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Validating the Turkish version of the team-based learning assessment scale: a psychometric evaluation

Sevim Şen Olgay^{1*} and Şevval Çağan Kişin²

Abstract

Background Team-based learning methods enhance course achievement, student success, and student satisfaction and are frequently used in nursing curricula. However, there is no valid and reliable tool for evaluating team-based learning in Türkiye. Adapting the Team-based Learning Student Assessment (TBL-SAI) into Turkish can provide a standardized and culturally appropriate evaluation tool, supporting nursing education practice and research. This study aimed to assess the validity and reliability of the Turkish version of the assessment (TBL-SAI-TR) among nursing students.

Methods This descriptive and psychometrics study was conducted between October and November 2022. The sample consisted of 430 nursing students. The translation-back-translation method was used to determine the language accuracy of the scale. The content validity, construct validity, item analysis, and internal consistency analysis were used as psychometrics tests of the study.

Results The Cronbach's α value of the TBL-SAI-TR was .90. The item-total correlations of the 23-item three-factor scale, validated by confirmatory factor analysis, were between .30 and .74, and the intraclass correlations were between .88 and .90.

Conclusion This study showed that the TBL-SAI-TR is a valid and reliable tool for assessing team-based learning among Turkish nursing students.

Keywords Active learning, Nursing students, Psychometrics

Background

Active learning techniques that encourage the development of cognitive, affective, and psychomotor skills are now widely used in various fields such as health sciences, engineering, general sciences, and business

and social sciences [1–5]. Active learning techniques have become a common standard in the accreditation of higher education institutions owing to their positive results in achieving program outcomes [6, 7]. Team-based learning (TBL) is an active learning technique that has been successfully implemented in diverse health-related curricula, including medicine, pharmacology, nursing, and dentistry [8–11]. TBL has become an increasingly important educational method in nursing curricula in the last few years [2, 12–14]. TBL, a small group teaching approach, offers collaborative, interactive, and facilitator-led learning sessions [12]. The structured format of TBL supports students' self-learning, responsibility, communication,

*Correspondence:

Sevim Şen Olgay
sevim.olgay@acibadem.edu.tr

¹ Faculty of Health Sciences Department of Nursing, Acibadem Mehmet Ali Aydınlar University, Kerem Aydınlar Kampüsü Kayışdağı Cad. 32 Atasehir, Istanbul 34752, Türkiye

² Faculty of Health Sciences Department of Nursing, Yeditepe University, Istanbul, Türkiye



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and problem-solving skills. Owing to this structured format, students achieve course objectives through a series of steps comprising self-preparation, individual and group readiness tests, feedback, and practice [4, 8, 9, 15, 16]. In addition, students who have completed all these stages undertake increased self-directed learning and may be motivated to continue lifelong learning [17].

TBL allows students to apply course concepts in practice and solve problems that they may encounter in the future [13]. Studies have shown that TBL boosts students' course satisfaction, improves their academic performance, and increases their participation and socialization in the classroom [18–20]. In addition, TBL is aimed at developing other skills in students, such as critical thinking, decision-making, and acting as a team [9, 21]. One of the most important reasons that TBL has been preferred in professional courses, such as health-related courses, is that this type of learning has long been used to support students' active knowledge acquisition and is considered enjoyable by students [22].

Owing to these benefits, TBL is recommended for use in nursing education; it can help nursing students develop the ability to effectively address multiple issues arising from complex environments in close contact and collaboration with varied disciplines and patients [23]. In a 2024 meta-analysis, Gao et al. examined 14 articles with a total of 1942 participants, inferring that TBL could improve the quality of learning in nursing education [24]. Lee and Wang concluded that the use of the TBL method in nursing education courses such as anatomy and physiology could increase learning motivation and performance [25]. Vannini et al. reported that teamwork increased students' satisfaction and clinical reasoning ability in a repeated online TBL experiment with nursing students [26]. Göktepe et al. reported that TBL contributed positively to the learning experiences of nursing students in a leadership course in Türkiye [27]. Other studies involving medical students in Türkiye reported that TBL contributes substantially to learning experiences, student participation, and student satisfaction [28–32]. However, Kweon and Park found that TBL has disadvantages, such as unequal workload distribution among team members, passive learning as successful students take the lead, and team learning evaluation based only on the final outcome. Therefore, they stressed the necessity of student evaluations in this method [23]. In the studies examined, the tools measuring student feedback are limited; only one study used a tool for TBL student evaluation [33]; evaluations are commonly made based on academic performance, observation, or feedback [27, 28, 32, 34]. Although Sterpu et al. emphasized high levels of student satisfaction and student participation in their study of 49

articles using the TBL method, further research is needed to evaluate the contributions of TBL to learning [35].

Mennenga developed the Team-based Learning Student Assessment Instrument (TBL-SAI) as a TBL student assessment tool [36]. This scale comprehensively evaluates the TBL method, including students' accountability, preference for lecture or TBL, and student satisfaction [36]. Additionally, this scale is widely used to evaluate the learning process in studies using TBL [2, 21, 26, 37–39]. However, no measurement tool in Türkiye can assess TBL's impact on learning. Translating TBL-SAI into Turkish and performing cultural adaptation validation can fill this gap and support future research on TBL and its use in various disciplines. Adapting the TBL-SAI into Turkish can enhance the applicability of TBL evaluation in nursing education in Türkiye, offering a culturally relevant tool for practice and future research. This study evaluates the psychometrics of the TBL-SAI in Turkish (TBL-SAI-TR). The following research questions are addressed:

1. Is the TBL-SAI-TR a valid tool?
2. Is the TBL-SAI-TR a reliable tool?

Methods

Study design and participants

This study was conducted to explore the psychometric properties of the TBL-SAI-TR in a sample of nursing students in Türkiye. The study group comprised nursing students from the undergraduate department of a university in Istanbul. The TBL model is used as an active learning tool in courses such as Internal Medicine Nursing, Leadership and Management in Nursing, Education in Nursing, and Surgical Nursing. The inclusion criteria for the study were as follows: being a nursing student, having at least one course taught using the TBL method, and being willing to participate in the research voluntarily. International students and pre-nursing students were not included in the study. The sample size recommended in the literature is 5–10 participants per survey item or 200–300 people [40]. As the number of items in the scale was 33, the researchers aimed to reach a sample of at least 165 students. A total of 437 nursing students who met the inclusion criteria were invited to participate in the study, and 430 nursing students fully completed the data collection form (98.39%).

Instruments

Data were collected using a sociodemographic questionnaire, the TBL-SAI, and the Self-Directed Learning Scale. The sociodemographic questionnaire was prepared by researchers in line with the literature [18, 20, 41–43]. A total of 11 questions related to the students'

sociodemographic characteristics, such as year of education, gender, and age, were included.

The TBL-SAI was designed by Mennenga in 2012 to determine students' evaluation of TBL. It comprises 33 items measuring three factors: accountability, preference for lecture or TBL, and student satisfaction. The scale is rated on a 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = undecided: neither agree nor disagree, 2 = disagree, and 1 = strongly disagree). The highest possible score is 165, and the lowest possible score is 33. The highest possible score can be obtained when students are satisfied with the TBL approach. The Cronbach's α value of the scale is 0.94, and its subscales are 0.78, 0.89, and 0.94 [36].

The Self-Directed Learning Scale was developed by Lounsbury, Levy, Park, Gibson, and Smith (2009) to determine individuals' self-learning levels. The validity and reliability of the Turkish version of the scale were assessed by Özçelik et al. in 2017. The scale has a one-dimensional structure and 10 items rated on a 5-point Likert scale. The highest possible score is 50, and the lowest possible score is 10. A higher score on the total scale indicates that participants have stronger self-directed learning. The Cronbach's α value of the scale is 0.85. The scale measures individual learning levels [44]; thus, the scale was used to evaluate the criterion validity of TBL-SAI for Turkish nursing students.

Translation process

Forward and back translation

To adapt the scale to the Turkish environment and conduct validity and reliability tests, written permission was obtained via e-mail from the author who developed the original scale. The principles of the International Testing Commission related to the intercultural adaptation process of self-report scales were taken as the basis [45–47]. The “translation-back-translation method” was used to check the language accuracy of the scale. The translation of the scale from English into Turkish was performed by two scientists who are experts in the fields of nursing education and psychology and two scholars from the foreign language department of the same university.

Cultural adaptation assessed by an expert panel

The suitability of the scale items, Turkish language accuracy, and cultural appropriateness were assessed by two Turkish translators. Later, the scale was edited by the researchers and translators, but no item was removed. After editing, the scale was translated back into English by one of the translators and rechecked. The translated scale was found to have the same meaning as the original one.

Content validity

The Davis technique was used to determine content validity by evaluating experts' representation of the scale items across all aspects of the variable being measured [48, 49]. To test the content validity of the TBL-SAI-TR, 11 experts (2 professors, 4 associate professors, 2 lecturers, 2 research assistants in Nursing, and 1 clinical psychologist) were asked to evaluate each item on a 4-point Likert scale (1 = not applicable, 2 = the item should be seriously revised, 3 = the item should be slightly revised, and 4 = applicable). For each item, the content validity index at the item level ranged from 0.86 to 1.00 and the mean content validity index (CVI) was 0.95, which was considered sufficient for content validity.

Pretesting and cognitive interviewing

A pilot study was conducted using the draft scale with 25 nursing students. These students were not included in the final sample. The KMO (0.839) and Bartlett test of sphericity ($\chi^2 = 3110.425$, $p = 0.000$) results showed that the pilot data were suitable for analysis. Thus, the scale initially had 33 items.

Data collection

Researchers collected data from students studying at a university in Istanbul from October to November 2022. The data were collected by the researchers at two different times using the online interview method. Participants required approximately 15–20 min to complete the survey. The students were asked to code the surveys so that we could anonymously match the test and retest responses. The scale was then readministered to 165 students 2 weeks later for test–retest purposes.

Data analysis

The data obtained in the study were evaluated using the SPSS 22.0 and AMOS statistical programs. The language and content validity of the scale, CVI, and average CVI were also examined. In the scale reliability and validity tests, Cronbach's α , item analysis, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), independent group t-test for determining discrimination, dependent group t-test for test–retest reliability, Pearson correlation analysis, and intraclass correlation (ICC) analysis were performed to examine criterion validity. Frequency and percentage analyses were used to determine the descriptive characteristics of the study participants, and mean and standard deviation statistics were used to examine the scale. Kurtosis and skewness values were assessed to determine whether the research variables exhibited a normal distribution. In the relevant literature, results related to the kurtosis and skewness values

of variables between +1.5 and -1.5 and between +2.0 and -2.0 [50] were considered to be normally distributed. Parametric methods were used to analyze the data. The significance level was accepted as $p < 0.05$ within the 95% confidence interval.

Results

Participant characteristics

In total, 430 nursing students participated in the study. The sociodemographic characteristics of the participants are presented in Table 1.

Item analysis

Item analysis results are shown in Table 2. For the 33-item scale, 10 items with item-total correlation values of < 0.30 were deleted based on expert opinion (items 1, 2, 4, 9, 10, 11, 16, 18, 21, and 24). Thereafter, it was determined that all remaining items had values of > 0.30 . The removal of the items with low correlation improved internal consistency without compromising the scale's theoretical framework, as the three-factor structure remained intact. The abovementioned deletion did not negatively affect the scale's construct validity; rather, it enhanced the precision of the factors. As a result of the repeated reliability analysis, the reliability of the scale was found to be 0.90 (Table 2).

Validity

EFA was performed to ascertain the construct validity of the TBL-SAI-TR scale. Based on the Bartlett test ($KMO = 0.876 > 0.60$), the sample size was considered to be sufficient for factor analysis. Using EFA with the Varimax method, the variables were grouped into three factors with a total explained variance of 55.452% (Table 3).

CFA was subsequently performed to examine construct validity. In the CFA, TBL-SAI-TR accountability (items 3,

Table 2 Item analysis

Item no	Mean with item deleted	Variance with item deleted	ITC*	Cronbach alpha with item deleted
Item 3	83.849	161.977	.463	.901
Item 5	84.023	167.052	.362	.903
Item 6	84.105	166.223	.348	.904
Item 7	83.663	166.646	.391	.903
Item 8	83.628	162.504	.571	.899
Item 12	84.180	163.342	.380	.904
Item 13	84.343	161.969	.404	.903
Item 14	83.826	166.507	.300	.905
Item 15	83.977	164.198	.456	.901
Item 17	83.907	164.459	.509	.900
Item 19	83.936	160.996	.617	.898
Item 20	83.907	160.892	.633	.898
Item 22	84.267	165.963	.334	.904
Item 23	84.215	159.913	.603	.898
Item 25	84.006	156.216	.741	.895
Item 26	84.035	155.613	.741	.895
Item 27	83.977	156.561	.704	.896
Item 28	84.477	163.666	.348	.905
Item 29	84.052	157.910	.641	.897
Item 30	84.180	161.517	.446	.902
Item 31	84.070	158.919	.616	.898
Item 32	84.006	158.579	.660	.897
Item 33	83.919	158.520	.689	.896

*ITC Item-Total Correlations

5, 6, 7, and 8), preference for lecture or TBL (items 12, 13, 14, 15, 17, 19, 20, 22, and 23), and student satisfaction (25, 26, 27, 28, 29, 30, 31, 32, and 33) were evaluated. The analysis comprised three dimensions, with a total of 23 items. Appropriateness indices used most frequently in the literature were employed in the present study. A diagram of the CFA is shown in Fig. 1.

When the goodness-of-fit indices were examined, the root mean square error of appreciation (RMSEA) was 0.06, comparative fit index (CFI) was 0.91, root mean square residual (RMR) was 0.07, χ^2/sd was 3.45, goodness-of-fit index (GFI) was 0.90, and adjusted GFI (AGFI) was 0.90. Results showed that the fit statistics calculated via CFA were compatible with the previously determined factor structure of the scale at an acceptable level (Table 4).

Examination of the standardized coefficients demonstrated high factor loadings and low and significant standard error values. These results confirm the construct validity of the previously determined factor structure (Table 5).

The convergent validity of the composite reliability (CR) value of the scale—with its subdimensions > 0.7 ,

Table 1 Distribution of students by sociodemographic characteristics

Groups	Frequency (n)	Percentage (%)
Age (Mean ± SD)	21.527 ± 1.12	
Gender		
Male	32	7.4
Female	398	92.6
Academic year		
Second year	209	48.6
Fourth year	221	51.4
Grade point average		
≤ 2.49	65	15.1
2.50–2.99	182	42.3
≥ 3.00	183	42.6

Table 3 Results of the explanatory factor analysis

Items	F1	F2	F3
Item 6	.824		
Item 7	.773		
Item 5	.753		
Item 8	.721		
Item 3	.548		
Item 14		.828	
Item 13		.774	
Item 20		.728	
Item 22		.701	
Item 23		.711	
Item 17		.638	
Item 19		.587	
Item 12		.529	
Item 15		.490	
Item 27			.802
Item 32			.777
Item 25			.769
Item 26			.765
Item 33			.760
Item 29			.750
Item 28			.607
Item 31			.719
Item 30			.772
Eigenvalues	2.057	2.576	8.121
Explained variance (%)	12.785	13.566	29.101
Cumulative variance (%)	12.785	26.351	55.452
Cronbach's α of each subscale	.78	.76	.88

Total Cronbach's α : .90

F1 Accountability, F2 Preference for lecture- or team-based learning, F3 Student satisfaction

CR values > average variance extracted (AVE) values, AVE values > 0.5, and maximum squared variance (MSV) < AVE—has shown that average shared square variance < MSV also has divergent validity (Table 6). These results indicate that the dimensions of the model were separate structures, and the observed variables explained the dimensions to which they belonged sufficiently and were consistent with one another.

For the criterion validity, the model's correlation with the Self-Directed Learning Scale was examined.

When examining the correlation indicators, the following results were obtained: $r=0.778$ (positive high) with $p<0.05$ for the TBL total versus the self-directed learning total; $r=0.536$ (positive medium) with $p<0.05$ for the relationship between accountability and the self-directed learning total; $r=0.679$ (positive medium) with $p<0.05$ for the relationship between preference for lecture or TBL and the self-directed learning total; and $r=0.719$ (positive high) with $p<0.05$ for the correlation

between student satisfaction and the self-directed learning total.

Reliability

The internal consistency of the TBL-SAI-TR was evaluated using the Cronbach's α coefficient. The Cronbach's α values for the scale's accountability, preference for lecture or TBL, and student satisfaction subdimensions were found to be 0.78, 0.76, and 0.88, respectively. The item-total correlations were found to be between 0.37 and 0.68 for accountability, between 0.34 and 0.63 for preference for lecture or TBL, and between 0.36 and 0.80 for student satisfaction. All subdimensions demonstrated good internal consistency and reliability.

To evaluate the stability of the scale over time, a test-retest analysis was performed on all participants at 2-week intervals. The ICCs for the scales and dimensions were found to be between 0.88 and 0.90. The correlation coefficients between the first and second tests were as follows: total $r=0.845$, total accountability $r=0.896$, total preference for lecture or TBL $r=0.865$, and total student satisfaction $r=0.869$; moreover, there was a significant difference at the $p<0.01$ level.

In addition, the mean scores of the first and second tests were compared with the dependent group t-test. No significant difference was observed between the test and retest measurements ($p>0.05$). These findings indicate that the scale provides reliable measurements when used over a short period of time.

Discussion

In this study, the TBL-SAI was translated into Turkish and its psychometric properties were evaluated among 430 nursing students. The results revealed that the 23-item TBL-SAI-TR has acceptable validity and reliability in Türkiye. The use of this tool can contribute to the evaluation of courses and teaching techniques following students' TBL experience and to support further research.

Validity

The CVI was calculated to evaluate the content validity of the scale. According to the literature, the item CVI value should be at least 0.80, and the average CVI value should be at least 0.90. [48, 49]. In the present study, the item content validity index ranged between 0.86 and 1.00 and the average CVI was 0.95. These results confirmed the suitability and comprehensibility of the TBL-SAI-TR.

Criterion validity is a type of validity used to determine the extent to which the measurement results reflect the measurements of a specified scale. To determine criterion validity, comparing the results obtained using one scale are compared with the results obtained using another

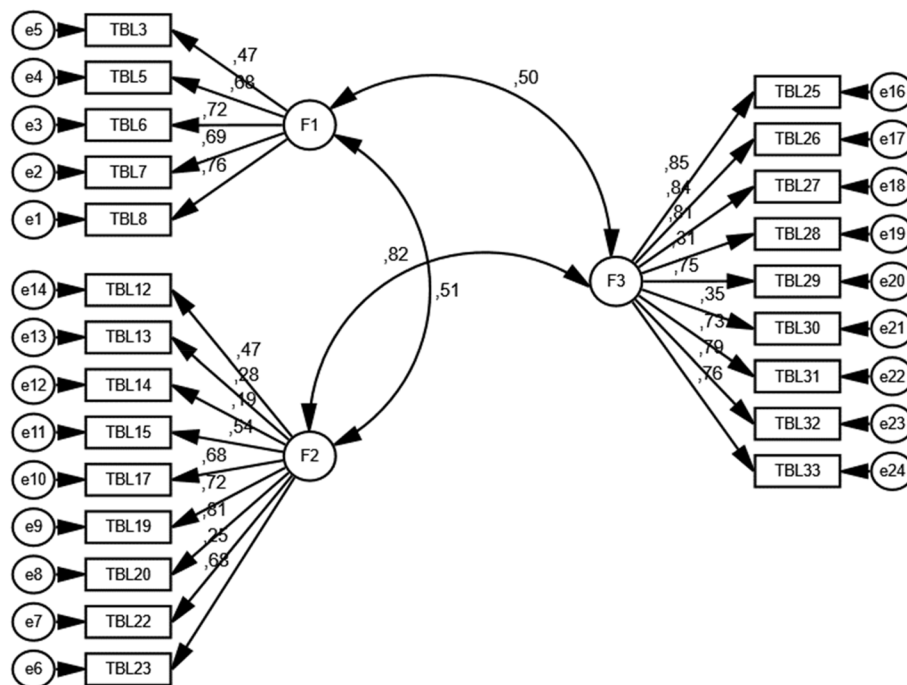


Fig. 1 Diagram of confirmatory factor analysis

Table 4 Confirmatory factor analysis index values

Index	Normal Value	Acceptable Value	Value
χ^2/sd	< 2	< 5	3.45
GFI	> .95	> .90	.90
AGFI	> .95	> .90	.90
CFI	> .95	> .90	.91
RMSEA	< .05	< .08	.06
RMR	< .05	< .08	.07

AGFI adjusted goodness-of-fit index, CFI comparative fit index, GFI goodness-of-fit index, RMR root mean square residual, RMSEA root mean square error of appreciation

scale [48]. Criterion validity was evaluated by performing a correlation analysis between the TBL-SAI-TR and Self-Directed Learning Scale scores. All the correlations were significantly consistent between the TBL-SAI-TR and Self-Directed Learning Scale scores ($p < 0.001$). These results confirm the criterion validity of the TBL-SAI-TR. The Self-Directed Learning Scale was used to evaluate the criterion validity of the TBL-SAI-TR, as self-regulation and individual responsibility in learning processes are relevant to TBL. The literature suggests that self-regulation skills are crucial in TBL experiences [51]. Therefore, examining the relationship between these two scales was valuable for assessing the TBL-SAI-TR's sensitivity to different learning approaches.

The test–retest measurements performed 2 weeks apart showed consistent results. In the present study, all ICCs were found to be above 0.88 and the test–retest correlation values were significant for all dimensions. In the test–retest measurements, no statistically significant differences were found, indicating that the measurements were repeatable. These results showed that the psychometric properties of the instruments were adequate in terms of their internal consistency and stability over time.

CFA is a type of structural equation model that can measure the relationship between observed variables and latent ones [48]. The most frequently used goodness-of-fit indices in the studies found throughout the literature were employed in this study. The results of the model translated into Turkish showed an acceptable goodness of fit. The acceptable goodness-of-fit criteria were calculated as RMSEA 0.06, CFI 0.91, RMR 0.07, χ^2/df 3.45, GFI 0.90 and AGFI 0.90. The factor loadings of all items were found to be between 0.42 and 0.85. In the original scale, factor loadings varied between 0.401 and 0.92 [52]. These results confirm the construct validity of the previously determined factor structure. By performing factor analysis, the TBL-SAI-TR was determined, as was its accountability, preference for lecture or TBL, and student satisfaction through the three-factor structure of the 23 items.

Table 5 Factor loadings

Items and Factors	β	Std. β	SE	t	p
Factor 1: Accountability					
8. I need to contribute to the team’s learning	1.000	.760			
7. I am proud of my ability to assist my team in their learning	.884	.687	.108	8.170	$p < .001$
6. I am accountable for my team’s learning	1.065	.721	.125	8.532	$p < .001$
5. My team members expect me to assist them in their learning	.896	.680	.111	8.093	$p < .001$
3. I contribute to my team members’ learning	.767	.468	.137	5.600	$p < .001$
Factor 2: Preference for lecture- or team-based learning					
23. I perform better in exams when we use team-based learning to cover the material	1.000	.678			
22. After working with my team members, I find it difficult to remember what we talked about during class	.486	.418	.127	3.068	.002
20. I remember material better after the application exercises used in team-based learning	1.070	.806	.118	9.088	$p < .001$
19. I remember information for longer when I go over it with members during the GRATS used in team-based learning	.970	.720	.117	8.276	$p < .001$
17. Team-based learning activities help me recall past information	.842	.681	.107	7.888	$p < .001$
15. I easily remember what I learn when working in a team	.746	.536	.118	6.342	$p < .001$
14. I talk about unrelated things during team-based learning activities	.549	.429	.131	2.264	.024
13. I get bored during team-based learning activities	.563	.434	.149	3.371	$p < .001$
12. I am more likely to fall asleep during lectures than during classes that use team-based learning activities	.823	.475	.145	5.660	$p < .001$
Factor 3: Student satisfaction					
25. I enjoy team-based learning activities	1.000	.853			
26. I learn better in a team setting	1.011	.837	.073	13.856	$p < .001$
27. I think team-based learning activities are an effective approach to learning	.982	.814	.074	13.239	$p < .001$
28. I do not like to work in teams	.431	.409	.108	3.978	$p < .001$
29. Team-based learning activities are fun	.912	.747	.079	11.575	$p < .001$
30. Team-based learning activities are a waste of time	.465	.442	.102	4.546	$p < .001$
31. I think team-based learning helped me improve my grades	.869	.728	.078	11.128	$p < .001$
32. I have a positive attitude toward team-based learning activities	.901	.787	.072	12.544	$p < .001$
33. I have had a good experience with team-based learning	.836	.756	.071	11.785	$p < .001$

B beta, Std β : standardized beta, SE standard error

Table 6 Convergent and divergent validity

	CR	AVE	MSV	ASV
TBL-SAI-TR	.84	.53	.41	.25
Accountability	.83	.59	.50	.46
Preference for lecture- or team-based learning	.91	.87	.32	.28
Student satisfaction	.78	.58	.49	.32

ASV average shared square variance, AVE average variance extracted, CR composite reliability, MSV maximum squared variance

TBL-SAI-TR Team-based Learning Student Assessment Instrument–Turkish Form

Reliability

The reliability of the TBL-SAI-TR scale and its subscales, including accountability, preference for lecture or TBL, and student satisfaction, was assessed using Cronbach’s α , with values found to be 0.90, 0.78, 0.76, and 0.88, respectively. The scale has sufficient internal consistency because these values are above the acceptable limit of

0.70 [40]. When the Cronbach’s α values obtained from the original scale were compared, the findings were found to be consistent in the accountability subdimension and somewhat consistent in the other dimensions [36]. In his study on pharmacy and biomedical students, Parthasarathy (2019) reported that the Cronbach’s α value of the TBL-SAI was 0.65, and its subscale accountability, preference for lecture or TBL, and student satisfaction were 0.50, 0.41, and 0.62, respectively [39]. Additionally, the item–total correlations were calculated to determine the relationship between the items and the scale scores. The item–total correlation of an item should be above 0.20 [48]. Because the item–total correlations in the study were between 0.30 and 0.74, the scale’s internal consistency is considered sufficient. The potential impact of the course content on students’ scores was considered during the test–retest applications. Therefore, the time interval between the test and retest was determined to minimize significant changes in the learning experience measured by the scale. However, there may exist individual

differences in students' learning experiences during this period. Future studies could extend the test–retest interval to assess the scale's long-term stability.

Adaptability

These results were found to be compatible with the three-factor structure of the 33-item TBL-SAI at an acceptable level [36]. The item placements of the factors were the same as those of the original scale. However, in the Turkish validity study, the following items were removed: item 1 (“I spend time studying before class in order to be more prepared”), item 2 (“I feel I have to prepare for this class in order to do well”), and item 4 (“My contribution to the team is not important”) in the accountability subdimension; item 9 (“During a traditional lecture, I often find myself thinking of unrelated things”), item 10 (“I am easily distracted during a traditional lecture”), item 11 (“I am easily distracted during TBL activities”), item 16 (“I remember the material better when the instructor lectures about it”), item 18 (“It is easier to study for tests when the instructor has lectured about the material”), item 21 (“I can easily remember material from the lecture”), and item 24 (“After listening to the lecture, I find it difficult to remember what the instructor talked about during the class”) in the preference for lecture or TBL subdimension. Further, 23 new items were created. However, all items belonging to the student satisfaction subdimension had the same items as the original scale.

This study evaluated the cultural appropriateness of the TBL-SAI-TR through psychometric analyses. As part of the validity study, content validity, construct validity, and criterion validity analyses were conducted, and item–total correlations were examined. The results indicated that the scale is meaningful and consistent for Turkish nursing students. Compared with other TBL studies in nursing education, this study highlights the importance of adapting educational tools to local cultural and contextual factors [48]. While the three-factor structure of the TBL-SAI-TR remained consistent with the original version, some discrepancies were observed in the Turkish adaptation, particularly with regard to items related to student preferences and accountability. These differences may reflect variations in educational approaches and cultural attitudes toward learning, as noted in similar studies conducted in non-Turkish contexts [2, 21, 36, 39].

Future studies could use qualitative methods to explore the scale's application among Turkish student populations and gain deeper insights into its applicability in various learning contexts. This could further improve the scale's cultural relevance and offer valuable insights into its ability to reflect the unique aspects of learning environments in Türkiye. Future validation studies could also involve diverse educational settings to assess whether the

TBL-SAI-TR maintains its reliability across disciplines and educational levels.

Strengths and limitations

This study has several limitations. First, the sample size is limited because the study included nursing students from only one institution. Second, due to the limited number of courses in which the TBL was applied, only second and fourth-grade students were included in the study. Third, because the TBL model had not been previously applied in this institution's nursing education, students and faculty members were inexperienced. They felt nervous before conducting the TBL. In contrast, they were relaxed with the education model previously used. There were no significant issues while adapting the scale to Turkish with the help of experts in the language accuracy control phase. Positive feedback was received from the experts regarding the simplicity, understandability, and clarity of the scale. Therefore, adapting the scale items to the Turkish language was fulfilling for the researchers. In our study, student satisfaction with the TBL was high. Using the TBL method, they could focus better on the course and prepare for their exams more easily. Additionally, TBL was considered more engaging than traditional courses. Hence, the contents of the courses using TBL enabled students to acquire long-lasting knowledge. Finally, the number of the participants increased as a result of the positive TBL experiences of students. The students who had TBL experiences felt advantaged compared to other students.

Conclusion

The results of this study indicate that the Turkish version of the TBL-SAI is a valid and reliable tool for accurately measuring students' evaluation of TBL. Our findings confirmed the three-factor structure of the TBL-SAI-TR: accountability, preference for lecture or TBL, and student satisfaction. The TBL-SAI-TR can be easily used to evaluate students' experience of TBL in Türkiye. Future studies should employ different sample sizes to evaluate the effects of the TBL method, an active teaching method used by faculty members in Türkiye.

Additionally, the TBL-SAI-TR scale items are straightforward and easy to understand. Students can usually complete it within 10 min. The items of this scale are not specific to nursing education; thus, it may be used in other disciplines where the TBL method is applied. Future studies should be conducted with undergraduate and graduate students in different disciplines as well as among students from different countries and cultural backgrounds. This can help verify the applicability of the scale, expanding the use of the TBL method. Validity and reliability studies of the TBL-SAI translated into

other languages can provide a better understanding of the scale's psychometric properties.

Abbreviations

TBL-SAI	Team-based Learning and Student Assessment Instrument
TBL	Team-based learning
TBL-SAI-TR	Team-based Learning and Student Assessment Instrument-Turkish Form
CVI	Content validity index
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
ICC	Intraclass correlation analysis
CR	Composite reliability

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Authors' contributions

SŞO made substantial contributions to the study design and data analysis. SŞO drafted the paper and critically revised it. ŞÇK made substantial contributions to the study design and data analysis. All authors read and approved the final manuscript and also share responsibility for the accuracy and integrity of the work.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding authors upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Non-Invasive Clinical Research Ethics Committee of the involved university (Application number: 202206Y0267 Tarih: 08.07.2022) and was conducted in accordance with the principles outlined in the Declaration of Helsinki. First, the rationale and purpose of the study were explained to the volunteer nursing students participating in the study, after which the survey link was shared. The survey was administered only to those who provided informed consent in writing. The participants were assured of the anonymity of their data, that the survey data would not be used for purposes other than the research, and that the data would be discarded after the completion of the study. Permission was obtained via e-mail from the person who developed the scale for its translation into Turkish, validity and reliability study, and use of the original title.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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