team performance is not always same as its highest performer or sum of its individual members. Similar effect has been observed in a study, where their team GRAT score was on average 16% higher than mean team IRAT scores for all teams. With GAP they found no correlation. They also found that all teams always did better than their smartest member and team performed better if all its members were well prepared. [6] It has also been stated that the group outperforms the individual.[1] (Table 4)

The feedback of all the items has shown that 67.8 to 88.14 % students (Average 78%) have accepted TBL as a good learning method. This is in consistency with a prior study in which students felt TBL was a viable alternative. They have reported that students felt TBL helped them understand anatomical concepts.[6]

TBL used in Physiology, during a study, has found 98% students agreeing that TBL was very helpful and presented an opportunity to discuss topic with peers to understand concepts. [7] One interesting finding in another study is that, even though favoured by all, high achieving students showed higher preference to TBL than the low achievers. [10]

The highest number of students (84%) in this study have given positive response to the preparatory phase of the TBL. 80% felt motivated for self-study. (Table 6) Due to its individual and group testing pattern, TBL is perceived by the students as a good, motivational self-directed learning method. Prior studies have also found that the TBL promotes self-directed learning.[11,12]

69% students felt that the TBL was actually a challenge and brought out the best in them. 2 other studies also report students being motivated to prepare well before session.[13,14] One of them has reported that 82.9% students felt the IRAT to have helped them learn how to study prior to exams in available time. [14] The other has surmised that motivation may be due to the awareness of having to appear for test individually (IRAT) before joining their team. They also found that males (82.3%) were motivated more by TBL mode of learning than females (68.4%). This they attribute to males and females having different learning style preference as per VARK model. [13]

In this study TBL has helped students (73%) understand the value of the team-work in studying, understanding, applying concepts and improving their communication skills. The previous studies have also reported students' satisfaction in team interaction and better learning as part of a team. [7,15] In one study students (77.7%) felt they had more effective understanding of the subject when they studied as team than individually. 71.3% students from the same study also felt that the TBL sessions will actually build their higher skills to perform as a team member.[14] Students have also perceived that team study was important for higher engagement with more question solving ability as a group and benefits from peer interaction. [9]

A study has found high acceptance of value of team-work in students after TBL. They had measured team related outcomes like ability to work in a team, mutual respect in members, contributing to team effort.[10] It is observed that working as team increases active participation by students.[1] This positive feedback about team-work also leads us to believe that when TBL becomes part of the curriculum, higher skills fostered through the team-work so early in their career will help the students become better professionals.

Even though they valued team work, when asked specifically in question number 5.5 , 51% students in this study showed preference to study individually than in team. Students' giving less value to team work as compared to other aspects of TBL probably due to more individualistic and competitive secondary education, leading to non-sharing, has been previously reported.[13]

86 % students in this study liked GAP or clinical problem solving part of TBL. One study has similar result with (84%) students agreeing that TBL is much better method in developing their critical thinking and the problem solving skills. [14]

This study also found that students (86%) mainly like the immediate feedback part of the TBL. In another study students felt that all their doubts about the topic are dealt with in the immediate feedback part of TBL session.[16]

Even though in our study, this was their 1st and one time exposure to TBL, 69% students preferred TBL to the traditional didactic sessions. They felt that TBL definitely has a place in the Anatomy curriculum. 68% even considered it a possibility that some topics may be covered without a prior didactic lecture. Comparatively only 31% felt TBL could replace didactic lectures for some topics in one study. [7] But there has been other report with comparable finding. Their students found TBL to be an interesting way of learning, enabling them to understand and analyse the topic better than in lectures. [15] There are also in contrast prior studies documenting more acceptance of didactic mode of teaching by the students in comparison with newer active learning strategies like TBL. [17,18]

With very good feedback from the students TBL has become part of curriculum in many institutes. [6]. A Study has reported replacing anatomy lectures with TBL. [1] But another study has felt that supplementing didactic lectures with TBL would be more advantageous, especially for the low achievers. [7] Another study found that TBL not only improves students scores as compared to didactic teaching but also it makes studying more enjoyable. Students in their study also said

that TBL motivates them through need for self directed and peer learning.[19]

It has been observed in a study that the students enter any learning session with prior assumptions about its value. Even though the study has found no difference in effect on knowledge gain by the students in didactic and active forms, authors of that study still felt that it is prudent to find whether active learning will affect overall outcome.[17] Another study has noted that the students' higher rating of didactic mode was mainly based on their perceived satisfaction based on scores and not other outcomes needed to emerge as a good practitioner. [18] We have also felt the need to explore these aspects more and so at present TBL can be used in addition to the didactic teaching.

In this study, peer evaluation, which is a part of standard procedure of TBL as described by Michaelson and necessary to ensure accountability, has not been done. As stated by previous researchers we also felt that students might show resistance to it. [7] The peer evaluation has been also considered by another previous study to be a controversial part of TBL, with the suggested need to change it's pattern in future. [6]

CONCLUSION

TBL is thus a good active teaching learning tool for the large classes. The study has shown that students learn and perform better with this team-based approach. They show better understanding during case solving or critical thinking exercises as a team. TBL improves performance of all students especially the low achievers. Students through their positive feedback have shown that TBL should definitely become part of Anatomy curriculum. In future, with TBL integrated in curriculum, we would like to explore its effect on overall performance of the students and on their soft skill development such as working in team, communication, critical thinking. TBL as a teaching learning tool in Anatomy will definitely contribute to making medical students better professionals in future.

REFERENCES

1. Vasan NS, Defouw DO, Compton S. Team-based learning in Anatomy: an efficient, effective and economical strategy. Anat Sci Educ 2011;4(6):333-339.

2. Burgess A, Bleasel J, Haq I, Roberts C, Garsia R, Robertson T, Mellis C. Team based learning (TBL) in the medical curriculum : better than PBL?. BMC Med Educ 2017;17(1):243

3. Ismail NA. Effectiveness of Team-based learning in teaching medical genetics to medical undergraduates. Malays J Med Sci 2016;23(2): 73-77

4. Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE guide no. 65. Med Teach 2012;34(5):e275-287.

5. Compton S, Kamei R, Cook S. The history and future of Team-based learning. Proc. Singapore Healthc. 2016;25(1):3-4.

6. Nieder GL, Parmelee DX, Stolfi A, Hudes PD. Team-based learning in a medical gross anatomy and embryology course. Clin Anat N Y N. 2005;18(1):56-63.

7. Punja D, Kalludi SN, Pai KM, Rao RK, Dhar M. Team-based learning as a teaching strategy for first-year medical students. Australas Med J. 2014;7(12):490–499.

8. Koles PG, Stolfi A, Borges NJ, Nelson S, Parmelee DX. The impact of Team-based learning on medical students' academic performance. Acad Med J Assoc Am Med Coll. 2010;85(11):1739-1745.

9. Malone E, Spieth A. Team-based learning in a subsection of a veterinary course as compared to standard lectures. Journal of the scholarship of Teaching and learning 2012;12(3):88-107.

10. Vasan NS, Defouw DO, Compton S. A survey of student perceptions of Team-based learning in anatomy curriculum: favorable views unrelated to grades. Anat Sci Educ 2009;2(4):150-155.

11. Letassy NA, Fugate SE, Medina MS, Stroup JS, Britton ML. Instructional design and assessment – Using Team-based learning in an endocrine module taught across two campuses. Am. J. Pharm. Educ 2008;72(5):1-6.

12. Cheng C-Y, Liou S-R, Tsai H-M, Chang C-H. 2014. The effects of team-based learning on learning behaviours in the maternal-child learning course. Nurse Educ Today 34(1):25-30.

13. Inuwa IM. Perceptions and attitudes of first-year medical students on a modified Team-based learning (TBL) strategy in anatomy. Sultan Qaboos Univ Med J. 2012;12(3): 336-343.

14. Deardorff AS, Moore JA, Borges NJ, Parmelee DX. Assessing first year medical student attitudes of effectiveness of Team-based learning. Med Sci Educ. 2014;20(2):67-72.

15. Vijayalakshmi SB, Srinivasan A, Nazli L, Ansari AW. Performance and perception of the first year medical students about the Team-based learning in anatomy. J Contemp Med Educ 2016;4(3):120–122.

16. Alwahab A, Abdulqader S, Nugud A, Nugud S, Cyprian F, Shaikh AA, Anwar K. Team-based learning in an undergraduate pathology curriculum and its effects on

student performance. J Taibah Univ Med Sci 2018. (Available online 27 June 2018)

17. Haidet P, Morgan RO, O'malley K, Moran BJ, Richards BF. A controlled trial of active versus passive learning strategies in a large group setting. Adv Health Sci Educ Theory Pract 2004;9(1):15-27.

18. Jelsing EJ, Lachman N, O'Neil AE, Pawlina W. Can a flexible medical curriculum promote student learning and satisfaction? Ann Acad Med Singapore 2007;36(9):713-718.

19. Hashmi NR. Team based learning (TBL) in undergraduate medical education. J Coll Physicians Surg Pak 2014;24(8): 553-556

TABLES

Table 1 : Scores and statistics of TBL sessions for both Groups A & B

TBL Session	Case & control group	Test	Mean score	Total no. (N)	Std. dev.	Std. error mean
I	Case Group A	IRAT	8.26	59	2.62	0.34
		GRAT	11.03	59	2.41	0.31
		GAP	13.07	59	2.48	0.32
		TOTAL	10.83	59	1.88	0.25
	Control group B	MCQ – B	7.45	59	2.73	0.36
		AP MCQ – B	10.93	59	2.72	0.35
		TOTAL – B	8.52	59	2.39	0.31
II	Case Group B	IRAT	7.44	59	2.39	0.31
		GRAT	10.24	59	1.85	0.24
		GAP	13.32	59	2.63	0.34
		TOTAL	10.32	59	1.63	0.21
	Control group A	MCQ – A	7.14	59	2.71	0.35
		AP MCQ – A	10.83	59	3.05	0.40
		TOTAL – A	8.36	59	2.16	0.28

Foot note:

Case group – group which attended TBL session, **Control group** – remaining group when one group went for TBL session, **IRAT** – Individual Readiness Assurance Test, **GRAT** – Group Readiness Assurance Test, **GAP** – Group Application Problem, **Std. dev.** – Standard deviation

Table 2: Paired samples test for both groups A & B

Gr.	Pair	Paired Differences					t	df	p - Significance (2-tailed)
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
A	GRAT – IRAT	2.77	3.14	0.41	1.95	3.59	6.79	58	0.000
	GAP – IRAT	4.81	3.42	0.45	3.91	5.70	10.79	58	0.000
	TOTAL – IRAT	2.57	2.19	0.29	2.00	3.14	9.01	58	0.000
B	GRAT – IRAT	2.80	2.40	0.31	2.17	3.42	8.96	58	0.000
	GAP – IRAT	5.88	3.12	0.41	5.07	6.70	14.46	58	0.000
	TOTAL – IRAT	2.88	1.66	0.22	2.45	3.31	13.38	58	0.000

Foot note :

IRAT – Average IRAT for concerned group, **GRAT** – Average IRAT for concerned group, **GAP** – Average IRAT for concerned group, **Total** – Average Total score for concerned group

Table 3 : Comparison of Mean IRAT marks of a learner group with its mean total marks, for different types of learners

Sr. no.	Learner	No. of students	Mean IRAT marks	Mean total marks	% of raise in marks
1	Slow < 35 %	24	4.41	8.95	102%
2	Medium – 35 – 50 %	32	6.57	10	52.2%
3	Medium – 50 – 74 %	39	9.02	11.2	24.1%
4	Advanced > 75 %	23	11.52	11.95	3.7%

Foot note:

Learners have been categorized in to slow, medium and advanced learners depending on percentage of marks they have obtained in their IRAT.

Table 4 : Comparison of different scores of each team for both the groups A & B

Group	Team number	Highest IRAT score from team	Average IRAT score of team	GRAT	GAP	Average Total score of team
A	A1	12	10.12	13.5	15	12.95
	A2	12	8.62	15	15	13.12
	A3	10.5	8.62	15	15	13.1
	A4	12	9.75	13.5	15	12.85
	A5	12	8.4	12	15	11.84
	A6	10.5	7.5	7.5	9	7.97
	A7	12	8.25	7.5	9	8.2
	A8	12	9	12	15	12
	A9	10.5	8.1	10.5	9	9.34
	A10	12	7.12	9	15	10.27
	A11	10.5	8.25	10.5	12	10.32
	A12	12	6.9	10.5	15	10.76
	A13	9	6.75	9	12	9.22
	A14	12	8.62	9	12	9.8
B	B1	8	7	7	12	8.5
	B2	10	7.25	10	15	10.67
	B3	8	5.75	7	15	9.02
	B4	9	6	10	15	10.3
	B5	9	6.25	10	15	10.37
	B6	11	7.4	11	12	10.22
	B7	9	5.6	8	6	6.68
	B8	12	10.25	12	15	12.37
	B9	10	8	11	15	11.3
	B10	10	7.25	10	15	10.67
	B11	11	8.25	10	15	10.97
	B12	9	6.8	13	12	10.84
	B13	12	10.25	13	15	12.77
	B14	12	8.75	11	12	10.62

Table 5: TBL feedback analysis for each item

| Q No	Question	Percentage of rating		
		1 & 2	3	4 & 5
1.1	The suggested study material covered objectives thoroughly	88.14	5.932	5.93
1.2	The given learning objectives were clear and specific	83.90	10.17	5.93
1.3	TBL motivated me to undertake self-study	79.66	11.86	8.47
2.1	TBL helped me learn how to study in a group	75.42	11.02	13.56
2.2	Group discussions helped me understand the topic better	70.34	15.25	14.41
2.3	TBL taught me the importance of team work	74.58	15.25	10.17
2.4	TBL helped me improve my communication skills	72.03	15.25	12.71
3.1	The Individual Readiness Assurance Test (IRAT) covered the topic thoroughly	74.58	19.49	5.93
3.2	The Group Application Problem (GAP) taught me to apply my knowledge to clinical problem	85.59	9.322	5.08
3.3	The immediate feedback and discussion after Group RAT and GAP increased my understanding of the topic	85.59	8.475	5.93
4.1	The TBL sessions were well organized with reference to time and place	79.66	12.71	7.63
4.2	The facilitators guided the sessions well and kept me active	86.44	5.932	7.63
4.3	TBL focuses on understanding rather than memorization	78.81	13.56	7.63
4.4a	most beneficial part of the TBL - a) Preparatory reading	83.90	10.17	5.93
4.4b	most beneficial part of the TBL - b) IRAT	77.12	18.64	4.24
4.4c	most beneficial part of the TBL - c) Teamwork	77.97	14.41	7.63
4.4d	most beneficial part of the TBL - d) Feedback	82.20	11.86	5.93
4.5	TBL challenged me and brought the best out of me	68.64	23.73	7.63
4.6	TBL had a positive impact on my learning	77.97	11.86	10.17
5.1	I prefer TBL to normal didactic sessions	69.49	16.95	13.56
5.2	Some topics can be learned using TBL without any prior didactic sessions	67.80	16.95	15.25
5.3	More topics should be covered as TBL sessions	76.27	11.02	12.71
5.4	I look forward to learn again in a TBL session	80.51	11.86	6.78
5.5	I would prefer studying individually than as team in TBL	50.85	27.97	21.19
5.6	Learning TBL technique will help improve my overall performance	75.42	12.71	11.86

Foot note :

Q no. = Question number, **1 & 2** = Strongly agree & agree, **3** = Neutral, **4 & 5** = Disagree & Strongly disagree

Table 6: Feedback analysis for Questionnaire subsets

Sr. no.	Subset	Subset - average response		
		1 & 2	**3**	**4 & 5**
1	Preparatory phase	83.9	9.33	6.77
2	Team work	73.09	14.2	12.71
3	Actual tests conducted	81.92	12.44	5.64
4	Conduction of session (4.4 excluded)	78.32	13.55	8.13
5	About future (5.5 excluded)	73.89	13.89	12.03

Foot note :

Subset - average response - 1 & 2 = Strongly agree & agree, **3** = Neutral, **4 & 5** = Disagree & Strongly disagree

GRAPH

Graph 1: Graph showing Analysis of Question no. 4.4, for most beneficial part of TBL
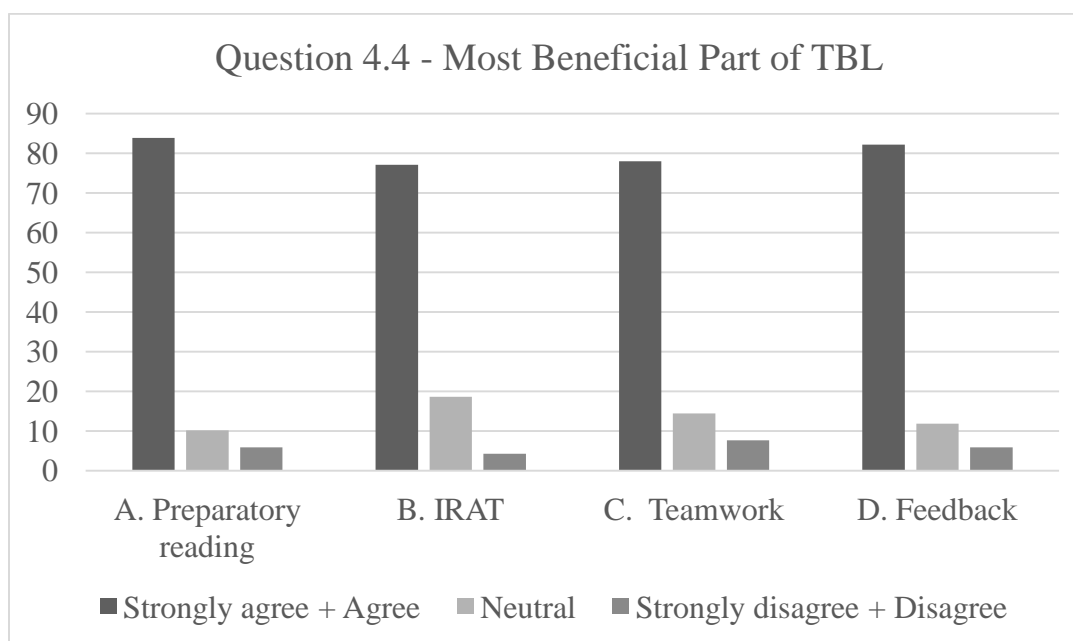
Figure legends

(4 parts of question are as follows – a. – Preparatory Reading, b. – IRAT, c. – Teamwork, d. – Feedback)