Validating and Assessing the Reaction of Medical Students Toward Team-Based Learning

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Abstract- The aim of this study was to evaluate the psychometric properties of tools "Team-Based Learning Student Assessment Tool", Classroom Engagement Survey (CES) and to assess the reaction of learners toward TBL sessions at Tehran University of Medical Sciences. This descriptive study was done in 2013. The first step was to assess the reliability and validity of the tools. TBL-SAI questionnaire include 39 items, and CES consists 8 items. The validity was assessed through Delphi rounds by experts and reliability, through internal consistency and Test-Retest approach. Then, the reaction of medical students (N=78) was assessed concerning the aspects of team-based learning sessions through TBL-SAI and CES. The data were analyzed through descriptive tests. Our results have study confirmed the TBL-SAI and CEA validity. The tools 'reliability was approved through: TBL-SAI Cronbach's alpha=0.79, CES Cronbach's alpha=0.71 and TBL-SAI ICC=0.82, CES ICC=0.75. The result of the second phase showed the TBL_SAI scores of participation were appropriate concerning TBL session (159.60±12.89). According to confirmed validity of tools, these can be used in researches related to team-based learning in Iran. It could facilitate assessing the learners' reaction of team-based learning studies at Iranian medical science universities. In the present study, the reaction of students who participate in TBL sessions had been positive and their participation, satisfaction, and accountability had been improved.

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Keywords: Team-based learning; Validity; Reliability; Accountability; Participation; Satisfaction

Introduction

In the recent decades, student center approach is considered by the medical education system. In this regard, a change in teaching methods, from teacher-centered approach toward participatory approach is considered as one of the priorities of efficient education. Team-based learning (TBL) is one of the most respected participatory methods in medical universities. TBL is collaborative learning with the specific structure that has been used since 1970 (1). It was initially designed by Michelson, and it was met with open arms because of its convenient features (2). This approach provides a learner center atmosphere and with respect to Andragogy principals, meets the educational needs of learners in the teaching process and focuses on the knowledge's application in a highly interactive environment. This method provides a platform to obtain a higher level of knowledge and to master the educational content to develop their self-directed learning, critical thinking, teamwork and problem-solving skills (1,3-4). The team-based learning has focused on individual and team response, group interaction and encouragement to participate in group discussions that could play an important role in achieving the educational goals as well as create a positive environment of hidden curriculum of the educational system. The basic elements of team-based learning including team-building, Readiness Assurance Process, immediate feedback, sequencing in the classroom, problem solving, motivational structure, team application exercises, and peer evaluation (4).

Implementing team based learning emphasizes on 6 basic steps, including:

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1- Readiness: To implement team-based learning, the student is obliged to study the course content before the session.
2- Individual Readiness Assurance Test (IRAT): The multiple choices can be implemented after the first session. Exam questions should be from the main issues rather than details. In addition, it must be tough enough to create group discussions. At this stage, 10 to 20 multiple-choice questions can be designed.
3- Group Readiness Assurance Test (GRAT): At this stage, immediately after the IRAT, the test will be conducted. Individual and group Readiness tests are performed to ensure the students' study.
4- Appeals: At this stage, members can refer to the content of their previous study to explain their reasons for choosing the answer. After completing the test, team members will fill the appeal form about their incorrect answers.
5- Provide feedback by a facilitator lead to group discussion.
6- Providing Team Application Exercise (TAE): it should be considered in the design TBL assignments, group discussions, and encourage students to make decisions and report their decision. In this stage, all groups will be given the same task. This is more beneficial that the task is selected from the studies content and must include high levels of cognitive. Moreover, the peer assessment can be done at the end of the team-based learning sessions (5).

According to the team-based learning process, the following points can be regarded as infrastructures; adult learning's principles and Andragogy such as reducing class time dedicated to passive learning and replace it with active learning and encourage students to develop creative thinking, communication and problem-solving skills (6-7). TBL benefits led to its popularity in medical science so that development capabilities are important for medical students. Moreover, in this method, there is no need to specify a specific location for small groups or increase the number of teachers and the implementation of the TBL applicable with one teacher in a large class (over 100 students) (8-9). This privilege of TBL has caused an outbreak of using this approach in educational programs of universities that have a limited number of teachers and physical space. Due to the essentiality of using evidence-based practice, the use of new teaching methods in the education systems and its assessment is important. This study aimed to assess the psychometric tools of the reaction toward team-based learning and its implementation at Tehran University of Medical Sciences.

Materials and Methods

The present study was a cross-sectional study, which was conducted in two phases consisted of validation of tool and assessing of student`s reaction.

In validation step, 19 experts participated, the external validity assessment group consisted of 7 experts; medical education (n=5) and professional translators (n=2), the content validity assessment group, included 12 experts; medical educations (n=4), clinical educators (n=6). In this step 73% (n=14) participants were female. The mean age (35.5±8.5) and the average work experience (9.0±5.5) year.

To reliability assessment, 64 medical students enrolled, 54.68% (n=35) were female. The mean age (35.5±8.5) and the average work experience (9.0±5.5) year. In the second phase, 78 medical students were participated 33(42.3%), and 45(57.6%) were male and female respectively, and their mean age was 22.4(3.2).

Measures

The first phase of the study was psychometric tools including Team-Based Learning-Student Assessment Instrument (TBL-SAI) and Classroom Engagement Survey (CES). The TBL-SAI consist of 39 items in the areas of accountability (13 items), preference for lecture or team-based learning (16 items) and students' satisfaction (10 items) by 5-point Likert scale (from strongly agree to strongly disagree) and the Classroom Engagement Survey questionnaire included 8 items that examined the students' engagement in class. The TBL-SAI tool mentioned in Mennenga study were developed and psychometric (10) which is considered as useful questionnaires related to team-based learning method (11-14).

Procedures

Validation step: The first stage of the present study was conducted with the aim of tool psychometric assessment. Initially, Team-Based Learning-Student Assessment Instrument (TBL-SAI) and Classroom Engagement Survey (CES) tools were translated from English into Persian through two independent professional translators. After reviewing and reaching an agreement between the translated versions, one the Persian version of the questionnaire was provided. After that, a professional translator translated the forward

version back into English. These versions were compared with the original questionnaire. Finally, the final version reviewed and confirmed by the expert panel of medical education and clinical educators.

We evaluate the qualitative content validity of the questionnaires through two Delphi rounds for assessing the content relevance of questions, and appropriate use of language (15). After that, two indexes of quantitative validity were calculated; "Content Validity Ratio (CVR)"and "Content Validity Index (CVI)." To determine the content validity ratio (CVR) experts were asked to assess each of the items on a three-point Likert scale(essential, useful but not necessary and not necessary). The minimum value of content validity was evaluated by Lawshe Table (16). Content validity index (CVI) of items were evaluated using a four-point Likert scale (17-18).

Moreover, the reproducibility of the tools was assessed through the test-retest approach, participants filled out questionnaires twice at a 2-week interval, and Intraclass Correlation Coefficient (ICC) was computed. Internal consistency was evaluated through alpha Cronbach.

Reaction assessment

In the second stage, the reactions of the students to TBL sessions were evaluated using CES and TBL-SAI questionnaires. The TBL sessions related to Rheumatology course were held with the participation of 78 Physiopathology students in Tehran University of Medical Sciences (TUMS). TBL sessions were implemented as follows: To run TBL training session, briefing sessions for familiarity with TBL were conducted. At preparation stage, Students were required to study the intended content prior the session. At the beginning of sessions, members were introduced to each other. Then, the individual preparation Assurance Test (IRAT) was conducted. The test was consisting of 15 multiple choice questions. After that, Group Readiness Assurance Test (GRAT) was conducted in the group in which students were asked to answer questions through group discussions. Then they received feedback from the facilitator to lead to the correct answer. After the test, members were asked to fill out an appeal form about their wrong answers. However, in the present study, no form was filled. In team application phase, the students have discussed 5 cases related to the lesson content in small groups. Then, they have debated about their answers in the large group and received feedback from facilitators. Ultimately, all team members using the peer assessment questionnaire evaluated other team's performance. At the end of the course, the CES and TBL-SAI questionnaires were completed to assess the reaction of participants.

Statistical analysis

CVR is calculated as "a proportional level of agreement on how many "experts" within a panel rate an item "essential" calculated in the following way:

$$CVR = \frac{n_e - (N/2)}{N/2}$$

Where CVR is the content validity ratio, one is the number of panel members indicating an item "essential," and N is the number of panel members"(16). Item-level CVI (I-CVI) is calculated as "the number of experts giving a rating of either 3 or 4 divided by the total number of experts"(19). Scale-Level CVI(S-CVI) is computed as "the proportion of items given a rating of 3 or 4 by both raters involved''(19). Reliability criteria were assessed by Cronbach alpha and intraclass correlation coefficient (ICC). The reaction questionnaire data were analyzed by computing percentages, means, standard deviations, ranges and correlation through descriptive and analytical test.

Results

The validity of the tools

The results of Delphi rounds have approved the face and content validity of questionnaires by consensus. The results of the analyzing content validity ratio (CVR) indicated that all items achieved the higher scores than 0.56 and none of the items was eliminated. The item-level CVI (I-CVI) analysis showed that all the items had achieved scores above 0.78. So, were retained in questionnaires. S-CVR is computed to be 0.90. The reproducibility of CES and TBL-SAI was confirmed by ICC=0.75 and ICC 0.82 respectively. The results of reliability assessment are summarized in Table 1.

Assessment of student's reaction

The results indicated that the student's engagement was in the range (16-32) and mean score (26.45±3.64) which was significantly different from the standard score (standard score=24)(Sig 0.0001) (10,20). The range of accountability scores determined as (25-57) and mean (46.23±6.66). The results indicated the student's accountability to participate in TBL was significantly desirable (standard score=27, Sig 0.0001) (10,20). Also, there was a significant correlation between accountability and Readiness Assurance Tests

(Pearson's r=0.51 and Sig 0.03). Preference for the lecture or team-based learning scores acquired range (35-69) and mean score (48.78±5.23) that there was statistically significant difference between the preference for the lecture or team-based learning (Sig 0.0001). Moreover, the range of the students' satisfaction of TBL was (27-48) and mean (38.13±3.40)(standard score=27) (10,20). the results showed the students' satisfaction of TBL was statistically significant (Sig 0.0001), the total score of the TBL-SAI instrument range (111-187) and the mean (159.60±12.89) and according to the standard score of 102 (10,20), the results showed that the team-based learning was optimal experience and statistically significant (Sig 0.0001). Moreover, in the present study, the result of IRAT achieved 8.53 (out of 11) and their GRAT means score was 10.25 (out of 11), which significantly improved (Sig 0.001).

Table 1. Reliability of TBL-SAI and CES questionnaires

		Cornbrash's alpha	ICC
CES questionnaire		0.71	0.75
TBL-SAI questionnaire		0.79	0.82
TBL-SAI domain	**Accountability**	0.82	0.81
	Preferred teaching method	0.70	0.71
	Satisfaction	0.73	0.75

Discussion

The team-based learning using the principles of collaborative learning and participating in small groups is considered as an efficient tool in the medical education system. In the present study, the validity and reliability of TBL-SAI and CES have been approved in the Iranian context. The Student Assessment tool (TBL-SAI) was developed in Mennenga study (10). The Classroom Engagement Survey is one of the most common tools in team-based learning that has been used in various studies (10,21-23).

"Delphi technique" is the key method for evaluating the content and face validity (24-25). Same as various studies (24,26-29), we have used the Delphi technique to assess the validity of the tools. The results of the present study confirmed internal consistency and test-retest of tools which the results were similar to previous studies (21,27,30). The internal consistency of the tool in Mennenga study was 0.9, and its components were in the range of (0.8-0.9) (10) and other studies were reported as 0.8 which is desirable (10,22-23). In TBL-SAI, the use of negative verbs in items was done to reduce bias in filling out the questionnaire and prevent students' error (11,31).

Three basic steps in the implementation of team-based learning methods include; the first, the necessity of student's preparation, the second, conducted individual and group assessment of the studied contents. The third, achieving a higher level of learning will be provided by forming small groups and do group assignments (7,32) of TBL session, and Team Application Exercise TAE holds after participating in small groups. In the present study, student readiness scores in groups were more improved in comparison with individual scores. The mentioned results have been approved in various studies which may be created through the synergistic teamwork and peer-learning (3,11-12,33-35). So, we can expect in small groups of TBL, students applying their previous knowledge and interact with other team members, develop their problem-solving skills, clinical reasoning and teamwork (22,33,36-39). However, the use of TBL in the education system in a long-term improves the impact of team-based learning (33,36-37,42).

Our results revealed the student participation in TBL were above average. The results were similar to several related studies (11,22,36,43). Team-based learning method has been established based on foundation principles of student-centered approach and has emphasized on students' active participation as an important factor for effective learning. Active participation occurs when students prepare before class, have a small group discussion and reflection during and after class (44).

Accountability is another concept in TBL-SAI, the purpose of accountability is to demonstrate the preparation of students to participate in class activities or teams. The results of this study confirmed the student's desirable status of accountability which is similar to Corbridge and Mennenga studies (11-12). Students' preparation before TBL sessions has a favorable impact on the learner's participation in small groups and effective learning. Pre-reading and prepare schema or concept map based on the principles of cognitive theory (40), can be realized in team-based learning. So, in order to achieve effective learning, it is

recommended to focus on improving students' pre-reading, self-Direct learning and teamwork skill.

The key factors of effective learning are student satisfaction and cooperative climate. Results of the present study indicated that learners have an optimum satisfaction of team-based learning that was similar to several studies (11-12,33-34,37). It seems to student satisfaction had an impact on the result of students' preference for team-based learning in the present study. Results of this study were similar to various studies (11-12,22,33,35,37). Create a sense of activity and effective participation in the learning process lead to learners to achieve either learning satisfaction or effective learning. Moreover, it makes students more likely to have a team-based learning which is important in adult learning. So, the design of team-based learning method based on the principles of adult learning cause the development of communication and cognitive skills and the effective education in various academic levels (undergraduate and postgraduate). The main limitation of our study was the limited number of participants in validation assessment processes which also limited the external validity of our results. Additional psychometric analysis such as construct validity and concurrent validity is also needed to assess in future studies in the Iranian context.

With regard to the confirmation validity and reliability of our study tool; it can be used as a validated tool in applied research in the field of teaching and learning in the Iranian context. Our results demonstrated the reaction of the students who participates in TBL sessions were optimistic.

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