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Team-based learning: Implementation and evaluation of nursing students' experience and satisfaction

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Abstract

Team-based learning is an alternative to passive learning. Its defining characteristics are small-group collaboration and active student participation. This study evaluated students' accountability, performance, and satisfaction with the team-based learning strategy, as well as the impact of gender and cumulative grade point average. It was a quasi-experimental one-group post-test study conducted at the College of Nursing and Health Sciences, Jazan University, Saudi Arabia. A team-based learning session with 214 students was conducted. Descriptive statistics, chi-square, and multilevel regression were used to analyze students' accountability, preference, and satisfaction with team-based learning using an online survey. Students were accountable; 85% used pre-class materials to prepare. The majority of students expressed satisfaction with their session engagement. Most believe that team-based learning motivated them to engage and recommend it for nursing courses. Male students' scores on the team readiness assessment test improved by 30.73%. The multilevel regression analysis revealed a substantial gender effect on gain increases (P-value < 0.0001). Students expressed great satisfaction with their team-based learning experience. This study demonstrated that team-based learning improved student involvement, performance, and accountability and recommends its application in the nursing program; however, further research is needed to improve the transferability of results. *(Afr J Reprod Health 2024; 28 [10]: 52-61).*

Keywords: Team-based learning, nursing students, experience, gender, Saudi Arabia

Résumé

L'apprentissage en équipe est une alternative à l'apprentissage passif. Ses caractéristiques déterminantes sont la collaboration en petits groupes et la participation active des étudiants. Cette étude a évalué la responsabilité, les performances et la satisfaction des étudiants à l'égard de la stratégie d'apprentissage en équipe, ainsi que l'impact du sexe et de la moyenne cumulative. Il s'agissait d'une étude post-test quasi-expérimentale en un seul groupe menée au Collège des sciences infirmières et de la santé de l'Université de Jazan, en Arabie Saoudite. Une session d'apprentissage en équipe avec 214 étudiants a été organisée. Des statistiques descriptives, le chi carré et une régression multiniveau ont été utilisés pour analyser la responsabilité, les préférences et la satisfaction des étudiants à l'égard de l'apprentissage en équipe à l'aide d'une enquête en ligne. Les étudiants étaient responsables; 85 % ont utilisé du matériel préalable au cours pour se préparer. La majorité des étudiants ont exprimé leur satisfaction quant à leur participation à la séance. La plupart pensent que l'apprentissage en équipe les a motivés à s'engager et le recommandent pour les cours de soins infirmiers. Les résultats des étudiants de sexe masculin au test d'évaluation de la préparation à l'équipe se sont améliorés de 30,73 %. L'analyse de régression multiniveau a révélé un effet substantiel selon le sexe sur l'augmentation des gains (valeur P < 0,0001). Les étudiants ont exprimé une grande satisfaction quant à leur expérience d'apprentissage en équipe. Cette étude a démontré que l'apprentissage en équipe améliorait l'implication, la performance et la responsabilité des étudiants et recommande son application dans le programme de soins infirmiers ; cependant, des recherches supplémentaires sont nécessaires pour améliorer la transférabilité des résultats. *(Afr J Reprod Health 2024; 28 [10]:52-61).*

Mots-clés: apprentissage en équipe, étudiants en soins infirmiers, expérience, genre, Arabie Saoudite

Introduction

It is crucial in higher education to develop and strengthen skills such as problem-solving, critical thinking, and interpersonal communication. As a result, it is vital to create an educational environment that links theoretical knowledge with practical experience[1]. While lectures have been

standard for a long time[2], there are worries about the passive nature of students and the one-way flow of information. Consequently, there is a focus on interactive teaching methods in lectures. The argument has been made that participation during a lecture improves students' attention, and participants typically value interactive sessions[3]. Hence, a growing body of research supports using different teaching methods where students are involved in their own learning, like flipped classrooms, team-based learning (TBL), lab games, and online teaching materials that can be delivered at different times[4].

Based on a meta-analysis of 225 studies, active learning is effective in STEM (Science, Technology, Engineering, and Math) programs. A 6% improvement in exam performance has been achieved. In addition, it decreases failure rates, Active learning reduces the average failure rate from 34% to 22%, with students in traditional lecture-based courses 1.5 times more likely to fail[5]. Michaelsen established TBL in the 1970s to enhance the participation of students in a sizable, college-level business class[6] Since then, TBL has been applied in a variety of educational settings, including medical education and nursing[7]. TBL increases levels of engagement and boosts academic performance, especially in lower-achieving students[8]. Moreover, TBL has been demonstrated to enhance nursing students' clinical performance and problem-solving abilities[9]. It is also linked to high levels of student satisfaction among undergraduate nursing students in the areas of learning experience quality, teamwork, clinical reasoning, and professional development[10] It has also been established that TBL training can help nursing students gain more confidence in their ability to provide safe patient care[11].

TBL is applied in many universities in Saudi Arabia[12,13], In Jazan University, it is applied in the college of medicine in some courses[14], However, in the nursing program at Jazan University, traditional lectures are the primary teaching method; problem-based learning (PBL), project-based learning, and TBL are not officially recognized teaching and learning strategies. Nevertheless, there are efforts to implement many active learning strategies, including PBL, flipped classrooms, and TBL. The purpose of this study is to evaluate the students' perceptions and experiences regarding TBL and to assess the effects of gender and cumulative grade point average (CGPA) on these experiences. The results of the study will be used to improve curriculum design and develop better teaching and learning techniques in the nursing program. Other programs at Jazan University may find these findings useful as well. In light of this, the following specific objectives were set for the current study: (1) To evaluate the experience and satisfaction of students regarding TBL (2) To identify the effects of gender and CGPA on the students' experience. (3) To determine the impact of gender and CGPA on the student's performance on the individual and team readiness assessment tests.

Methods

Study design

This one-group post-test quasi-study was undertaken in March 2023 at the Nursing College of Jazan University, Saudi Arabia.

Sample size

All the students registered in the pathology course at the 5th level were recruited. All the students who voluntarily agreed to participate in the learning session were selected (eighty males and 134 females).

Inclusion criteria

All the students who voluntarily agreed to participate in the learning session

Exclusion criteria

Students who didn't fill out the questionnaire were excluded.

Procedure

The study objectives and steps were explained to all participants prior to the session, and the study materials were distributed one week before the session.

A team-based learning (TBL) session on respiratory diseases was offered to the students on two separate days. As described by Michaelsen & Sweet, the session consisted of three stages: (a) advanced preparation by the students; (b) individual readiness assessment tests (IRAT); (c) team readiness assessment tests (TRAT); and (d) application, which

included whole class discussion and reasoning[15]. TRAT and IRAT were the same tests, consisting of six multiple-choice questions (MCQs). The results were only used for the study and will not affect the student's final grades. Students were given 10 minutes to complete the IRAT, after which their test papers were collected without any feedback. Then they were distributed into groups of 9 to 13 students for the TRAT, with a total of 7 male groups and 13 female groups. Throughout the 20-minute session, the students' interactions and group dynamics were observed. The discussion was then held for about 30 minutes, during which all teams shared and defended their answers. Following the session, all participants were requested to complete a questionnaire aimed at assessing their individual experiences regarding the session.

Data collection tool

The students' TBL experience was assessed via an online 5-point Likert scale survey. The survey URL was distributed via a printed barcode following the session. The link contained the survey and a consent form for participation. The survey consists of 17 items that assess students' perceptions of TBL. This instrument is divided into five subscales: students' previous TBL experience (1 question), session preparation (2 questions), assessment test evaluation (5 questions), students' engagement and participation during the session (4 questions), and teamwork benefits (3 questions). Plus 2 questions for an overall evaluation of their experience.

Statistical analysis

Data were analyzed using IBM SPSS Statistical Package. TBL experience evaluation was done by assessing three main domains: student accountability, preference for TBL over traditional lectures, and TBL satisfaction. Descriptive statistics were computed for each question within the five subscales to summarize the data. These included frequencies, percentages, mean scores, standard deviations, and average responses. A chi-square test was conducted to assess whether there were significant differences in performance improvement between male and female participants. This test evaluates the association between categorical variables and helps determine if the observed distribution of performance improvement is significantly different from what would be expected by chance.

Multilevel regression analysis was employed to identify variables that significantly affect performance improvement. This method accounts for hierarchical data structures and allows for the examination of how variables at different levels (e.g., individual and group levels) impact the outcome.

The Kruskal-Wallis test was used to compare median scores across different groups within the dataset when the assumption of normality was not met. This non-parametric test assesses whether there are statistically significant differences between the medians of three or more independent groups.

The significance level for all statistical tests was set at $\alpha = 0.05$. This threshold determines whether the observed results are statistically significant, with a p-value below 0.05 indicating strong evidence against the null hypothesis.

Ethical approval

All procedures performed in studies involving human participants followed the ethical standards of the institutional research committee (Scientific Research Ethics Committee of Jazan University (HAPO-10-Z-001)) and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Standing Committee for Scientific Research at Jazan University, Reference No. REC-44/08/593.

Results

A total of two hundred and fourteen students participated in this study; most of them were female (62.6%). The majority of participants (94%) were high-achieving students with a CGPA greater than 3 (Table 1).

Table 2 shows the response differences of all students in the sample for the TBL assessment method. The study revealed that a majority of the students (61.2%) held a neutral view of TBL sessions, while just a small proportion (15.4%) expressed a positive impression.

Regarding preparation for the session: Around 85% of the students have completed the necessary preparations by studying the pre-session resources. The prospect of sharing their knowledge and perspectives in the classroom has acted as a source of inspiration for their careful preparation.

Table 1: Background of the participants

Variable	Category	Gender Female N	%	Male N	%
Age	16-20 years old	105	(78.4)	56	(70.0)
	21-24 years old	29	(21.6)	24	(30.0)
	Total	**134**	(100)	**80**	**(100)**
CGPA	1-1.9	7	(5.2)	1	(1.3)
	2-2.9	6	(4.5)	0	(.0)
	3-3.9	16	(11.9)	22	(27.5)
	4-5	105	(78.4)	57	(71.3)
	Total	**134**	**(100)**	**80**	**(100)**

Table 2: Display the perception of students in the study sample about the TBL assessment.

	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)	Total (%)
. Previous experience regarding TBL	33	0	131	39	11	100
Before this session, I used to have a negative impression of TBL	(15.4)	(.0)	(61.2)	(18.2)	(5.1)	
. Preparation	1	0	32	83	98	100
I finished reading the pre-session material	(.5)	(.0)	(15.0)	(38.8)	(45.8)	
I was inspired to prepare in advance because I knew I would be sharing my ideas during this TBL session	0 (.0)	0 (.0)	33 (15.4)	66 (30.8)	115 (53.7)	100
. Assessment tests	0	0	7	63	144	100
Testing for readiness was a successful learning activity.	(.0)	(.0)	(3.3)	(29.4)	(67.3)	
The tRAT discussions helped me to correct my mistakes.	0 (.0)	0 (.0)	8 (3.7)	52 (24.3)	154 (72.0)	100
I enjoyed the individual readiness assessment	0 (.0)	0 (.0)	20 (9.3)	60 (28.0)	134 (62.6)	100
I enjoyed the team readiness assessment	0 (.0)	0 (.0)	10 (4.7)	57 (26.6)	147 (68.7)	100
I enjoyed the group readiness discussion	0 (.0)	0 (.0)	9 (4.2)	51 (23.8)	154 (72.0)	100
. Engagement and Participation during the session	3	0	32	61	118	100
Unlike traditional lectures, I am less likely to feel sleepy during this session	(1.4)	(.0)	(15.0)	(28.5)	(55.1)	
When I am in this session, I am less distracted than when I am in a traditional lecture	3 (1.4)	0 (.0)	41 (19.2)	75 (35.0)	95 (44.4)	100
Compared to traditional lectures, this session is less boring	4 (1.9)	0 (.0)	21 (9.8)	71 (33.2)	118 (55.1)	100
This session increased my participation in the class discussion	3 (1.4)	0 (.0)	28 (13.1)	77 (36.0)	106 (49.5)	100
. Benefits of working in teams	0	0	11	76	127	100
I easily remember what I learn when working in a team	(.0)	(.0)	(5.1)	(35.5)	(59.3)	
I learn better in a team setting	0 (.0)	0 (.0)	12 (5.6)	70 (32.7)	132 (61.7)	100
Solving problems in a group is an effective way to learn and practice	1 (.5)	0 (.0)	12 (5.6)	65 (30.4)	136 (63.6)	100

Table 3: Analysis of TBL student's assessment questionnaire. The scores for all subscales are obtained by adding all students' responses on a 5-point Likert scale (1 for strongly disagree to 5 for strongly agree) for that subscale

Subscale	Female			Male			P-Value
	N	Max Score	M±SD	N	Max score	M±SD	
Previous negative experience regarding TBL (1 Q).	134	5	3.0±1.3	80	5	2.9±1.2	0.760
Preparation (2 Qs).	134	10	9.0±1.1	80	10	8.7±0.9	**0.011**
Assessment tests (5 Qs)	134	25	23.4±2.1	80	25	23.3±2.0	0.809
Engagement and Participation during the session (4 Qs).	134	20	17.4±2.4	80	20	18.0±1.9	0.057
Benefits of working in teams (3 Qs).	134	15	13.7±1.6	80	15	13.8±1.3	0.594
Overall evaluation (2 Qs).	134	10	9.1	80	10	9.1	0.970

* M±SD represents mean value± standard deviation. Max score: maximum possible score for related subscale. * Bold font represents a significant difference using the T-test between females and males (P<0.05*).*

Concerning their experience with the assessment tests, a considerable percentage of the participants (74.8%) said that they believed the learning activity to have been successful. Additionally, a substantial majority of the students (95.8%) expressed enjoyment in engaging in group discussions during the TRAT. Moreover, a significant majority of the students (96.3%) acknowledged that the TRAT facilitated their understanding and correction of mistakes.

When questioned about their engagement and participation during the session, the majority reported feeling less sleepy (84%) and less distracted (79%). It also improved their participation in class discussions (86%), and they perceived it to be less boring than traditional lectures (88%).

Students demonstrated positive opinions regarding teamwork benefits. More than 93% of the participants agreed that studying in groups improved their ability to learn and remember material. Rather, they thought that it was an effective strategy for problem-solving practice.

Overall, according to their experience, 94.4% of the participants were satisfied with the TBL session, and 89.3% of the participants thought that TBL should be adopted as a teaching method in other courses in nursing.

The results obtained in Table 3 show that the previous perception regarding TBL assessment for males and females was neutral. The results for the remaining four subscales showed moderately favorable trends. outcomes toward strongly agree and agree, leading to a relatively good overall satisfaction with the TBL approach.

However, a significant difference (*P = 0.011*) between female and male students was found regarding their preparation for the TBL session. Both have prepared well, but females were significantly better (9.0±1.1 vs 8.7±0.9).

Figures 1 and 2 show the IRAT and TRAT scores for the students in each group, respectively. Some groups had some outlier results. In terms of IRAT results, group 3 had the lowest median percentage (about 45%), with more than 75% of its members scoring less than 65%. However, after the group discussion, the same group clearly improved their performance and obtained an average of more than 90%. Group 1 displayed a symmetric distribution. Fifty percent received less than 70%. The same group, however, achieved a perfect score on the TRAT test. Each of the three groups (2,8,17) had one student who received a zero. Two of these groups improved their performance and received full marks in the TRAT. There was a single student in each of groups 2, 8, and 17 who had a score of zero. Two of the aforementioned groups demonstrated enhanced performance and achieved perfect scores in the TRAT. As shown in Table 4 and Figure 3, which demonstrate the gender influence on student performance and improvement on IRAT and TRAT scores. Figure 3 shows that female students performed higher on IRAT (83.4%) than male students (65.8%), while their TRAT scores were comparable. Nevertheless, the level of improvement was higher in male students.

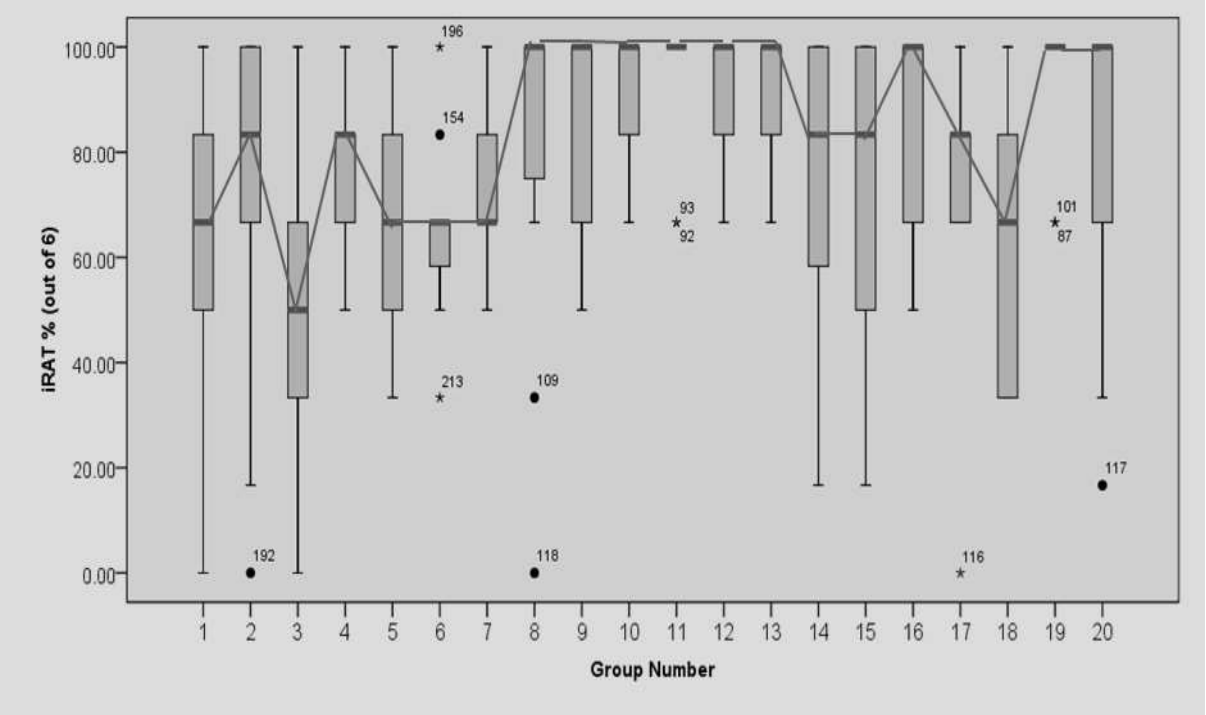

Figure 1: Box Plot for describing the distribution of the results given in% (out of 6) of the individual's assurance **re**adiness test (IRAT) for all created small groups in the class

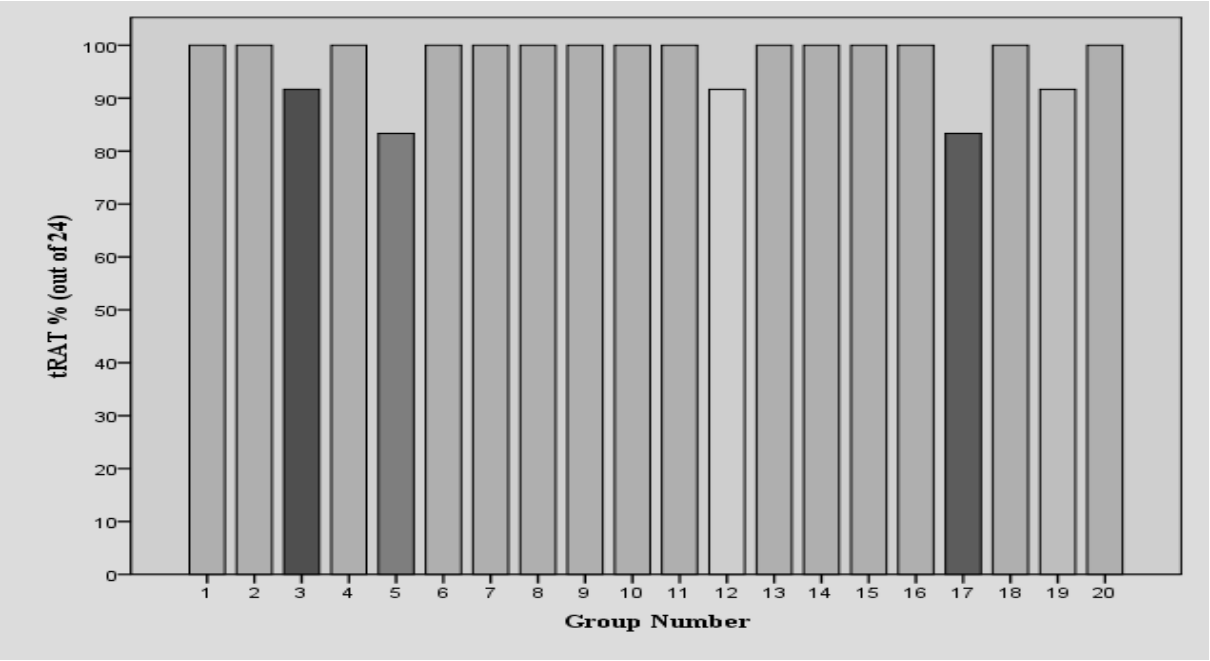

Figure 2: Bar graph plot for displaying the distribution of the results given in% (out of 24) of the team assurance readiness test (TRAT) for all created small groups in the class

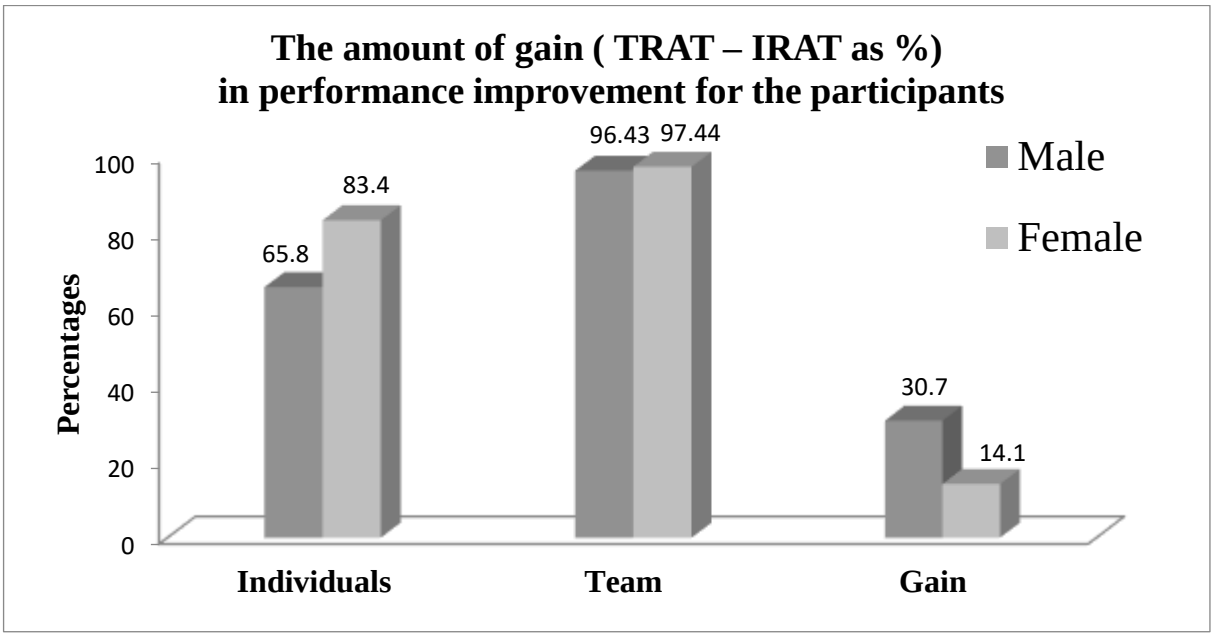

Figure 3: Represents the difference in main gain (TRAT-IRAT) for performance improvement given in % for male and female in the study

Table 4: Gender effect on the improvement of the performance of the students
Gain Improvement in Percentages (GI = TRAT – IRAT (%)

Gr .Nr	Gender	Individuals IRAT% (out of 6)	Team TRAT% (out of 24)	Gain GI %	Kruskal Wallis test P-Value
1	M	60.61	100.00	39.39	
2		70.51	100.00	29.49	
3		48.33	91.67	44.17	
4		76.39	100.00	23.61	
5		69.23	83.33	14.10	
6		65.28	100.00	34.72	
7		70.37	100.00	29.63	
	Total	**65.82**	**96.43**	**30.73**	
8	F	81.94	100.00	18.06	0.001
9		85.00	100.00	15.00	
10		90.00	100.00	10.00	
11		93.33	100.00	6.67	
12		91.67	91.67	.00	
13		93.33	100.00	6.67	
14		75.76	100.00	24.24	
15		75.00	100.00	25.00	
16		88.33	100.00	11.67	
17		73.33	83.33	10.00	
18		63.33	100.00	36.67	
19		92.59	91.67	.00	
20		80.56	100.00	19.44	
Total		**83.40**	**97.44**	**14.11**	

Furthermore, at a significance level of 5%, there is a statistically significant difference in performance between males and females based on their TBL level. A chi-square test was used to determine the difference between the performance improvement of males and females.

Table 5: The effect of gender, age, and GPA on the improvement of the students' performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	11.369	6.958		1.634	.104	-2.348	25.086
Gender	16.659	3.624	.313	4.597	.001	9.515	23.803
Age	-1.734	3.986	-.029	-.435	.664	-9.593	6.124
GPA1	9.767	9.779	.072	.999	.319	-9.512	29.046
GPA2	.666	11.085	.004	.060	.952	-21.187	22.519
GPA4	5.907	4.576	.098	1.291	.198	-3.114	14.928

a. Dependent Variable: GI

The results showed a significant difference (chi-square = 27.167, $p < 0.001$, df = 1). In terms of gain improvement (GI), male participants represented a highly significant improvement in their performance ($p = 0.000$). Table 5 shows the results of the adjusted multilevel regression analysis. In the model, after adjusting all other variables, age, and GPA, the gender variable is still statistically significantly affecting the outcome GI (gain improvements) ($P < 0.0001$).

Discussion

This study aimed to assess the effectiveness of a single-day TBL session conducted with a cohort of undergraduate students enrolled in the pathology course at Jazan University's Nursing College in Saudi Arabia. The results of the study revealed that the TBL strategy promotes students' accountability, as 84.6% of the students had completed the pre-session material.

Their meticulous preparation has been motivated by the idea of imparting their knowledge and viewpoints to their peers in the classroom. This is congruent with the findings of a comparable study conducted at Almaarefa University's undergraduate health science program[17]. This observation shows that students exhibit a high level of dedication and responsibility, which is consistent with the primary idea of TBL.

Moreover, the high percentage of the students who agreed that they are learning better in team settings reflects the satisfaction levels among students who participated in TBL sessions. Additionally, there was a distinct preference observed for TBL over traditional lectures. The results indicated above are consistent with the findings reported in prior research on nursing programs that utilized the TBL methodology[7,16].

The application of a typical TBL session contributes to the enhancement of students' interpersonal and teamwork skills[18], which are vital in healthcare and patient safety. Medical errors caused by poor communication are common in modern healthcare and can be harmful to patients. Team-Based Learning teaches healthcare professionals how to work in teams, use evidence-based knowledge, and communicate with patients. This technique emphasizes decision-making and problem-solving, which improve communication, collaboration, and teamwork. These competencies prevent errors[19].

In our study, students agreed that working in teams boosted their learning and memory and was effective for problem-solving. The TRAT scores improved statistically significantly when compared to the previous IRAT results. The improvement of TRAT scores can be expected through coordinated efforts. It is realistic to expect that team performance and knowledge acquisition will outperform that of individuals. Previous studies have demonstrated that the use of collaborative examinations has a positive impact on student performance[20,21].

The research results indicated that students had a higher propensity to modify their answers toward accurate responses while in a group setting. Additionally, collaborative tests were found to enhance long-term recall of the material[22].

Regarding the factors affecting the students' performance, our study revealed that gender significantly affected the students' performance. This is in contrast to the findings of Salih *et al.* (2021), who found no significant difference between males and females[23]. Our findings are explained by the fact that there are more high-achieving females with a CGPA of 4-5 (78.4%) than males (71.3%).

The findings of this study indicate that students expressed a positive perception of TBL, seeing it to be both effective and interesting. Furthermore, they encouraged the incorporation of TBL into a wider range of curricular courses. These findings are consistent with previous studies in this field[17,24].

Limitations

This study is the first to investigate the experience and satisfaction of nursing students at Jazan University, Saudi Arabia, with regards to TBL. The current study had a limited sample size, which can lead to a decline in the study's statistical power. Additionally, the study only included one subject (pathology). Our findings lack generalizability to all nursing students and students in other colleges of Jazan University.

While they offer a snapshot of the participants in this study, they may not accurately represent the greater student population or be applicable to different disciplines. Hence, it is imperative to replicate the study using a more extensive sample size and a random selection method in addition to applying the TBL sessions in different subjects. Furthermore, instead of focusing on a single topic, the TBL strategy should be used throughout the course.

Conclusion

This study provides evidence supporting the efficacy of TBL as a viable instructional approach for educating undergraduate nursing students.

In conclusion, the authors of this study assert that TBL proved to be a successful pedagogical approach, fostering active learning and promoting the development of collaboration abilities within the examined student population.

It is recommended that the implementation of TBL be considered in nursing education due to its feasibility and lack of additional infrastructure or faculty requirements. Furthermore, the TBL is recommended as a highly engaging method for nursing curricula since it can boost nursing students' participation by utilizing active teaching methods. Faculty who are contemplating the implementation of TBL should adhere to a standardized TBL framework, conduct research, and report on the results in order to develop a more thorough comprehension of the impact and relative merits of the impact of TBL on the learning outcomes.

However, it is crucial to emphasize the significance of training the teaching staff to ensure favorable outcomes. A further study involving the teaching staff is necessary as a baseline measure before the official implementation of TBL in our undergraduate nursing program.

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Contribution of authors

Hind A.M Elamin devised and refined the method and research, and he helped write the first draft. She also edited and revised the document.
Iman K. Abdel Gadir oversaw the study's design, execution, and documentation, including methodology and manuscript creation.
Mohammad Zaino contributed to the research by developing the approach and writing the initial draft and manuscript.
Nisreen Daffa Alla oversaw the study's design, execution, and documentation, including methodology and manuscript creation.
Amna M. Ali contributed to the research by developing the technique and writing the initial draft and final manuscript.
Amani M. Mustafa directed the outcomes' design, execution, and documentation, including methodology and manuscript writing.
Eltuhami A. Abdalgadir contributed to the manuscript's conception, methodology, implementation, drafting, review, and editing.

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