Team Based Learning Experience from a College of Pharmaceutical Sciences in United Arab Emirates

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ABSTRACT

Introduction: Team-Based Learning (TBL) is an active-learning methodology that has been successfully employed in various health schools' curricula. This study assessed the perception of pharmacy students studying in a College of Pharmaceutical Sciences towards TBL with an emphasis on their perception to online TBL. **Materials and Methods:** The study was a cross sectional survey including students of all the four years of Bachelor of Pharmacy program. Team-based learning student assessment instrument (TBL-SAI) was used to evaluate the perception of pharmacy students towards TBL. **Results:** Out of the total 82 students, majority were female ($n=52$, 63.4%, 95% CI: 52.4 - 73.2) and were from final year of the program ($n=38$, 46.3%, 95% CI: 35.4 - 57.3). Mean age of the study participants was 21.3 ± 2.0 years, with age range from 17 to 27 years. Majority of the students' responses indicated that they favored various aspects of TBL. Mean scores for the three TBL-SAI subscales, accountability, preference for lecture or TBL, student satisfaction, were 31.3 ± 3.3, 54.3 ± 7.4, 31.2 ± 4.4 respectively. All the three subscales of TBL-SAI attained scores well above the threshold favoring TBL. Majority of the students preferred online TBL compared to paper based TBL. No statistically significant results were found in logistic regression analyses carried out to identify characteristics associated with preference for TBL. **Conclusion:** Pharmacy students preferred TBL over traditional lecture-based teaching. Furthermore, they preferred the online mode of TBL as they found it to be more organized, student and environment friendly compared to paper based TBL.

Keywords: Team-Based Learning, Pharmacy, Online, Perception, United Arab Emirates.

INTRODUCTION

Active-learning methodologies encourage higher cognitive level knowledge and development of soft skills and are being utilized extensively in undergraduate teaching nowadays.[1,2] Team-Based Learning (TBL) is one of these techniques and has been successfully employed in various Health Schools' curricula,[3,4] including medicine,[4-8] pharmacy,[9-12] nursing,[13-15] and dentistry.[16,17] TBL utilizes a small group teaching approach which offers collaborative, interactive, facilitator-led learning sessions.[18] The structured format of TBL promotes self-learning, accountability, communication and problem-solving skills in students. Through this structured format, the students develop on theoretical knowledge following a sequence of steps comprising of self-preparation, readiness assurance testing at individual and team levels, feedback and application.[19,20]

TBL has proved beneficial for both the students as well as the teachers. It improves student performance in assessments, representing their better understanding of the concept.[21,22] TBL helps the faculty members to move the theoretical content delivery to pre-class preparation stage allowing them to dedicate more class time for active learning with the knowledge acquired during pre-class session.[18,23] Several previous studies have reported positive perception of students towards

TBL.[5,11-12] Students reported that TBL gives them active learning opportunity with an engaging environment, which promotes deeper understanding and improved knowledge retention.[9] TBL was employed in pharmacy education for the first time in the year 2008,[24] and since then it has been embraced in a number of pharmacy schools and colleges all around the world.[9-12] Pharmacy students have reported that TBL assists them in achieving professional competencies like working effectively as an individual in a team and performing professional collaborative activities.[25] In addition, they stated that TBL improves their ability to think critically and communicate effectively.[11,25]

RAK Medical and Health Sciences University implemented online TBL through its University Management System. During the online TBL, the students take individual readiness assurance tests (IRAT) and the follow-up team readiness assurance tests (TRAT) in the Online Examination Center. The present study assessed the perception of pharmacy students studying in a College of Pharmaceutical Sciences in United Arab Emirates towards TBL. The study also looked into the preference of students for online TBL compared to paper based TBL.

MATERIALS AND METHODS

Study design and Sample Population

The study was conducted through a cross sectional survey design in RAK College of Pharmaceutical Sciences, RAK Medical and Health Sciences University, Ras Al Khaimah, United Arab Emirates. Students studying in all the four years of B. Pharm program of the College were considered for the study. One hundred and thirty-two students were requested to participate in the study. Ninety-two students agreed to participate and gave informed consent. Ten students were excluded from the study for not submitting or submitting incomplete questionnaire.

G*Power 3.1.9.7 version was used to calculate the sample size for the study.[26] Sample size computation was done using t-tests to calculate mean difference from constant (one sample case) with two tails, effect size d=0.5, α error probability=0.05, critical t=±1.99 and power=98%. The minimum sample size required as per the calculation was 67. Eighty-two students were included in the study and their data were analyzed.

Study Instrument

The perception of pharmacy students towards TBL was assessed using Team-based learning student assessment instrument (TBL-SAI) by Heidi Mennenga.[27] Appropriate permission was sort from the original author to use the instrument for the study. TBL-SAI consist of 33 items with five-point Likert scale, aimed to assess the students' perception and attitudes towards TBL. The instrument is divided into three subscales; accountability (eight items), preference for lecture or team-based learning (16 items) and student satisfaction (nine items). In addition to this, five items were added to the questionnaire to assess the preference of students for online TBL in comparison to the paper based TBL and five additional items gathered the demographic details of the students.

Statistical Analysis

The study data was analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics were used to describe the characteristics of the study sample. Cronbach α was used to assess the TBL-SAI's internal consistency. Scores of >102 on the total scale, >25 on the accountability subscale, >45 on the preference for TBL or lecture subscale and >28 on the student satisfaction subscale indicated preference for TBL.[9,11] Shapiro-Wilk test was employed to assess the normality of the study data distribution. The categorical variables were represented as frequency and percentages with 95% confidence intervals (CIs) whereas the continuous variables were represented as range, mean and standard deviation. Student t-test was used for analyzing the characteristics and the total TBL-SAI score mean values. The differences in the mean of threshold total TBL-SAI scores as per participants 'characteristics were analyzed by Chi square test or Fisher's exact test. Regression analysis was done to identify the characteristics related with preference for TBL. The results were reported as odds ratios with 95% CIs. $p < 0.05$ was considered statistical significant.

Ethical Considerations

The study was approved by the RAK Medical and Health Sciences University Research and Ethics Committee (RAKMHSU-REC-187-2020-F-P).

RESULTS

Demographic Characteristics

A total of 82 students completed the TBL-SAI. The response rate was 89.1% (82 out of 92). Majority of the students were female (n=52, 63.4%, 95% CI: 52.4 - 73.2) and were from final year of the program (n=38, 46.3%, 95% CI: 35.4 - 57.3). The mean age of the participants was 21.3 ± 2.0 years, with age range from 17 to 27 years. Majority of the students (n=48, 58.5%, 95% CI: 47.6 - 69.5) were in the age group of 17-21 years, were Arabs (n=57, 69.5%, 95% CI: 59.8 - 79.3) and had a GPA of 4.0

(*n*=42, 51.2%, 95% CI: 40.2 - 62.2). The demographic characteristics of the student participants are depicted in Table 1.

Validity and reliability of study instrument

The TBL-SAI is a reliable and validated tool for evaluating the preference for TBL. The Cronbach's alpha reliability score for the total scale (33 items) was 0.744, 0.620 for the accountability subscale, 0.697 for the preference for TBL or lecture subscale and 0.626 for the student satisfaction subscale.

Students' responses to the study instrument

The majority of the students' responses indicated that they favored various aspects of TBL and had a preference towards TBL. Students' responses to all the domains of the study instrument are represented in Figures 1 to 4.

Accountability subscale

Majority of the participants agreed that they have to prepare before the class (92.7%), need to contribute towards the learning of their teams (92.7%) and felt proud that they contributed to their team's learning process (81.7%). The mean score for the accountability subscale score was 31.3 ± 3.3.
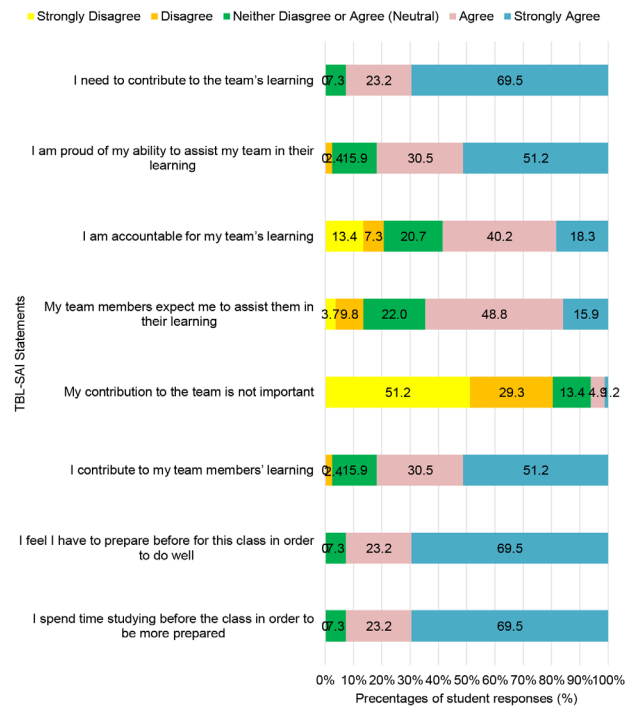

Figure 1: Students' responses to the items of the "accountability" subscale.

Table 1: Demographic characteristics of study participants.			
Characteristic	**Frequency (*n*=82)**	**Percentage (%)**	**95% CI**
Age			
17-21	48	58.5	47.6 - 69.5
>21	34	41.5	30.5 - 52.4
Gender			
Male	30	36.6	26.8 - 47.6
Female	52	63.4	52.4 - 73.2
Ethnicity			
Arab	57	69.5	59.8 - 79.3
Non-Arab	25	30.5	20.7 - 40.2
Year of Study			
Year 1	14	17.1	9.8 - 25.6
Year 2	14	17.1	8.6 - 25.6
Year 3	16	19.5	11.0 - 28.0
Year 4	38	46.3	35.4 - 57.3
GPA			
2.0	8	9.8	3.7 - 17.0
3.0	32	39.0	29.3 - 50.0
4.0	42	51.2	40.2 - 62.2

CI: Confidence interval, GPA: Grade point average.

Figure 2: Students' responses to the items of the "preference for lecture or team-based learning" subscale.
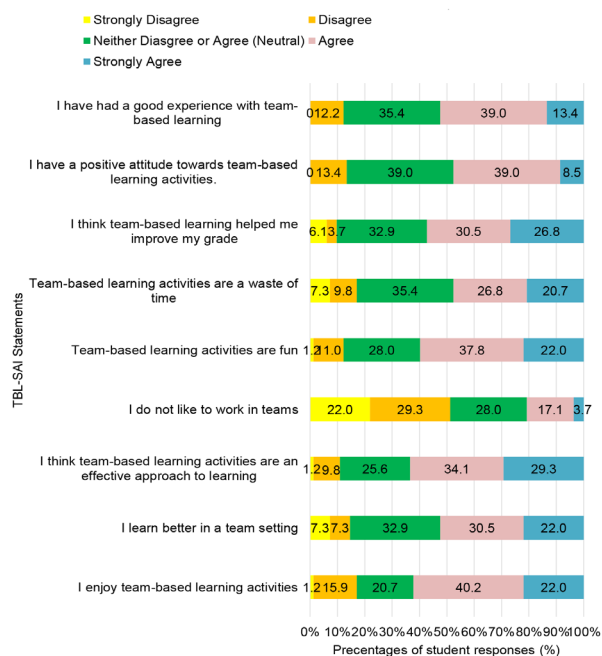
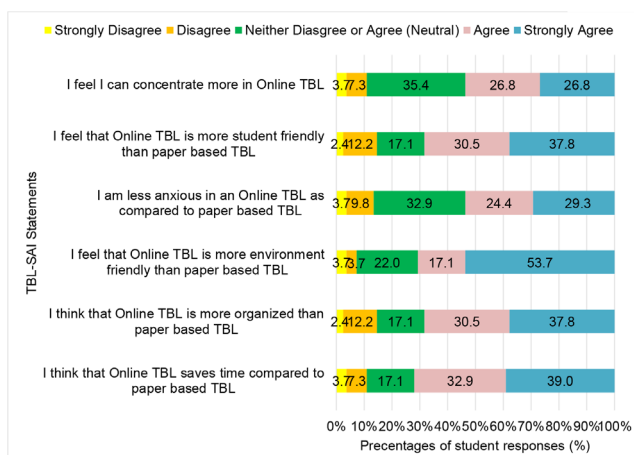Figure 3: Students' responses to the items of the "student satisfaction" subscale.

Figure 4: Students' responses to the items related to Online TBL.

Preference for lecture or team-based learning subscale

Most of the students preferred TBL over lecture, as a large number of students agreed that they remember information better (68.3%) and longer (65.9%) and do better in exams (46.3%) when they study the material as TBL. Moreover, most of the students reported that it is difficult for them to remember things taught during the lecture (74.4%) and that they often end up thinking of non-related things during lectures (51.2%). The mean score for the preference for lecture or team-based learning subscale was 54.3 ± 7.4.
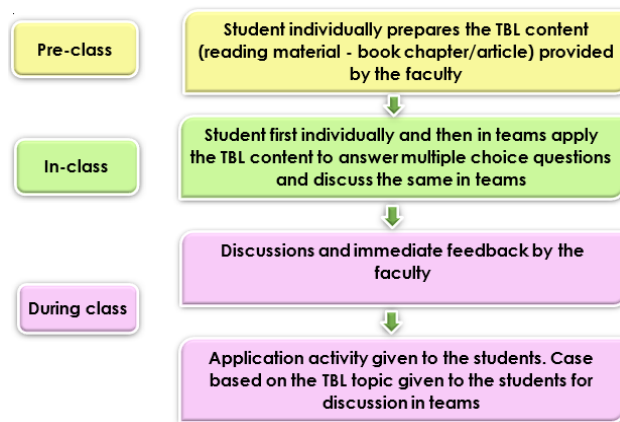

Figure 5: Team based learning – components.

Table 2: Scores for the different subscales of TBL-SAI.				
	Accountability subscale score	Preference for Lecture or Team-Based Learning Subscale score	Student Satisfaction Subscale score	Total TBL-SAI scale score
Reference range	Scores >25 favor TBL	Scores >45 favor TBL	Scores >28 favor TBL	Scores >102 favor TBL
Range	25.0 - 40.0	42.0 - 80.0	21.0 - 40.0	96.0 - 160.0
Mean ± SD	31.3 ± 3.3	54.3 ± 7.4	31.2 ± 4.4	116.9 ± 10.8

TBL-SAI: Team-Based Learning Student Assessment Instrument, SD: Standard deviation.

Student satisfaction subscale

A high percentage of students were content with TBL as a teaching and learning methodology. Majority of the students believed that TBL is an effective learning approach (63.4%) and they learn better in a TBL setting (52.5%). Overall, majority of the students enjoyed TBL activities (62.2%). The mean score for the student satisfaction subscale was 31.2 ± 4.4. All the three subscales of TBL-SAI attained scores well above the threshold favoring TBL (Table 2).

Online TBL vs paper based TBL

Majority of the students were of the opinion that online TBL is more student friendly than paper based TBL (68.3%), they can concentrate more during online TBL as compared to paper based TBL (53.6%) and online TBL is more organized than paper based TBL (68.3%). These responses clearly indicated that the students preferred online TBL as opposed to paper based TBL (Figure 4).

Demographic characteristics and TBL preference association

Demographic characteristics of the study participants were studied as per the mean total TBL-SAI score (Table 3). The analysis revealed that students aged >21 years, GPA >3.0, studying in first and second years and male students had higher mean total TBL-SAI scores. However, these results could not reach statistical significance (Table 4). Logistic regression analysis for characteristics associated with preference for TBL did not reveal any statistically significant results (Table 5).

Table 3: Demographic characteristics of study participants as per total TBL-SAI score.

| Characteristic | Total TBL-SAI Score | | 95% CI of difference | *p*-value* |
	Mean	Mean difference		
Age				
17-21	116.72	-0.41	-5.27 to 4.43	0.864
>21	117.14			
Gender				
Male	117.63	1.15	-3.80 to 6.11	0.645
Female	116.48			
Ethnicity				
Non-Arab	122.52	8.08	3.20 to 12.95	0.001
Arab	114.43			
Student group				
Junior students	117.71	1.23	-3.80 to 6.27	0.628
Senior students	116.48			
GPA				
2.0 – 3.0	116.05	-1.66	-6.43 to 3.10	0.490
>3.0	117.71			

TBL-SAI: Team-Based Learning Student Assessment Instrument, GPA: Grade point average.
*Student t-test.

Table 4: Comparison of scores for the different subscales of TBL-SAI as per student groups.

| TBL-SAI subscales | Student Group | | *p*-value* |
	Junior	Senior	
Accountability subscale score	30.92	31.48	0.546
Preference for Lecture or Team-Based Learning Subscale score	55.92	53.51	0.167
Student Satisfaction Subscale score	30.85	31.48	
Total TBL-SAI scale score	117.71	116.48	0.628

TBL-SAI: Team-Based Learning Student Assessment Instrument.
*Student t-test.

Qualitative comments

Out of the total 82 students, 28 students gave qualitative comments. Among these 28 students, 20 students expressed at least one positive aspect of TBL. Some of the comments received were: *"TBL is a useful way to learn apart from the lectures and it's even better", "TBL is an effective way of learning"," We learn better in teams", "I score good marks in TBL", "TBL is an interesting way of learning"* and *"Online TBL is more fun and I focus more in it".*

DISCUSSION

This is the first study assessing the perceptions of pharmacy students towards TBL in UAE. Medical and health sciences students as future healthcare providers are required to have good communication and teamwork skills, as these are essential for providing better patient care in a multidisciplinary healthcare system. TBL's interactive nature enables medical and health sciences students to improve their communication and teamwork abilities, facilitating a useful learning experience.[18]

The total TBL-SAI score of pharmacy students in our study was 116.9 ± 10.8 which was higher than the threshold score of >102. Furthermore, the scores of different subscales, accountability, preference for lecture or team-based learning, student satisfaction, were well above the threshold levels, suggesting that the students preferred TBL to the traditional lecture. These findings are in line with the findings of other studies conducted in pharmacy students. These studies reported that the students favored various aspects of TBL and preferred it to the traditional teaching methodologies.[10-12]

Structured steps of TBL encourage the students to self-learn, examine, communicate, work together, be accountable and problem-solve in small groups. Majority of our students agreed that they self-learn and prepare before the class in order to do well during TBL session. Almost all the students acknowledged that during TBL they have to contribute to the learning of their teams and held themselves responsible for the team's learning. Similar findings were reported by a number of studies,[6,10,11] conducted to explore the acceptance and perceptions of medical and health sciences students towards TBL. Professional accountability is an essential attribute for a medical and health science professional and the TBL model ensures that the students are exposed to it early in their academic life through the team based-activities.

In our study, majority of the students reported that they perform better in their exams and retain the information longer when a topic is covered through TBL. Furthermore, with TBL activities the students

Characteristic	Reference Total TBL-SAI Score				Mean Total TBL-SAI Score			
	≤102	>102	OR (95% CI)	*p*-value [†]	≤117.7	>117.7	OR (95% CI)	*p*-value[†]
Age				0.475				0.710
17-21	5 (10.4)	43 (89.6)	Ref		26 (54.2)	22 (45.8)	Ref	
>21	2 (5.9)	32 (94.1)	1.860 (0.339 - 10.209)		17 (50.0)	17 (50.0)	1.182(0.490-2.849)	
Gender				0.065				0.561
Male	5 (16.7)	25 (83.3)	Ref		17 (56.7)	13 (43.3)	Ref	
Female	2 (3.8)	50 (96.2)	5.0 (0.906 - 27.608)		26 (50.0)	26 (50.0)	1.308(0.530 - 3.229)	
Ethnicity				0.573				0.016
Arab	6 (10.5)	51 (89.5)	Ref		8 (32.0)	17 (68.0)	Ref	
Non-Arab	1 (4.0)	24 (96.0)	2.018 (0.176 - 23.096)		35 (61.4)	22 (38.6)	3.381(1.250 - 9.146)	
Student group				0.746				0.540
Senior students	5 (9.3)	49 (90.7)	Ref		16 (57.1)	12 (42.9)	Ref	
Junior students	2 (7.1)	26 (92.9)	1.327(0.241 - 7.315)		27 (50.0)	27 (50.0)	0.750 (0.299 - 1.880)	
GPA				0.073				
2.0 – 3.0	6 (15.0)	34 (85.0)	Ref		23 (57.5)	17 (42.5)	Ref	0.371
>3.0	1 (2.4)	41 (97.6)	7.235 (0.830 - 63.070)		20 (47.6)	22 (52.4)	1.488(0.623 - 3.558)	

Table 5: Logistic regression analysis for characteristics associated with preference for TBL.

TBL-SAI: Team-Based Learning Student Assessment Instrument, OR: Odds ratio; CI: Confidence interval, GPA: Grade point average.

[†]Chi square test or Fisher's exact test.

can easily recall what they have learnt in the past. During TBL sessions, students solve problems both individually as well as in groups and additionally they get feedback from the facilitator, this can have a positive impact on their learning, knowledge retention and performance. Our findings are congruent to previous studies, which have reported that TBL is an effective strategy in improving the academic performance of the students.[24,28]

Most of the students in our study had a positive attitude towards TBL activities, had an encouraging experience with TBL and believed that these activities are an effective approach for learning. A number of studies conducted in different student population, medical,[6-8,28] dental,[16,29] nursing,[13-15] and pharmacy,[9-12] have recognized the positive attitude of students towards TBL as a learning methodology. Faculty have also exhibited their support and positive perception towards TBL as an effective teaching and learning methodology.[23]

Based on student responses to the TBL-SAI, our study reports a clear preference for TBL; however, some responses highlighted few challenges with TBL. Some students reported that they are easily distracted during the team activities and therefore bear a negative perception towards TBL. Similar challenges were reported by previous studies conducted to understand the student engagement during TBL activities.[11] Distraction during

team activities can be tacked by enhanced supervision by the facilitators, implementing team-building exercises and keeping the teams together for longer period.

RAK Medical and Health Sciences University implemented Online TBL through its University Management System. During the Online TBL, the students take individual readiness assurance tests (IRAT) and the follow-up team readiness assurance tests (TRAT) in the Online Examination Center of the University (Figure 5). Our study assessed the perception of students towards the various aspects of the Online TBL. Majority of our students had positive perception towards Online TBL. Majority of the students were of the opinion that Online TBL is more student friendly than paper based TBL, they can concentrate more during Online TBL as compared to paper based TBL and Online TBL is more organized than paper based TBL. The students also preferred environment friendly aspect of Online TBL. These responses clearly indicated that they preferred online TBL as compared to paper based TBL. Online TBL is an evolving paradigm and is very much need of the hour, particularly in these COVID-19 testing times. However, it should have well thought of implementation of different elements of the TBL including proper orientation to the students and facilitators, individual and team readiness assurance tests, application exercises, and peer evaluation.[30]

The study has some limitations. Firstly, the cross-sectional nature of the study, limited the data collection to single time-point. It would be more practical to assess the perception of the students over a period of time at multiple time-points as they get more exposure to TBL during progression through their academic years. Secondly, the study had a small sample size, which limits the generalization of the results. Thirdly, the study included only pharmacy students. Students from other colleges like medical, nursing, dental, etc. would have given a comprehensive perception across different disciplines.

CONCLUSION

Currently, for achieving better patient care, the practice of medical and health sciences is employing multidisciplinary approach involving coordinated efforts of healthcare professionals from different disciplines. Keep up with this, the graduate competencies have also evolved, from being knowledge oriented to problem solving, collaboration and communication oriented. Our pharmacy students preferred TBL over traditional lecture-based teaching. Furthermore, they preferred the online mode of TBL as they found online TBL more organized, student and environment friendly compared to paper based TBL. Students also reported that they concentrate better during an online TBL compared to paper based TBL.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

TBL: Team-Based Learning; **IRAT:** Individual Readiness Assurance Test; **TRAT:** Team Readiness Assurance Test; **TBL-SAI:** Team-Based Learning Student Assessment Instrument; **SPSS:** Statistical Package for the Social Sciences; **CI:** Confidence Interval; **GPA:** Grade Point Average.

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PICTORIAL ABSTRACT

Team Based Learning Experience from a College of Pharmaceutical Sciences
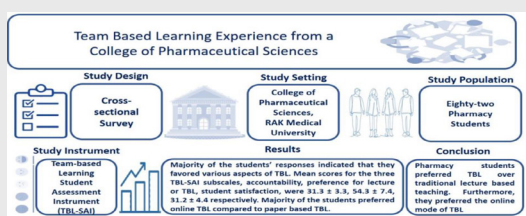
SUMMARY

- Study assessed the perception of pharmacy students studying in a Pharmacy College towards TBL with an emphasis on their perception to online TBL.

- Students preferred TBL over traditional lecture-based teaching.

- Students preferred the online mode of TBL as they found it to be more organized, student and environment friendly compared to paper based TBL.

About Authors

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