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A comparison of conventional lecture and team-based learning methods in terms of student learning and teaching satisfaction

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Abstract

Background: Team-based learning (TBL) is a structured type of cooperative learning that has growing application in medical education. This study compares levels of student learning and teaching satisfaction for a neurology course between conventional lecture and team-based learning.

Methods: The study incorporated 70 students aged 19 to 22 years at the school of rehabilitation. One half of the 16 sessions of the neurology course was taught by lectures and the second half with team-based learning. Teaching satisfaction for the teaching methods was determined on a scale with 5 options in response to 20 questions.

Results: Significant difference was found between lecture-based and team-based learning in final scores ($p<0.001$). Content validity index of the scale of student satisfaction was 94%, and external and internal consistencies of the scale were 0.954 and 0.921 orderly ($p<0.001$). The degree of satisfaction from TBL compared to the lecture method was 81.3%.

Conclusion: Results revealed more success and student satisfaction from team-based learning compared to conventional lectures in teaching neurology to undergraduate students. It seems that application of new teaching methods such as team-based learning could be effectively introduced to improve levels of education and student learning.

Keywords: Lecture, Learning, Satisfaction.

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Introduction

Cooperative learning is a form of active learning (AL) in which small groups of students work together on an issue. This method provides opportunities to develop social and communication skills and group thinking (1,2). Team-based learning (TBL) is a structured kind of cooperative learning that has been experienced in different learning environments since the 1970s (1), and its application in medical education is growing (2-4). This method, first used in business education, was later applied to undergraduate (2-4) and postgraduate (6,7) students in various areas relate to health (8). The aim of TBL is to achieve higher levels of cognitive learning using personal knowledge within a collaborative team (1).

TBL consists of three stages. At the first stage students need to study and make preparations for class discussions. The second stage is to measure students' knowledge of the subjects to be studied in the first phase with individual readiness assessment test (IRAT). This step involves a group readiness assessment test (GRAT) by establishing small groups for discussions between the teacher and classmates. At the third stage higher-level concepts are

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discussed in the groups. In fact, effective learning in TBL is conducted through interactive discussions based on key educational principles and evaluations (1).

TBL has been used in many basic and clinical courses in the field of medicine (3) but only in a few studies has it been compared with other educational methods. However, in these studies, there are many differences in aspects of research design, educational methods and study samples, but all of them have consensus on more active participation and student engagement in the process of education (6, 8-10).

In most fields of rehabilitation, different courses ranging from basic topics to professional issues are often taught by conventional lectures. In many instances, inadequate and limited information of teachers from appropriate teaching techniques is a major obstruction to achieving a good level of education, and concequently increase of students learning and satisfaction. Among the basic courses, neurology is a difficult lesson in medical and paramedical fields (11-12) and usually students lack the motivation to pursue topics in class and are passive in terms of participation in learning during taught lectures, mostly because of its wide, detailed and volatile nature. In terms of this hypothesis at least a part of low success rates and the lack of student satisfaction from this lesson can be attributed to teaching method. In this study, student learning and satisfaction from TBL and lecture methods were compared among undergraduate students in teaching a neurology course.

Methods

Participants

The study population was all undergraduate students at the School of Rehabilitation who had chosen two units of a neurology course in the academic year 2012. This non-randomized study included 70 (32 boy and 38 girl) students ranging in age from 19 to 21 years (Mean= 20.71, SD= 0.87 years). This study was approved by the Ethics Committee of IRAN University of Medical Sciences.

The content of the teaching sessions

Based on principle topics of the neurology course, from 16 academic sessions, the first half (or 8 sessions) was taught with the lecture method and the second half (8 sessions) was taught with TBL. Topics taught by lectures were: 1) pathophysiology of the nervous system, 2) examination and assessment of the motor system, 3) evaluation of neural reflexes in diseases of the nervous system, 4) examination of pairs of cranial nerves in nervous system diseases, 5) nervous system infections, 6) cerebro-vascular accidents (CVA), 7) degenerative diseases of the nervous system and 8) disease of the extra-pyramidal system. The following list of topics was taught in the other block of 8 sessions by TBL: 1) muscle diseases (Myopathies), 2) types of epilepsy and differential diagnosis, 3) increased pressure inside the skull and brain tumors, 4) traumatic brain injury, 5) headache and dizziness, 6) low back pain, 7) neuropathies and 8) congenital anomalies of the nervous system. These topics were allocated to a teaching method with consideration to creating a good balance between them in terms of volume of content and the degree of difficulty of the subject.

Lecture method

The first eight sessions of the neurology course were taught by conventional lectures. In all of these sessions, tips to improve the quality of teaching were taken as the following: 1) Making preparations in terms of educational facilities, convenience and time management. 2) Use of a good introduction speech. 3) Good presentation style with consideration of comprehensive content, logical organization of the issues and an ability to keep students' attention during the speech. 4) Summary and conclusion of the content. In the ninth session, the entire content of the lecture method presented in 8 sessions were tested by multiple questions, to cover all the material taught and to include questions varying in degrees of difficulty. Explanations were given about the TBL technique during the ninth

session that was pertinent to the eight next sessions. Furthermore, in accordance with the provisions of the TBL technique, students were divided into groups of 6 to 7 and for each group a name was chosen and a manager appointed.

TBL method

In each of the 8 sessions taught by TBL, the same steps were followed: 1) Designing IRAT that consisted of clear questions with simple to difficult arrangements. The same methodology was used to design multiple questions in both lecture and TBL methods. 2) Conducting IRAT and 3) GRAT in a closed book situation. 5) Correct GRAT and filling in an appeal form for every mistake as a separate response for each group. 6) Complete a peer evaluation form by each student. Students had to determine the level of cooperation of each member in his or her team according to some criteria (preparation for the discussion in terms of self-study, participation in-group discussions, an ability to ask opinions from the peer group and flexibility to accommodate the team's decisions). To do this work, each student divided the total of 100 scores between his or her team members without considering his or herself. 7) At the end of each session, the topic of the next session was introduced and some related resources were determined for self-study.

Evaluation of student satisfaction

The degree of student satisfaction from TBL compared to the lecture method was determined by a questionnaire "student satisfaction scale" (SSS) including a set of 20 questions with 5 options according to the Likert scoring method (5= totally agree, 4=agree, 3 = somewhat agree, 2= disagree, 1= totally disagree). This scale was designed during this research after a careful review of the relevant sources. The SSS form was completed in the last TBL session by each student. Prior to using this scale, its content validity was determined by making an evaluation with a content validity index (CVI). For this purpose, the SSS form was given to 8 academic teachers to rate each question on this scale according to the following four criteria; no necessity and appropriateness of using in SSS, requires overall modification, requires a minor modification, and the necessity and appropriateness of using in SSS. Based on previous studies, a CVI score greater than 80 percent was considered as an acceptable value. To calculate the CVI in each question, the number of teachers who selected options 3 or 4 was divided by the total (13,14).

To determine an overall score for each lesson in TBL, the formula A + C = D was used. In this formula, A was the score in the IRAT, C = P% × B was adjustment of a peer evaluation score (B was the score in the GRAT and P was the mean of the peer evaluation scores) and D was the final score. At the end of 8 sessions taught by TBL, the mean of the scores of eight sessions was calculated and considered as the total TBL score. The final score for the entire neurology course was the average of the two scores for each teaching method.

Statistical analysis

The Kolmogorov-Smirnov test showed normal distribution of data in different variables ($p > 0.206$). Differences in means were tested using the two-sample t-test to compare two means and the one-way ANOVA test was used to compare more than two means. The correlation between two variables was assessed by the Pearson correlation test. To determine reliability of the SSS results, external consistency was achieved by calculating intra-class correlation coefficient (ICC) and Cronbach's alpha coefficient and internal consistency was achieved by calculating ICC and Cronbach's alpha with Split - Half Model. The effect of removing each question on the Cronbach's alpha coefficient of SSS was also studied. Statistical analysis was done by SPSS.18 software, at the significance level of $p < 0.05$.

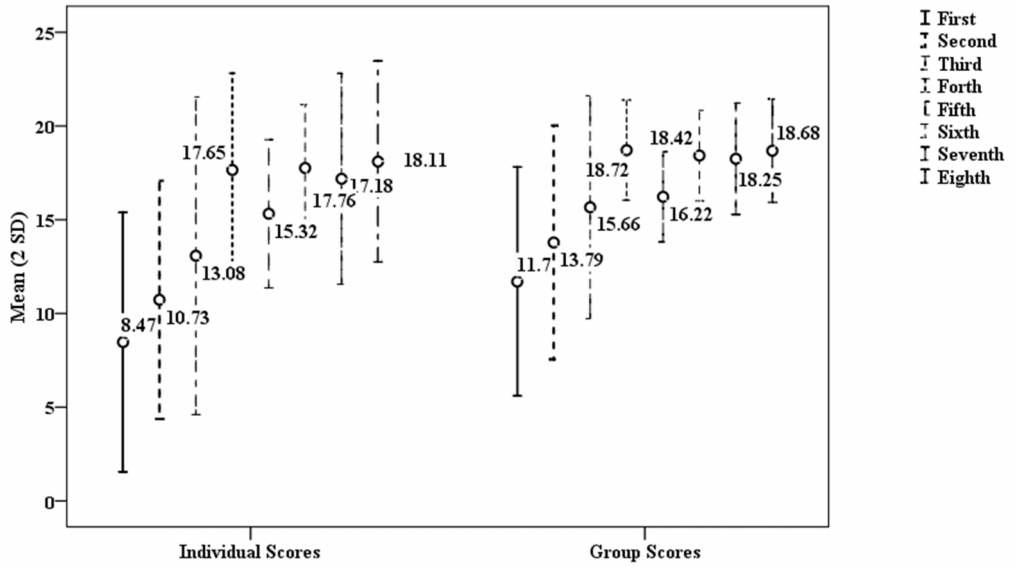

Fig. 1. Progress of the student scores in IART and GART assessments of the TBL during 8 teaching sessions

Results

The average of student scores after 8 teaching sessions by conventional lectures was 11.99 (SD=1.44, Min=10.0, Max=15.5) out of 20. Fig. 1 shows the progress of student scores during those 8 teaching sessions with TBL evaluated by IRAT and GRAT. According to the chart, student scores increased according to an increased number of teaching sessions in both tests, and there was significant difference between averages of student scores in IRAT and GRAT evaluations (p<0.001).

The mean of final student scores for the neurology course was established by calculating the averages of scores for conventional lectures and TBL methods; it came to14.06 (SD= 1.07, Min= 12.14, Max= 15.89) out of 20. In Fig. 2, the mean and SD of student scores in teaching by the lecture and TBL methods and also the final score, shows significant difference between them (p=0.015).

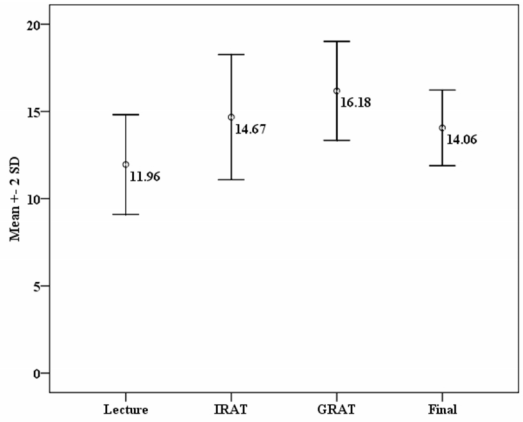

Fig. 2. Mean and SD of the student scores in lecture, TBL and final results

Table 1 shows the mean and SD of student scores in the lecture method, IRAT and GRAT; final results are shown as a function of gender. The average scores for girls were higher than boys and significant difference was observed between them except in the lecture score. There was also significant difference in terms of gender between the lecture score in IRAT and GRAT evaluations (p<0.001). There was significant difference in terms of gender for overall satisfaction (p= 0.007); girls indicated more satisfaction than boys.

The Student Satisfaction Scale (SSS) was developed with 20 items to assess levels of satisfaction from teaching. CVI was calculated to determine content validity and the total amounted to 94.0% (rang= 92-97%). ICC was calculated to check reliability of the scale. The questionnaire was completed twice within two weeks to determine external consistency of the SSS, and Cronbach's alpha coefficient was 0.954 (p<0.001).To obtain internal consistency, Cronbach's alpha coefficient calculated using a Split-Half model, or by half the number of ques-

Table 1. Comparison of the student scores in lecture, TBL and final results according to gender.

Score	Gender	Number	Mean	SD	p value
Lecture	Female	38	12.19	1.40	0.068
	Male	32	11.52	1.44	
IRAT	Female	38	15.24	1.79	0.001
	Male	32	13.36	0.86	
GRAT	Female	38	16.74	1.32	0.001
	Male	32	14.91	0.47	
Final	Female	38	14.46	0.96	0.001
	Male	32	13.13	0.72	

Table 2. Change of the overall Cronbach's alpha coefficient for elimination of each item on the Student Satisfaction Scale.

Item	α coefficient	Item	α coefficient	Item	α coefficient	Item	α coefficient
1	0.918	6	0.909	11	0.921	16	0.922
2	0.922	7	0.910	12	0.917	17	0.914
3	0.917	8	0.913	13	0.913	18	0.920
4	0.913	9	0.914	14	0.921	19	0.919
5	0.915	10	0.921	15	0.916	20	0.917

tions, and it was 0.921($p< 0.001$). Table 2 illustrates the effect of removing any of the questions from the SSS on the Cronbach's alpha coefficient.

In the last session of the neurology course, the degree of student satisfaction from TBL compared to the lecture method was measured by completing the SSS questionnaire with a 5 choices Likert scale. The range of scores in this questionnaire was 20 (totally disagree) to 100 (totally agree). As shown in Table 3, the average level of student satisfaction was 81.30 (SD= 9.22), which represents the percentage of satisfaction from TBL compared to the lecture method.

In this study, student averages for the last academic semester were 15.85 (SD= 1.14, Min= 13.78, Max= 17.83) out of 20. The Pearson correlation test revealed no significant correlation between this score and the mean of the TBL score (r=-0.107, p=0.394) or its degree of satisfaction (r=0.012, p=0.926). But the correlation between student averages for the last academic semester and the final lecture score was significant (r= 0.431, p= 0.001).

Discussion

In the present study, considerable growth was observed from the lecture score to IRAT and GRAT scores in TBL. Various factors can influence this result, such as the effect of self-study, class preparation and the effect of team cooperation in the learning process. Similar results have been reported in other studies. For example, a study by Zghieb et al., at the School of Medicine, American University of Beirut compared second year medical students' evaluations of satisfaction and performance in teaching of a pharmacology course with a modified TBL technique with students' scores in previous academic years. In this study, students expressed a positive attitude towards TBL and their scores in GRAT were higher than in IRAT. The study focused on the ability of TBL to achieve better results in teaching the pharmacology course to medical students compared to the traditional lecture method (15).

In addition to the comparison of levels of student learning between two methods (conventional lectures and TBL) this study also employed an SSS dorm that determined content validity and reliability. Items

Table 3. Descriptive statistics for the SSS score twice within two weeks of completion (n=70)

	Mean	SD	Min	Max	Range
First assessment	81.30	9.22	63	94	31
Second assessment	81.02	8.76	67	94	27

of this scale were selected among the benefits that were discussed for active learning in literature (Appendix 1). According to the results of this scale, students showed more than 80.0% satisfaction from teaching with TBL compared to the lecture method. Although, there is no report of a similar questionnaire in past studies, more satisfaction was realized from TBL from various aspects was reported with different methods (16,17).

In most previous studies, TBL was used to teach preliminary and clinical courses of medical fields, and comparisons of these methods have been made less frequently (6,9,10). On the other hand, the use of TBL as a new active learning method in teaching neurology was not reported until 2011. In a study by Tan et al., on teaching two topics of Neurology to medical students, the average scores for TBL were remarkably higher than those in passive learning and this difference was more prominent in weaker students. Present study is very close to Tan et al study in terms of findings obtained. So, the degree of improvement in TBL was higher in weaker students than in stronger students. No relation was found between a student's average in the previous term and a student's TBL score and also the degree of satisfaction from this educational method. In other words, a student's previous academic history had no effect on the course score or the degree of satisfaction from TBL. But this effect was remarkable in the lecture method. It means that TBL can lead students to better academic performance regardless of their previous educational record. However, evaluations for the lecture method showed that a higher score could usually be expected from students with better academic performance.

In this study, great efforts were made to provide good conditions to compare lecture and TBL methods, taking a full semester to administer and compare methods and request a balance between them in terms of teaching time and content, according to certain educational principals. As can be seen in previous studies, the duration of intervention or teaching time, was limited, sometimes it only addressed TBL; there may not have been a good balance between TBL and lectures in terms of teaching time, or some differences may have existed in implementation of TBL. Therefore, the results of those studies cannot be compared directly. However, results of other studies generally indicate higher learning achievement and satisfaction with TBL than passive learning methods, and this is confirmed in the results of this study.

On the other hand, there was no significant difference between genders in conventional lectures however, in both IRAT and GRAT assessments of TBL, girls scored remarkably higher than boys. Also, girls reported more satisfaction with TBL than boys. Therefore, in terms of degrees of learning and satisfaction from TBL, girls performed better and expressed greater satisfaction compared to boys. There are limited available sources that have considered gender in assessments of TBL. In a study by Wiener et al., on applications of TBL for first year students of Vienna University School of Medicine, in the majority of items, women were more satisfied than men, and in the item "Overall I am very satisfied with the TBL method", a remarkable difference was found between genders. But in test results, men in both initial and final exams achieved higher scores from TBL than women (16). In terms of satisfaction from TBL, results of the present study are near to those from the Wiener et al study but in terms of scores obtained with TBL, the results of the two studies are contradictory. Although there were differences between the studies in terms of time durations and subjects that could have affected results, it seems that gender difference in learning needs further investigation for more precise interpretation.

In the present study, a scale was developed with 20 questions to evaluate and measure satisfaction from TBL compared to the lecture method. The CVI of this scale based on expert opinions achieved 94%. According to sources, a CVI evaluation

above 80 percent is appropriate and accept able and confirms the content validity of the self-assessment scale (14,15). Another important characteristic of the each questionnaire is its reliability. Reliability ensures that results are safe use for in the research and clinical applications. The present SSS scale had high internal consistency indicating a high correlation between its items. Also, the external consistency or test-retest reliability of the scale was good. It seems that after 8 continuous teaching sessions with TBL, students attained a level of confidence and mastery of the subject about the strengths and weaknesses of this technique that its effect was found as highly reproducible results as questionnaires were repeated twice within two weeks.

Although the researcher tried to request a good balance between volume of content and the degree of difficulty of the training courses of the neurology unit, that from 16 academic sessions, the first half was taught with the lecture method and the second half was taught with TBL, but the difference between the topics of the two methods may be a limitation for this study.

Conclusion

This study revealed the successful use of TBL in teaching the neurology course compared to the lecture method. According to initial perceptions of the difficulty of this lesson and reports of low learning and satisfaction in teaching with the conventional lecture method, there is no doubt that using new training methods such as TBL can increase the level of education achieved by students. In terms of the effect of gender, girls had higher scores and expressed greater satisfaction than boys. According to limitations of previous studies, further research is needed to determine the effects of gender more precisely. A Student Satisfaction Scale was applied and it's content validity and reliability determined that the questionnaire was practical and useful making it suitable for use in subsequent similar studies. These results are pertinent to educational administrators, teachers and students because they highlight the importance of the use of an appropriate training method to transfer of knowledge and achieve predetermined goals.

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