Student Team Achievement Division as a tool for peer assisted co-operative learning in neuroanatomy

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Abstract: Student Team Achievement Division (STAD) is a co-operative learning approach premised on a group learning activity that emphazises learning as a social exchange of knowledge between students, in which each student is accountable for his or her own learning and is also encouraged to assist others in achieving their goals. It promotes the cognitive, psychomotor, and emotional growth of students involved in the team. By random sequencing, 60 participants were allocated to interventional group (n=30) and control group (n=30). The participants of the interventional group were subjected to STAD strategy and participants of the control group were instructed to do a conventional self learning on the ventricles of brain. The outcomes were statistically analysed. It was found that the performance of the students is far better with STAD approach than conventional self learning. Our study has shown that Students team Achievement Division can be used as an effective tool for Peer assisted Co-operative Learning in Anatomy. Further studies can be done to investigate the contribution of STAD to teaching other disciplines of Anatomy and other basic medical sciences.

Key words: Student Teams Achievement Division, Peer assisted learning, Co-operative learning

Introduction

Traditional lecture-based teaching, followed by conventional self learning is the most common instructional technique in higher education around the globe, and it is extensively utilised and admired by many faculties and students. It has long been seen to be the most effective method of directly imparting knowledge to students. The usefulness of this strategy, however, is increasingly being challenged since didactic teaching is a passive, superficial approach that involves minimal engagement from students in their learning. This teaching-learning method seldom mobilizes students' initiative and fails to stimulate innovation in the classroom [1]. Active learning captivates students' interest in learning, encourages student involvement, and reinforces the knowledge. One of the active learning strategies are the co-operative learning achieved via Peer assisted learning.

Peer Assisted Co-operative Learning (PACL) encompasses a broad range of student activities, such as discussion, seminars, collaborative work projects – all of which take place within the context of various-sized groups and workplace-based coaching. This one-of-a-kind learning approach is an amorphous word that refers to bilateral, reciprocal learning experiences that benefit all participants by encouraging active participation. PACL promotes the cognitive, psycho-motor, and emotional growth of students involved in the team. Self-confidence, individuality, clinical reasoning, self-evaluation, and peer cooperation all improve as a result of this [2, 3]. The advantages of PACL are not only limited to

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test scores. The construction of a reciprocal social support system has also been shown to reduce subjective discomfort and improve course satisfaction for students [4]. Several studies analyzed the results of PACL with that of faculty-led teaching in clinical skill acquisition and problem-based curriculum design in the health sciences, finding that students' academic performance after PACL was as successful as faculty-led teaching technique.

There are several strategies for employing PACL such as jigsaw method, proctor model, discussion seminars, cascading groups, reciprocal teaching, scripted cooperation and collaborative projects [5]. There is currently a considerable body of data supporting the effectiveness of PACL in clinical training of medical students. Physical examination, resuscitation procedures, ultrasound, and surgical expertise have all been taught well using this technique. In contrast to clinical training, there is scanty of literature on the effectiveness of PACL in teaching basic sciences for preclinical medical students. Student Teams Achievement Division (STAD) is a co-operative learning approach premised on a group learning activity that emphasizes learning as a social exchange of knowledge between students, in which each student is accountable for his or her own learning and is also encouraged to assist others in achieving their goals. STAD shifts the focus of teaching away from knowledge transmission to knowledge construction. It improves learning outcomes and social skills, and more the students work together in cooperative learning, the more they comprehend, retain, and feel positive about themselves and their peers. Furthermore, working together in a collective unit which improves learning outcomes and social skills. This learning atmosphere also fosters student responsibility [6].

In this study, we employed STAD as a tool for PACL for the purpose of teaching Neuroanatomy to encourage students' active engagement and better understanding. We evaluated effectiveness of learning complicated subjects by using STAD approach with that of self learning. To our knowledge, this is the first study where STAD technique has been employed as a PACL tool in teaching Anatomy.

Objectives

To employ STAD as a tool for PACL in Neuroanatomy and compare its effectiveness with the traditional learning.

A brief description of STAD strategy

The discussion topic is presented to the students in a usual lecture format during the teaching hours. Then during the small group activities session, the students are assigned to 5 or 6 members learning team. The team should be heterogeneous consisting performers of all levels. The team members are asked to discuss the topic taken. The team's primary role is to ensure that all team members learn to prepare their members for a quiz. Following the discussion, the students will be working on individual quiz. Now the students are not allowed to help each other. Each student individual score is assessed. The mean total score of the team is also assessed. The idea behind this is to give each student performance goal that will be achieved if they work harder. The team which has scored more will be awarded a reward. This ensures to contribute to the team score, each student should improve his performance score which could be achieved by active participation and learning in the discussion (Fig. 1).

Methodology

After obtaining approval and clearance from the Institute Research Cell and the Institute Ethics Committee [IEC reference number:AIIMS/BBN/IEC/DEC/2021/126], a randomized interventional study was carried out among the first year M.B.B.S. students in the Department of Anatomy, AIIMS Bibinagar. The study participation was voluntary. We provided all students with detailed information about the study's objectives and assured them of confidentiality and anonymity when it came to their personal information.

Study participants

The study involved a total of 60 participants (37 male and 23 female). The sixty participants for this study was selected based on their performance in their previous internal assessment. Now the sixty participants were divided into two subgroups of high performers (30 participants) and average performers (30 participants) based on their scores in the previous internal assessment. Then by simple random allocation, participants from the high performers group were allocated to control group (15 students) and interventional group (15 students). Similarly, the participants from average performers group were also allocated to control group (15 students) and interventional group (15 students). Now all the sixty participants were ultimately assigned the control group [n=30; 17 male and 13 female] and the interventional group [n=30; 20 male and 10 female]. This ensured that both the control and interventional group is heterogeneous containing performers of all levels.
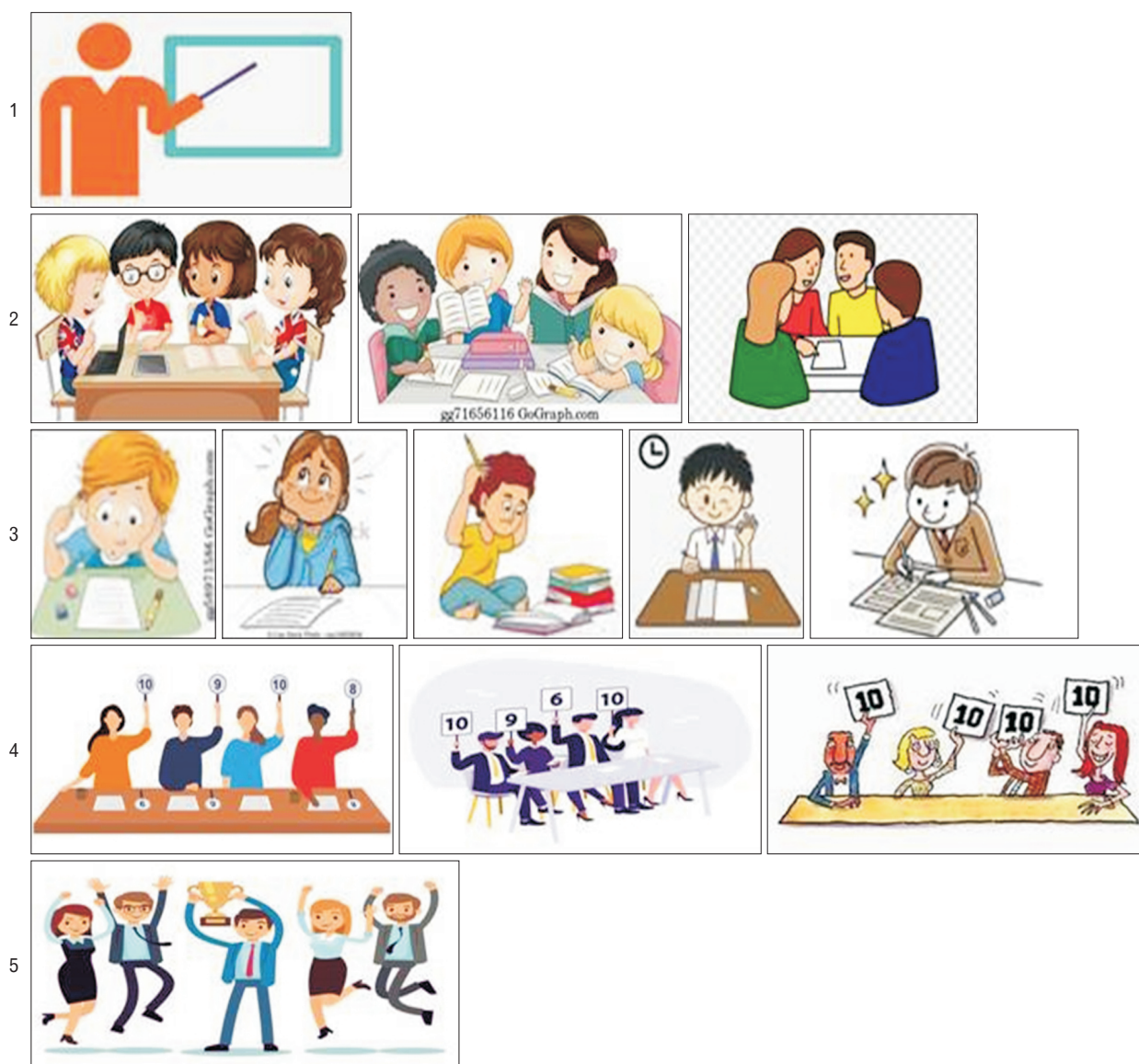
Fig. 1. Steps involved in STAD. Step 1: Teach via conventional lecture format. Step 2: Team study – members in a team help each other. Step 3: Individual test (no one is allowed to help others). Step 4: Participants are asked to go back to their original teams; in addition to individual scor assessment, total score of the team is also evaluated. Step 5: Team with the highest score is rewarded.

Materials and Methods

All the participants were given a conventional didactic lecture on the ventricles of brain for 1 hour 30 minutes. The proposed interventional strategy was carried out during the tutorial hours. The participants of the interventional group were subjected to STAD strategy. The thirty (30) students of the interventional group were subdivided into five teams of 6 members each by stratified random sampling technique to ensure that the team performers were heterogenous. They were asked to discuss with their team members about the ventricles of the brain. The total time allotted for this discussion was 45 minutes. The participants of the control group were instructed to do a conventional self learning on the ventricles of brain. The time allotted for self learning was also 45 minutes. Both the groups were then subjected to a post assessment test on the same topic after duration of 45 minutes. The assessment test consisted of 20 multiple choice questions, out of which, 15 questions were straightforward and 5 questions required critical thinking and the time allotted for the assessment was 25 minutes. Now the students were not allowed to help each other. Each student individual
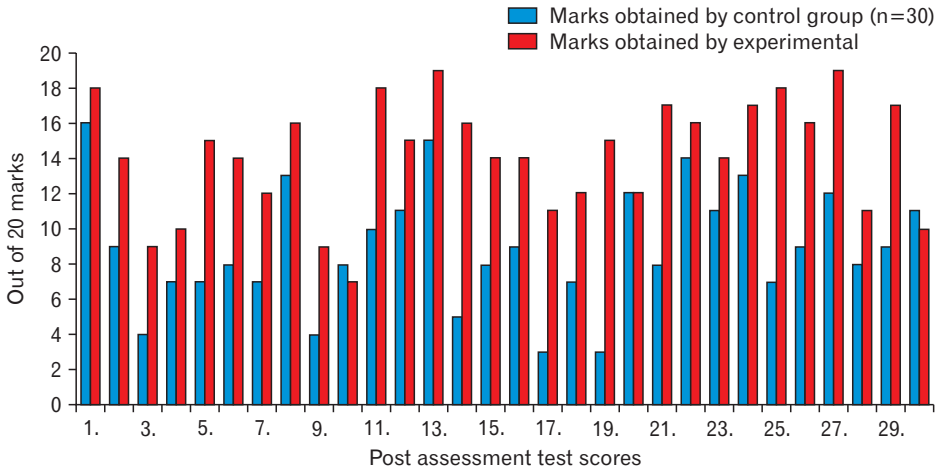
Fig. 2. Marks obtained by the students in the post assessment test.

Table 1. Marks obtained by the students in the post assessment test

No.	Marks obtained by control group (n=30) Max marks=20	Marks obtained by experimental group (n=30) Max marks=20
1.	16	18
2.	9	14
3.	4	9
4.	7	10
5.	7	15
6.	8	14
7.	7	12
8.	13	16
9.	4	9
10.	8	7
11.	10	18
12.	11	15
13.	15	19
14.	5	16
15.	8	14
16.	9	14
17.	3	11
18.	7	12
19.	3	15
20.	12	12
21.	8	17
22.	14	16
23.	11	14
24.	13	17
25.	7	18
26.	9	16
27.	12	19
28.	8	11
29.	9	17
30.	11	10

score (post assessment tests score) was assessed (Fig. 2, Table 1). The mean total score of the team was also assessed. The team that scored more was awarded a reward.

A prevalidated questionnaire for feedback comprising both closed ended and open ended questions prepared on the basis of 5 point Likert scale were used to assess the learning experience of the students in the interventional group and their perception towards the activity.

Appropriate statistical analysis was done on the quantitative and qualitative data. Mean and standard deviation was used to measure the quantitative variables and any significant difference in the outcome was analysed by unpaired student t-test. Mean score was calculated for the close ended statement with Likert Scale response. The open ended questions were analysed by content analysis for identifying, interpreting and obtaining themes for student's response.

Results

The present study included 60 (37 males; 23 females) First year M.B.B.S. students of 2020-21 batch of AIIMS Bibinagar. All students were of age group 19–22 years. None of them had the prior experience of STAD technique. Individual score obtained by each student was calculated and presented in the Bar graph (Fig. 2, Table 1).

The two tailed P value obltained is 0.0001 which is considered to be statistically very significant ($P<0.01$); t=6.012 with 58 degrees of freedom. The result signifies that the performance of the students is far better with STAD approach than conventional self learning (Table 2).

Most of the participants (30% strongly agree; 57% agree) agreed that the STAD technique gave them in-depth understanding of the subject. Many (50% strongly agree) were of the view that STAD approach kept them motivated throughout the learning. They also opined that it greatly improved their communication skills (Fig. 3, Table 3).

Table 2. Comparison of students' performance in the assessment test using unpaired t test

| Group | Intervention applied | Assessment test (out of 20 marks) | | Computed t-value | P-value |
		Mean	Standard deviation		
Experimental group (n=30)	STAD technique	14.16	3.23	6.012	0.0001
Control group (n=30)	Conventional self learning	8.93	3.4		

STAD, Student Team Achievement Division.

Table 3. Feedback from the students regarding the STAD strategy

| No.	Feedback question	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)
1	Gives in-depth understanding of the subject	30	57	13	0	0
2	Promotes co-operative learning and helps us encourage each other in the learning process	53	40	7	0	0
3	It is time consuming	10	20	27	30	13
4	Interacting with other students motivate me to learn	50	40	7	3	0
5	Keeps us interested and motivated throughout the session	50	50	0	0	0
6	Improves our learning skills	50	37	13	0	0
7	Improves our problem-solving skills	27	63	10	0	0
8	Improves our communication skills	43	50	7	0	0
9	Major topics to be covered by this method	33	27	20	17	3

STAD, Student Team Achievement Division.
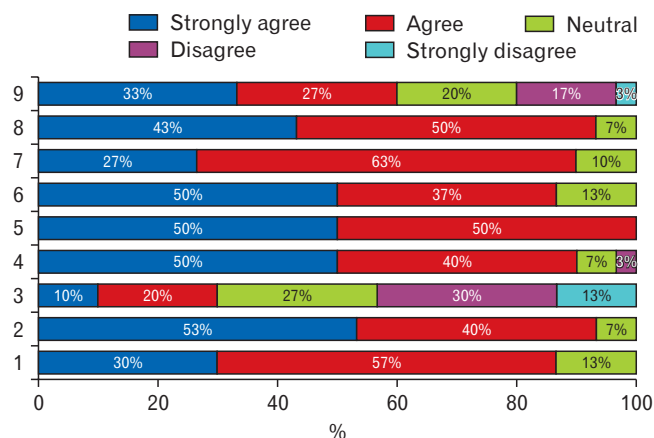
Fig. 3. Feedback from the students regarding the STAD strategy. 1, Gives in-depth understanding of the subject; 2, Promotes co-operative learning and helps us encourage each other in the learning process; 3, It is time consuming; 4, Interacting with other students motivate me to learn; 5, Keeps us interested and motivated throughout the session; 6, Improves our learning skills; 7, Improves our problem-solving skills; 8, Improves our communication skills; 9, Major topics to be covered by this method. STAD, Student Team Achievement Division.

Discussion

Supportive classroom environments are essential for engaging students in meaningful learning experiences, encouraging positive relationships between them, and allowing students to effectively manage their own learning [7]. Slavin and his colleagues at John Hopkin's university created a sort of PACL called STAD. STAD is one of the most important PACL techniques, and it has influenced favourable outcomes in a variety of grades and topics [8].

Team rewards, individual responsibility, and fair opportunity for achievement are three fundamental elements of STAD. If a STAD group meets or exceeds a set goal, the group receives a certificate or other prize. As a result, the spirit of friendly rivalry is encouraged, and all or none of the groups are awarded based on their performance. In terms of individual responsibility, the performance of the teams is determined by the individual learning of each of the group members. Students teach one another to ensure that everyone in the group is prepared for the individual quizzes. Individual student progress outlines their contributions to the group in terms of equitable possibilities for achievement. This ensures that all group members, regardless of their skill level, are equally motivated to achieve their best [9].

Newman stated that well-structured cooperative learning approaches such as STAD may ensure that all members of a group actively engage in the learning process. STAD has taken into account one of the most important aspects of any teaching method: motivation. He considers group work to be an important teaching approach as well as a learning style. [10].

STAD can be used in a variety of contexts. Although STAD is not a full teaching approach, it may be used to structure lessons, which can lead to all students' success.

The key tenet of this method is that students work together to learn and are held accountable for their teammates' and personal accomplishments [11]. Reportedly, ours is the first study in the literature where STAD approach has been applied for better understanding of basic medical sciences.

The present study proved that STAD as a tool in PACL is beneficial. Almost 90% participants agreed that STAD gave them in-depth understanding of the subject and helped them to encourage each other in the process of learning. They felt their communication skill and problem solving capacity was greatly improved by this approach. Many participants of STAD reported that the approach was more informal and relaxed, which helped them to concentrate better. A few participants remarked that they felt freer to ask questions and gather information. A few other participants opined that they could take this strategy as a chance to better them and also to assist others and to be offered help from others in understanding complicated topics. Moreover, the students intervened with STAD achieved significantly better score in the post assessment test ($P<0.01$) when compared to the students who did conventional self-learning. The STAD group was focused on cooperative learning with positive peer communication, whereas the control group was focused on conventional learning with no peer communication, which may explain the difference in the importance of these two educational strategies. One of the core concepts of the STAD cooperative learning approach is group incentives, which can have a significant influence on student progress. Another possible explanation why learners in the STAD group were more effective than those in the control group is because traditional instruction does not provide individual learning and practise with interpersonal feedback. Furthermore, the learning environment may enable learners to digest facts more deeply than those who are acquiring the knowledge on their own.

Like our study, Ishtiaq and Hussain [12] compared conventional groups (without group goals and individual responsibility) to STAD groups and found that the STAD group outperformed the traditional group. Our study participants (90%) agreed that interacting with other students motivate them to learn and perform better. Madden and Slavin [13] discovered that STAD groups had much greater overall self-esteem than control groups that might be considered as a psychological effect of cooperative learning approaches such as STAD. In the present study, more than half the participants agreed that STAD approach improves

their communication skill and problem solving skill which in turn gives a positive impact on the psychological aspect of learning. In a study done by Keramati [14] students taght by STAD technique are more successful than the control group students. Similarly Yu [15] found that subjects in the cooperation tended to have higher scores on both the posttest and questionnaire measuring attitudes toward science course.

The STAD method reduces listening time and empowers students to take charge of their own learning. This strategy emphasises contact and develops an attitude of collaboration and respect for other students, because each group relies on its members to do well in order for the entire group to flourish. Taking these factors into account, teachers should allow students to examine and develop successful ways of cooperating and communicating assignment information to their teammates [16].

Although students who worked in STAD groups scored much higher than students who used traditional techniques, this does not mean that participants should do everything in groups; individual work and whole-class instruction both have their role in education. There will always be learners who want to work independently. These individuals require instruction in conversational skills such as listening, assisting, and expressing a viewpoint. To form effective teams, participants must become acquainted with one another and attempt to foster an atmosphere of trust, fair interaction, comradeship, and supportiveness among themselves [17].

Limitation

Sample size is limited. As a result, caution should be exercised when extrapolating the findings to other contexts.

Conclusion

Our study has shown that Students team Achievement Division can be used as an effective tool for PACL in Anatomy. STAD, we believe, is viable and may be used as an instructional technique within the constrained contact hours of the content-rich undergraduate medical curriculum. The current study investigated the effectiveness of STAD in learning Neuroanatomy in general. Further studies can be done to investigate the contribution of STAD to teaching other disciplines of Anatomy and other basic medical sciences.

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Author Contributions

Conceptualization: AK, MC. Data acquisition: AK. Data analysis or interpretation: AK, RM. Drafting of the manuscript: AK. Critical revision of the manuscript: AK, RM, MC. Approval of the final version of the manuscript: all authors.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

References

1. Simpson V, Oliver M. Electronic voting systems for lectures then and now: a comparison of research and practice. Aust J Educ Technol 2007;23:187-208.
2. Bugaj TJ, Blohm M, Schmid C, Koehl N, Huber J, Huhn D, Herzog W, Krautter M, Nikendei C. Peer-assisted learning (PAL): skills lab tutors' experiences and motivation. BMC Med Educ 2019;19:353.
3. Guraya SY, Abdalla ME. Determining the effectiveness of peer-assisted learning in medical education: a systematic review and meta-analysis. J Taibah Univ Med Sci 2020;15:177-84.
4. Fantuzzo JW, Dimeff LA, Fox SL. Reciprocal peer tutoring: a multimodal assessment of effectiveness with college students. Teach Psychol 1989;16:133-5.
5. Drew C. Peer to peer learning - examples, benefits & strategies [Internet]. Helpful Professor; 2019 [cited 2022 May 9]. Available from: https://helpfulprofessor.com/peer-learning/.
6. Jonassen DH. Evaluating constructivistic learning. Educ Technol 1991;31:28-33.
7. Glynn LG, MacFarlane A, Kelly M, Cantillon P, Murphy AW. Helping each other to learn--a process evaluation of peer assisted learning. BMC Med Educ 2006;6:18.
8. Rawung IY. The use of stad model in teaching English. sintuwumarosoJET 2017;3:7-12.
9. Borg WR, Gall JP, Gall MD. Applying educational research: a practical guide. 5th ed. London: Pearson Education; 2005.
10. Newman HM. The sounds of silence in communicative encounters. Commun Q 1982;30:142-9.
11. Slavin R. Instruction based on cooperative learning. In: Mayer RE, Alexander PA, editors. Handbook of Research on Learning and Instruction. New York: Routledge; 2011. p.1-21.
12. Ishtiaq M, Hussain MS. Scope of Cooperative Learning (CL) strategies in teaching English to Saudi adult EFL learners: a study of practical barriers and possible implications. Int J Appl Linguistics English Lit 2017;6:110-21.
13. Madden NA, Slavin RE. Mainstreaming students with mild handicaps: academic and social outcomes. Rev Educ Res 1983;53:519-69.
14. Keramati M. Effect of cooperative learning on academic achievement of physics course. J Comput Math Sci Teach 2010;29:155-73.
15. Yu FY. The effects of cooperation with inter-group competition on performance and attitudes in a computer-assisted science instruction. J Comput Math Sci Teach 1998;17:381-95.
16. Johnson DW, Johnson RT, Smith KA. Cooperative learning returns to college what evidence is there that it works? Change Mag High Learn 1998;30:26-35.
17. Pandya S. Understanding students' opinion on co-operative learning implementation in mathematics. Eur J Educ Stud 2017;3:132-53.