Nurse Educator

Nurse Educator
Vol. 37, No. 4, pp. 168-172

Development and Psychometric Testing of the Team-Based Learning Student Assessment Instrument

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Team-based learning, an innovative teaching strategy, may be useful in meeting the demands of nursing education. However, educators may be hesitant to adopt this teaching strategy because of the lack of available research. The author discusses a study to determine whether a newly developed instrument, the Team-Based Learning Student Assessment Instrument, accurately measures the 3 subscales of accountability, preference for lecture or team-based learning, and student satisfaction. Results suggest the instrument is valid and reliable and may be a valuable tool in assessing the effectiveness of team-based learning.

Team-based learning offers educators a structured, student-centered learning environment.[1] Using a structured combination of preclass preparation, individual and group readiness assurance tests, and application exercises, team-based learning eliminates the need for traditional lecture or multiple instructors in the classroom.[2,3] In addition, team-based learning is an active learning strategy that truly engages students in their education.[4] Parmelee[4] asserts that "for professional students to be engaged fully, challenged intellectually, and have the opportunity to develop interpersonal and teamwork skills, the team-based learning strategy holds the greatest promise in curriculum development."[4(p6)] Research related to team-based learning has been conducted in a variety of disciplines and indicates positive student outcomes and student attitudes toward team-based learning.[5-9] In addition, the use of team-based learning also results in higher levels of student engagement.[7,10,11]

Although these positive findings encourage the use of team-based learning, educators may be hesitant to adopt this teaching strategy because much of the available literature is expository only. In addition, a major barrier to researchers is the lack of available instruments that evaluate team-based learning, resulting in further discouragement.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.nurseeducatoronline.com).

DOI: 10.1097/NNE.0b013e31825a87cc

Background

Team-based learning is a teaching strategy that is used worldwide and in a variety of disciplines, including business, psychiatry, law, marketing, accounting, engineering, and pharmacy.[1,9,10,12-16] Team-based learning has also been used extensively in medical education.[17,18] The increasingly extensive use of team-based learning in a variety of disciplines further reinforces the need for a valid and reliable measurement tool.

In a 2009 literature search for instruments related to team-based learning, 1 study used an observational tool to collect data in a team-based learning classroom.[19] However, no instruments specific to team-based learning were found. A 2012 literature search found 1 instrument that measured student satisfaction with a learning method, which was used in a team-based learning classroom.[20] Based on the lack of instruments related to team-based learning, the Team-Based Learning Student Assessment Instrument was developed. A valid and reliable tool to assess team-based learning has the potential to advance nursing education, whereas the use of alternative teaching strategies has the potential to enhance student engagement, accountability, and the overall educational experience.

Purpose of Study

The purpose of this study was to determine whether the newly developed Team-Based Learning Student Assessment Instrument accurately measures the 3 subscales: accountability, preference for lecture or team-based learning, and student satisfaction.

Methodology

The Team-Based Learning Student Assessment Instrument was developed in 3 phases: concept clarification, item development, and psychometric testing of the newly developed instrument.

Phase 1: Concept Clarification

In 2009, the author conducted a literature review with the goal of identifying key concepts related to team-based learning. EBSCO Host was used to search the literature for any publications regarding team-based learning. Using "team-based learning" as a keyword, the search yielded 998 results. Upon reviewing the article titles and abstracts, common themes included student satisfaction or enjoyment of the teaching strategy, accountability or advance preparation for courses, and student or faculty adaptation to team-based learning from lecture. Based on these observations, several specific searches were conducted including "team-based learning" and "accountability" or "preparation," which yielded 242 results; "team-based learning" and "satisfaction" or "attitudes," which yielded 339 results; and "team-based learning" and "lecture," which yielded 242 results. A 2012 literature search using the same keywords and database yielded similar themes among the 1,363 results. This literature search, in addition to the knowledge of important concepts in team-based learning, led the author to include the following as the main concepts for the Team-Based Learning Student Assessment Instrument: accountability (including student preparation for class and contribution to the team), preference for lecture or team-based learning (including the student's ability to recall material and student attention level), and student satisfaction. These concepts are conceptually and operationally defined.

Accountability occurs when students prepare in advance for a class and/or contribute to other members of the team.[20] Accountability is operationally defined by the accountability subscale on the Team-Based Learning Student Assessment Instrument. A higher score indicates an increased level of accountability.

Student recall refers to the ability of students to retrieve previously learned knowledge for use at a later time. The concept of student recall is operationally defined by 10 items on the Team-Based Learning Student Assessment Instrument preference for lecture or team-based learning subscale. A higher score indicates an increased level of student recall following team-based learning activities.

Attention levels refer to students' ability to remain focused and concentrate on the course content during both traditional lecture and team-based learning activities. The concept of attention levels is operationally defined by 6 items on the Team-Based Learning Student Assessment Instrument preference for lecture or team-based learning subscale. A higher score indicates a higher attention level in team-based learning activities.

Student satisfaction includes positive feelings toward either team-based learning activities or traditional lecture. The concept of student satisfaction with team-based learning is operationally defined as a score of greater than 30 on the Team-Based Learning Student Assessment Instrument satisfaction subscale.

Phase 2: Item Development

An initial 45-item instrument was developed based on a review of the literature and the conceptual model for team-based learning developed by Haidet et al.[21] In an attempt to avoid agreement bias, the instrument included both positively and negatively worded items.[21] A panel of 4 experts on team-based learning determined content validity of the initial 45-item instrument. The initial 45-item instrument had an acceptable scale content validity index of 0.85. However, based on content validity index values for individual items and based on comments and suggestions by the panel of experts, 7 items were deleted, and 1 item was added. The resulting 39-item instrument yielded an acceptable scale content validity of 0.89. Each of the 3 subscales also yielded acceptable scale content validity index values: accountability (0.90), preference for lecture or team-based learning (0.89), and student satisfaction (0.89).

Phase 3: Psychometric Testing

Sample

The study sample for psychometric testing of the Team-Based Learning Student Assessment Instrument consisted of undergraduate nursing students in a BSN program from a US southwestern university enrolled during the 2009-2010 academic year. The students were at various levels in the nursing program and were all currently enrolled in courses that used team-based learning. Based on Tabachnick and Fidell's recommendation that more than 200 participants should be used for instrument development in order to have an adequate sample size, this researcher planned to continue data collection until the study sample exceeded this recommendation.[22] Approval was obtained from the institutional review board to conduct psychometric testing on this instrument, which began in June 2009.

Instrument administration occurred in one of the final weeks of each semester. All students enrolled in a course that utilized team-based learning were approached to participate. The researcher visited the classroom to explain the study purpose to students and asked them to voluntarily complete the study instruments. Students signed a consent form indicating their voluntary participation in the study. Following the collection of the consent forms, the researcher handed out paper copies of the study instruments, including the 39-item Team-Based Learning Student Assessment Instrument and a 5-item demographic information form, for students to complete. No identifying information was included on the study instruments to maintain anonymity.

The sample (N = 396) was predominantly women (80.3%). The age of the participants ranged from 19 to 51 years. A majority of participants were white (49%) and Asian American/Pacific Islander (33.8%). The participants had a current GPA of between 2.5 and 4.0 with a mean of 3.4.

Instrument

The 39-item instrument used a 5-point Likert scale, with possible responses of strongly disagree, disagree, neither disagree or agree (neutral), agree, or strongly agree. A 5-point scale allows neutrality rather than forcing participants to make a decision on whether they disagree or agree, as does a scale with an even number of responses.[23] Because participants may express feelings of neutrality in their experiences with team-based learning, a 5-point scale allowed students to express their true feelings.[24] Interval scoring of the instrument was done by assignment of 1, 2, 3, 4, or 5 to the positive items and 5, 4, 3, 2, or 1 for the reversed items.

Table 1. Factor Loadings for Accountability Subscale With Varimax Rotation

Questions	Factor 1	Factor 2
Q1: I spend more time studying before class in order to be more prepared.	0.131	**0.719**
Q2: I read most of the assigned material before class.	0.12	**0.836**
Q4: I feel that I should be accountable for my own learning.	0.179	0.242
Q6: Because we work in teams, I spend more time preparing for class than I would otherwise.	0.340	0.279
Q12: I am proud of my ability to assist my team in their learning.	**0.699**	0.141
Q13: I need to contribute to the team's learning.	**0.781**	0.136

Note. Factor loadings greater than 0.40 are in boldface.

A higher total instrument score indicated a more positive experience regarding team-based learning. Each subscale was also summed to indicate student accountability, preference for lecture or team-based learning, and student satisfaction. Distributions of the 39 questions among the 3 subscales were as follows: accountability (questions 1-13), preference for lecture or team-based learning (questions 14-29), and student satisfaction (questions 30-39).

Results

Data Analysis

Factor analysis was conducted using Predictive Analytics Software (PASW) version 17.0 (SPSS Inc, Chicago, lll). Because the instrument was composed of 3 subscales, initially a separate factor analysis was conducted on each subscale using principal axis factoring with varimax rotation. Extraction of factors was determined by examination of the scree plot and consideration of eigenvalues greater than 1. Items with loadings of less than 0.40 were removed from the instrument.[24] A factor analysis was also conducted on the total scale in order to substantiate the individual subscale findings. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was greater than 0.60 for each subscale, indicating that factor analysis could be performed.[22]

Descriptive Data

On the accountability subscale, possible scores ranged from 13 to 65. A higher score indicated a higher level of accountability. The accountability subscale scores ranged from 21 to 63, with a mean of 48.4 (SD, 7.41). Based on a score of 39 as neutral, participants had a high level of accountability with team-based learning.

On the preference for lecture team-based learning subscale, possible scores ranged from 16 to 80. A higher score indicated a preference for team-based learning. The preference for lecture or team-based learning subscale scores of the participants ranged from 16 to 72, with a mean of 49.5 (SD, 11.29). Based on a score of 48 as neutral, participants slightly preferred team-based learning.

On the student satisfaction subscale, possible scores ranged from 10 to 50. A higher score indicated a higher level of satisfaction with team-based learning. Scores ranged from 11 to 48, with a mean of 33.09 (SD, 8.51). Based on a score of 30 as neutral, participants were generally satisfied with team-based learning.

A total instrument score was also calculated with possible ranges from 39 to 195. A higher score indicated a more favorable experience with team-based learning. The scores of the participants ranged from 57 to 175, with a mean of 131.7 (SD, 23.87). Based on a score of 117 as neutral, participants had a generally favorable experience with team-based learning.

Psychometric Properties

Accountability Subscale

Based on the scree plot, 2 factors were extracted on the accountability subscale using principal axis factoring with varimax rotation. Eleven of the 13 questions loaded at 0.40 or above. Questions 1 to 3 loaded on factor 2, which was labeled as contribution to team; questions 5 and 7 to 13 loaded on factor 1, which was labeled preparation. Questions 4 and 6 had loadings less than 0.40, therefore indicating that these questions should be removed.[24] Table 1 provides an example of some of the questions found on the accountability subscale with their corresponding factor loadings.

Preference for Lecture or Team-Based Learning Subscale

Based on the scree plot, 2 factors were extracted using principal axis factoring with varimax rotation. Factor 1 was labeled "team-based learning," and factor 2 was labeled "lecture." Because this subscale is described as assessing "student ability to recall material and student attention level in lecture and team-based learning," this scale is substantiated. All questions achieved loadings of greater than 0.40 (see Table 2 for a selection).

Student Satisfaction Subscale

One factor was extracted on the student satisfaction subscale and therefore could not be rotated. Question 32 had

Table 2. Factor Loadings for Preference for Lecture or Team-Based Learning Subscale With Varimax Rotation

Questions	Factor 1	Factor 2
Q14: During traditional lecture, I often find myself thinking of nonrelated things.	0.110	**0.743**
Q18: I get bored during team-based learning activities.	**0.772**	0.157
Q20: I easily remember what I learn when working in a team.	**0.691**	0.229
Q22: Team-based learning activities help me recall past information.	**0.802**	0.173
Q26: I can easily remember material from lecture.	0.186	**0.581**
Q28: I do better on examinations when we used team-based learning to cover the material.	**0.671**	0.309

Note. Factor loadings greater than 0.40 are in boldface.

Table 3. Factor Loadings for Student Satisfaction Subscale With Varimax Rotation

Question	Factor 1
Q30: I enjoy team-based learning activities.	**0.903**
Q32: I think lectures are an effective approach for learning.	0.210
Q33: I think team-based learning activities are an effective approach to learning.	**0.820**
Q35: Team-based learning activities are fun.	**0.808**
Q38: I have a positive attitude toward team-based learning activities.	**0.890**
Q39: I have had a good experience with team-based learning.	**0.863**

Note. Factor loadings greater than 0.40 are in boldface.

a factor loading of less than 0.40, indicating it should be removed from the subscale (see Table 3 for a selection).

Total Instrument

Once factor analysis of each subscale was complete, this researcher performed factor analysis on the entire 39-item instrument to substantiate the individual factor analyses. The scree plot indicated 3 factors would be most parsimonious. Therefore, 3 factors were extracted using principal axis factoring using varimax rotation. Questions 2, 4, 6, and 11 had factor loadings of less than 0.40. Factor analysis of each subscale validated the removal of questions 4 and 11 already and also question 32. In addition, factor analysis on the total instrument indicated question 5 loaded on 2 factors, which may indicate redundancy and therefore will be removed. Based on the factor analysis results of each subscale and the total instrument, the final instrument will consist of 33 questions, excluding 2, 4, 5, 6, 11, and 32 (see Table 4 for deleted items).

Further internal consistency assessments were performed on each of the factors, subscales, and the total scale to verify reliability. Based on the recommendation by Polit and Beck[24] that a Cronbach α of greater than .70 is acceptable for a new instrument and a Cronbach α of greater than .80 is desirable, the Team-Based Learning Student Assessment Instrument meets and exceeds expectations for a newly developed instrument. The 39-question instrument obtained a Cronbach α of .94. The subscales obtained a Cronbach α between .817 and .928. After eliminating the 6 items (Table 4), to create the final 33-question instrument, the total instrument obtained an acceptable Cronbach α of .941. The accountability, preference, and satisfaction subscales obtained Cronbach α's of .782, .893, and .942, respectively.

Limitations

This study has limited generalizability because it took place at 1 college of nursing and therefore lacks representation of a less homogenous population.

Discussion

The purpose of this study was to develop and evaluate the psychometric properties of the Team-Based Learning Student Assessment Instrument for use by students. The results of the psychometric testing of this instrument provide evidence of acceptable reliability and validity. Principal axis factoring with varimax rotation on the total scale substantiated the findings for each subscale. Results indicate that the newly developed Team-Based Learning Student Assessment Instrument did indeed accurately measure the 3 subscales. Based on the factor analysis, 6 items were eliminated, creating a final 33-item instrument. The total scale and each of the 3 subscales yielded acceptable reliability estimates.

Although this study indicates that the Team-Based Learning Student Assessment Instrument (see Document, Supplemental Digital Content 1, to view the full instrument, http://links.lww.com/NE/A75) is a valid and reliable tool, further psychometric testing should be conducted with a larger, heterogeneous population. Educators are invited to participate in further psychometric testing of the instrument by contacting this researcher. Further testing may reveal a shorter instrument that still maintains acceptable validity and reliability, which would be beneficial to researchers using team-based learning. Nevertheless, the use of this tool may provide educators with the evidence that team-based learning may be a teaching strategy to enhance the teaching and learning experience for both students and educators.

Conclusion

The Team-Based Learning Student Assessment Instrument, which was developed for use with students, demonstrated evidence as a reliable and valid tool. Because very few instruments related to team-based learning exist, the development of a reliable and valid instrument is crucial to the future research of team-based learning and to provide further statistical evidence promoting the use of team-based learning in various disciplines. Future research related to team-based learning may lead to nurse educators who are more willing to adopt this innovative teaching strategy in their classrooms. Furthermore, with the increasing demands of nursing education, evidence-based teaching strategies are more important than ever.

Table 4. Factor Loadings for Deleted Items With Varimax Rotation

Question	Factor 1	Factor 2	Factor 3
Q2: I read most of the assigned material before class.	0.145	0.207	0.391
Q4: I feel that I should be accountable for my own learning.	−0.023	0.037	0.327
Q5: Team-based learning makes me accountable.	**0.469**	0.240	**0.471**
Q6: Because we work in teams, I spend more time preparing for class than I would otherwise.	0.274	0.169	0.345
Q11: I do not need to help my team learn the material.	0.168	−0.069	0.366
Q32: I think lectures are an effective approach for learning.	0.155	**0.446**	−0.139

Note. Factor loadings greater than 0.40 are in boldface.

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NIH Provides Resource to Clarify Genetic Tests

Nurse educators are certainly being encouraged to incorporate genetic information into our curricula. This information can prove to be confusing or daunting to our students, and sometimes even to us. The NIH now provides a Genetic Testing Registry that can serve as a credible resource to support and enhance understanding of genetic testing. The NIH database provides links to information about at least 2,500 specific inherited diseases and describes genetic testing strategies.

The database can be searched by condition, test, gene, and laboratory performing the tests. Information is provided as to whether the test will sequence an entire gene for mutations, or examine only for specific genetic errors. The laboratories submitting the information are asked to attest to the accuracy of materials provided. Because genetic tests are performed as a laboratory service and not marketed as a medical device, these tests do not require Food and Drug Administration approval. Information available through the database is limited to Mendelian diseases and genes that impact drug metabolism. However, NIH reports plans to include exome, whole-genome sequencing tests, tumor mutations, and direct-to-consumer tests.

Providing students and colleagues with this database can further our understanding of genetic tests. Also, NIH provides valuable data that can assist us in serving as patient advocates for those who may express interest in or need for genetic testing. The database is available at http://www.ncbi.nlm.nih.gov/gtr/.

Source: Kaiser J. February 29, 2012. New NIH Database Brings Clarity to Genetic Tests. ScienceInsider. Available at http://news.sciencemag.org/scienceinsider/2012/02/new-nih-database-brings-clarity.html?ref=em. Accessed March 5, 2012.

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DOI: 10.1097/NNE.0b013e31825a868b