

In a hybrid dental curriculum what is better for learning, PBL or TBL? A cross sectional study

Ambreen Azam^a, Farhat Kazmi^b, Lamyia Anweigi^c, Alhanoof Aldegheishem^d, Munerah Binshabaib^e, Afsheen Tabassum^f

Abstract

Introduction: Innovative teaching strategies like problem-based learning (PBL) and Team-based learning (TBL) are applied in various medical and dental schools blended with traditional lecture-based learning. The college of dentistry, Princess Nourah bint Abdulrahman University (CD-PNU) adopted a hybrid dental curriculum from the commencement of the dental program, however, TBL was introduced to the students in the academic year 2018/2019. This study aimed to investigate the effectiveness of both PBL/TBL methodologies by appraising students' perceptions since inadequate studies at present compared PBL/TBL for dental students in Saudi Arabia.

Material and Methods: The current cross-sectional study included 157 dental students from the second to the fifth year. Google survey forms were utilized. The questionnaires were adapted and modified from a validated questionnaire designed by Thompson and colleagues (2009). Pearson's chi-squared test and descriptive analysis were used to analyze the data.

Results: In total, 82% of students completed the PBL questionnaire, and 84% achieved an almost similar survey for TBL. The data of the present study elaborated that both strategies were useful, Pre-session students' preparations, student involvement and peer learning within groups was higher in TBL. More ever there was enhanced learning in TBL due to the competitiveness among the groups and the devised assessments during the sessions.

Conclusions: This study demonstrates that the students perceived PBL and TBL to be a satisfactory teaching and learning modality. They felt better decision making, clinical reasoning with both and showed improved communication skills, effective learning with more efficient tutor feedback in TBL.

Keywords: Dental education; problem-based learning; team-based learning

Introduction

Nowadays, active learning strategies are extensively adopted in various medical

and dental schools blended with a didactic teaching component into a hybrid curriculum. These actions resulted in pioneering methods of teaching in medical education such as problem-based learning (PBL) with more recent, team-based learning (TBL).¹ These teaching tools create an active learning environment based on discussion and critical analysis enhancing student learning along with enhanced impact of the taught material.² PBL approach employs real problems as prompts to motivate students and get them involved actively and think critically.³ This knowledge grown would be remembered and

^a Corresponding Author; BDS, MSc; Assistant Professor, Dental Materials, College of Dentistry, Margalla Institute of Health Sciences Pakistan. Email: ambreen.azam@margalla.edu.pk

^b PhD; Professor & Head of Department Oral Pathology, Rashid Latif Dental College Lahore, Pakistan.

^c PhD; Assistant Professor of Prosthodontics, College of Dental Medicine, QU Health, Qatar University, Doha, Qatar.

^{d,e} PhD; Lecturer Dental Materials College of Dentistry, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia.

^f PhD; Assistant Professor of Periodontics, Department of Preventive Dental Sciences, College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.

practiced for problem-solving in their forthcoming clinical practice.² In a PBL setting, there are two sessions in a week. In first PBL session, a problem having clinical relevance is given to the learners, they meet in small groups of 8-10 students, designate their lead, explain the problem, explore and shed light on their perceptions followed by deriving the intended learning objectives. The students collect the missing information by utilizing further resources like books, e-learning and lectures amongst their group meetings where all participants contribute to deliberate their final findings for the given problem before beginning the conclusive discussion at the end of the week.¹ During the course of this process, the teacher acts as a mediator.^{4,5}

At present many medical and dental schools across the world are implementing another methodology called TBL because it uses active learning tools to enhance student's self-directed learning and improves student performance in complex clinical situations.⁶ TBL comprising of three parts was initially presented by Larry_Michaelsen in 1970 and later incorporated in 2001 for medical schools.^{7, 4, 5} In the first part, students are provided with study material for self-study. In the second part, in order to assess the basic understanding of the earlier given material, students finish an independent readiness assurance test (IRAT). Following the IRAT is the group readiness assurance test (GRAT), in which groups of 5-10 students redo the similar test and achieve an agreement for each answer. All confusions are clarified amongst the group by a mutual discussion along with the timely feedback by the instructor. In the last part, the students work in their teams on a given real-life problem as an assignment where they apply their acquired knowledge through the earlier parts of this strategy. Groups can come up to different solutions while working on the same problems, which further benefits them by giving a rich learning experience.^{1,4,5,7}

PBL teaching methodology has been used in different instructive settings for a vast range of disciplines.^{8, 9} However, in a hybrid curriculum, educator's main concern regarding PBL strategy is that it requires more arrangements from formulating the problem to commencing the sessions. Increased number of students, a large number of groups, varied student involvement and facilitator efficiency all together add to the difficulty in its implementation.^{10,11} On the other hand, TBL is gaining more popularity, due to its advantage of easy conduction, immediate student's feedback and the pre-class assignments improve students' problem-solving skills.¹²

In the Kingdom of Saudi Arabia Princess Nourah Bint Abdulrahman University (PNU) is the first all-female university. PNU offers diplomas, bachelors and post-graduate educational programs in various disciplines such as medicine, dentistry, nursing and pharmacy. A hybrid dental curriculum incorporating PBL tutorials with didactic lectures is adopted by the college of dentistry in Princess Nourah bint Abdulrahman University (CD-PNU). Whereas, the bachelor of dental surgery program spans for five years, with the students learning the basic sciences subjects and undergoing pre-clinical training in the first two with on patient clinical practice from the third year. PBL runs through the first three years as in the fourth and fifth-year case-based learning (CBL) is incorporated replacing PBL.¹³ Recent studies have demonstrated that TBL is more effective than PBL in terms of student's engagement, analytical thinking, and a sense of responsibility towards teammates.^{10,14} Therefore, from the academic year 2018-19, TBL has been incorporated in the dental curriculum at CD-PNU. As of now no such study has been conducted in Saudi Arabia which can evaluate the substantial need and analyze student's perception regarding the inclusion of TBL along with PBL in the dental curriculum.

Therefore, the study aimed to explore the student's understanding by comparing PBL with TBL in terms of adult learning behavior (self-directed learning), decision making, problem-solving, communication skills and teamwork.

Material and Methods

The current descriptive cross-sectional study was done at the College of Dentistry, Princess Nourah Bint Abdulrahman University PNU, Riyadh, Saudi Arabia. This study has been looked over and approved in 2019 by the institutional review board of the College of Dentistry, PNU, Riyadh, Saudi Arabia (Registration number# H-01-R-059).

The college of dentistry at Princess Nourah University (CD-PNU) conducts a hybrid PBL curriculum during its five-year dental education program. For all dental students PBL sessions were carried twice per week during the first three years of the program (Year 1, 2 and 3). TBL sessions were included once per week for all study years (year one to five) in the academic year 2018-19. While first-year students were very new to both these methodologies compared to the rest of the students, they were excluded from this study. Therefore, Total 157 Students from the Second year (39), Third year (39), Fourth year (41) and fifth-year (38) were invited voluntarily to participate in an online survey. The information regarding the purpose and objectives of the study was provided to all students. It was also mentioned that participation in the present study is voluntary and there will be no consequences associated with refusal from participation in the study. Google survey forms were utilized to formulate the online survey for the present study. The link for the online survey was sent to all students via email. Two questionnaires, one regarding PBL and almost similar regarding TBL, were distributed to student participants following the completion of the first semester of the academic year (2018-19). The questionnaires were adapted and modified from a validated questionnaire

designed by Thompson and colleagues (2009). Also, after an extensive search of indexed databases (Web of Science, PubMed/Medline) five additional questions were added to the above-mentioned questionnaire. The final PBL questionnaire consisted of 17 close-ended questions whereas TBL questionnaire consisted of 19 questions containing two additional questions related to individual and group tests. A 5-point Likert scale was used with a score of 1 = strongly disagree (SDA), 2 = disagree (DA), 3 = uncertain (UC), 4 = agree (A), 5 = strongly agree (SA).

A principal investigator managed data collection to maintain privacy and confidentiality. Mean and the standard deviation was reported for continuous variables like age while responses to questions were reported as a percentage to each of the 5 possible Likert scale options. For further comparison "strongly agreed" and "agreed" were combined as "Yes" and "strongly disagreed" and "disagreed" were combined as "No". Group mean differences (95% CI) were computed, and Pearson's chi-squared test was used for data analysis. The statistical significance was set at $P \leq 0.5$. Statistical analysis was performed using a Graph pad Prism software (version 5.0, USA).

Results

Study participant's demographic data; Total 128 (82%) students completed the PBL questionnaire with year 2 (34), year 3 (39), year 4(30), year 5 (25) students. A similar questionnaire was filled by a total of 131 students for TBL with a response rate of 84% with year 2 (34), year 3 (39), year 4(32) and year 5 (26) students. The mean age of students in the second, third, fourth and final year of undergraduate education was 21.9 ± 0.48 , 22.7 ± 0.4 , 23.9 ± 0.6 and 24.7 ± 0.5 years, respectively. All students were female and Saudi national. Perception of undergraduate students regarding PBL and TBL;

Table I demonstrates a comparison between PBL and TBL. Although irrespective of the study year no statistically significant difference in the responses (Yes or No) regarding PBL versus TBL was observed but comparing both teaching modalities students looked more inclined towards TBL compared to PBL. Regarding participation in sessions 77% strongly agreed or agreed that all team members tried to participate in the discussion in TBL and all team members consistently paid attention during group discussions in

TBL whereas 67% of students showed more students involved in discussion with lower concentration during a group discussion in PBL. In TBL, 73% of students agreed or strongly agreed towards the statement that Students did read the readings before the session compared to 66% in PBL. Also, there was enhanced learning in TBL due to the competitiveness among the groups and the devised assessments during the sessions.

Table I: Comparison between PBL and TBL

PBL/TBL Comparison		Student's response (YES)	Student's response (No)	P-Value (Chi-square Fisher's test)
Q1. All team members tried to participate in the discussion.	PBL	86 (67.18%)	15 (11.71%)	P> 0.05
	TBL	101 (77.09%)	15 (11.45%)	
Q2. Team members encouraged each other to express their opinion.	PBL	85 (66.40%)	10 (7.81%)	P> 0.05
	TBL	102 (77.86%)	14 (10.68%)	
Q3. Different points of views were respected by team members	PBL	98 (76.56%)	9 (7.03%)	P> 0.05
	TBL	101 (77.09%)	14 (10.68%)	
Q4. This team activity elicited multiple points of views before deciding on a final answer.	PBL	94 (73.4%)	13 (10.15%)	P> 0.05
	TBL	98 (74.80%)	17 (12.97%)	
Q5. All team members consistently paid attention during group discussions.	PBL	96 (75%)	14 (10.93%)	P> 0.05
	TBL	101 (77.09%)	13 (9.92%)	
Q6. Team members used feedback about individual and team performance to help the team be more effective.	PBL	86 (67.2%)	12 (9.37%)	P> 0.05
	TBL	87 (66.4%)	23 (17.55%)	
Q7. Students did read the readings prior to the session.	PBL	85 (66.40%)	14 (10.93%)	P> 0.05
	TBL	96(73.28%)	16 (12.21%)	
Q8. Completion of the out of class preparation assisted in my learning.	PBL	90 (70.31%)	11 (8.59%)	P> 0.05
	TBL	95 (72.51%)	16 (12.21%)	
Q9. The number of group members enhanced my experience of peer learning.	PBL	83 (64.84%)	12 (9.37%)	P> 0.05
	TBL	96 (73.28%)	16 (12.21%)	
Q10. I received useful and timely feedback from the tutor.	PBL	91 (71.09%)	14 (10.93%)	P> 0.05
	TBL	87 (66.41%)	20 (15.26%)	
Q11. The tutor helped to focus discussion and learning.	PBL	101 (78.9%)	10 (7.81%)	P> 0.05
	TBL	100 (76.33%)	17 (12.97%)	
Q12. Problem-solving allowed me to develop my clinical reasoning skills.	PBL	101 (78.90%)	11 (8.59%)	P> 0.05
	TBL	93 (70.99%)	19 (14.50%)	
Q13. Competitiveness between groups enhanced my learning.	TBL	94 (71.75%)	16 (12.21%)	P> 0.05
Q14. The individual and team tests at the beginning of class assisted in my learning.	TBL	94 (71.75%)	18 (13.74%)	P> 0.05

Figure 1 and 2 shows the detailed year-wise response to five questions comparing PBL

and TBL as 1) interesting methodology 2) decision-making skills 3) communication

skills, 4) self-directed learning/time management and 5) role of tutor. More than 70% of participants agreed that both PBL and TBL strategies are interesting. Results showed that 75 % strongly agreed or agreed that PBL enhances the confidence to speak in front of people, whereas 72.5% of students were inclined towards TBL. Notably, 74% of students believed that TBL improves decision-making skills compared to 70 % of students who agreed for PBL. Regarding feedback in TBL, 66% of students strongly agreed or agreed that “I received useful and timely feedback from the tutor”, compared to 71% in PBL. However, 75% of students either agreed or strongly agreed that the role of the tutor in the process of TBL is more helpful in comparison with 68% in PBL.

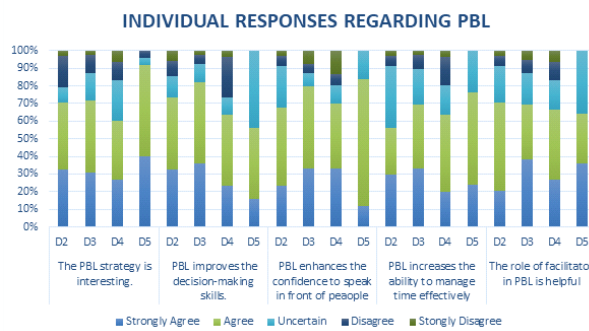


Figure 1: Year-wise responses for PBL

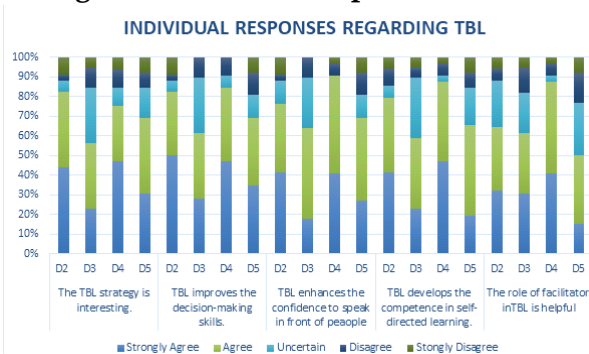


Figure 2: Year-wise responses for TBL

Discussion

Present study was initiated to gauge the perception of undergraduate dental students towards PBL and TBL from second to the fifth year in college of dentistry, Princess Nourah University. As globally, there is a change in teaching and learning approaches from

teacher-centered to student-centered in medical and dental schools.¹⁵ Two effective and broadly incorporated teaching strategies are PBL and TBL.¹⁶ TBL, with its close structural similarity to PBL, has been freshly incorporated in PNU, College of dentistry. The findings of this study demonstrate that there is no statistically significant variance in TBL and PBL regarding engagement of the students although holistically students’ responses looked more inclined towards TBL. These findings are in agreement to the survey done by Burgess et al., 2017 where students also favored TBL more than PBL.

Addition of TBL in the PBL based curriculum at PNUCD enhanced students learning due to their previous exposure of PBL in terms of problem-solving and group discussions. In year-wise responses, it was noted that 92% (23/25) of year 5 students liked PBL followed by 72% (28/39) of year 3 students whereas TBL was more liked by year 2 students 82% (28/34) followed by year 4 students 75%(24/32). This agrees with Y. Okubu et al, 2012.¹⁷ where learners with previous PBL practice also adjusted well to TBL teaching modality.

Literature has reported that PBL has many beneficial outcomes on students’ skills and competencies.¹⁸ In general, participants acknowledged in PBL/TBL questionnaires that both strategies help in the enhancement of self-confidence in public speaking. Results of our study illustrate that 75% strongly agreed/agreed that PBL increases the confidence to communicate in public whereas 73% of students were inclined towards TBL which is not in agreement with Anwar et al, 2015.¹⁹ who reported that TBL boosts student’s self-confidence and improve their communication skills.

Interactive small group discussions with four vital components namely: groups, accountability, feedback and task design are the structural units of TBL which makes it more beneficial in enhancing the decision-making skill of students.¹ Results of our study showed that with a small difference a slightly

higher percentage of students were in agreement that TBL helped them more in improving their decision-making skills compared to PBL (74% & 70%), which partially agrees with Burgess et al, 2017 study where a majority of students rated that both strategies enhanced their decision-making skills.

Recent studies have proved that both PBL and TBL are excellent tools for team building and help students to develop this life-long learning skill to solve problems.²⁰ Our study also showed that both PBL and TBL have a positive influence on student's behavior towards their teammates and strongly improve their teamwork. Our results also highlighted the perceived benefits of TBL as increased competitiveness, enhancement of knowledge through individual thinking and team discussions.¹⁷

According to available evidence in the literature, TBL provides more significant benefits to low achievers when compared with high achievers.²¹ TBL is more structured and focused; therefore, students perform better and are more motivated and well equipped before the start of the session. We also observed in our study that in TBL 77% of students strongly agreed/agreed that they complete pre-session preparation before their TBL sessions as compared to only 66% of students in PBL sessions. This result agrees with Persky and Pollack, 2011.²² where they concluded that TBL format increases active learning within the course.

Feedback is an essential component in successfully implementing any methodology. In this study, no statistically significant difference was observed regarding tutor feedback in PBL compared to TBL. Our results are in contrast with Burgess et al¹⁰ where a higher percentage reported timely feedback for TBL as compared to PBL.

Concerning tutor role, 75% participant in TBL strongly agreed/ agreed that the role of the tutor was more helpful for them compared to 68% of participants in PBL whereas a quarter of study participants were uncertain about it.

This is in contrast to the study done at Aljouf University, 2017 where a majority of students were uncertain about the role of tutors.²³

The limitations of this study involved student feedback after the completion of one semester, where they took fewer sessions in both PBL & TBL after the end of a semester.

Therefore, it is recommended that more significant results could have been obtained if feedback was taken at the end of multiple semesters instead of a single semester.

Conclusions

PBL and TBL share essential similarities. The results of this study establish that the students found PBL and TBL to be an acceptable teaching and learning methodology. They felt improved communication, decision making and clinical reasoning with both strategies. Students were found more focused and well prepared for TBL sessions compared to PBL. Role of the tutor was helpful in PBL/TBL with more efficient tutor Feedback in TBL.

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