

Team-Based Learning in oral pathology teaching: Analysis of students' perception and impact on academic performance

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Abstract

Higher education institutions seek innovative teaching methodologies, investing in student protagonism in the teaching-learning process. Team-Based Learning (TBL) is an innovative alternative that allows students to expand their intellectual capacity, also promoting dynamic contact between groups involved. This study aimed to evaluate the academic performance and satisfaction of dental students, regarding this methodology. For the study of the academic performance, the statistical calculation of the averages of theoretical assessments of students submitted to the traditional teaching method and to the TBL method was used. For the analysis of students' opinions, a TBL assessment instrument was used. As a result, it was observed that the average of grades was higher in both semesters evaluated when using the TBL method compared to the traditional method, proving to be more efficient in the item yield according to grade, with statistically significant difference ($p < 0.01$). The TBL method obtained satisfactory adherence by students, according to aspects of responsibility, method preference and student satisfaction.

Keywords: dental education, active learning, oral pathology, dental students, academic performance

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1. Introduction

Universities and higher education institutions, together with the teaching staff, play an important role in shaping the profile of new health professionals required by the market, requiring adjustments in the teaching and learning process to help the student build such skills (Espinoza Palma & Guevara Altamirano, 2021; Sujitha *et al.*, 2017).

It is therefore important to understand that through problem solving and experience in relevant subjects, students learn better. However, the educational methods most widely used have been, mainly, through traditional didactic means that use visual and auditory passive learning (Athanasaki *et al.*, 2020; Sujitha *et al.*, 2017).

In this way, constructed knowledge has more meaning than when information is passively “passed on” to the student. In Active Learning strategies, the student is the main agent in the process of building his/her knowledge, acting to learn and the teacher plays the role of facilitator in the teaching-learning process, as well as a mediator, attentive in the process of building the knowledge of students, maximizing their learning capacity by supporting collaboration, discussion and feedback (Burgess *et al.*, 2019; Cunha *et al.*, 2019; Espinoza Palma & Guevara Altamirano, 2021; Joshi *et al.*, 2022; Skhynoll *et al.*, 2021; Spencer *et al.*, 2022).

In this sense, there is a need for changes in the training of dental surgeons so that it is possible to train professionals in a generalist, humanist, critical and reflective way, becoming increasingly evident the fragility of the teaching model known as “traditional” or transmission learning, centered on the figure of the teacher who holds and transmits knowledge, which creates a distance between theory and practice and, consequently, lack of knowledge of reality (Cunha *et al.*, 2019; Huilaja *et al.*, 2022).

Thus, active methodologies seem to be viable didactic and pedagogical alternatives, with acceptance among undergraduate students, in accordance with the National Curriculum Guidelines for Dentistry Courses in Brazil. It has a procedural, formative evaluation process, which seeks to see subjects as protagonists of their learning process, seeking to know the academic background and desires of students, so that students and teachers can be agents/partners and co-responsible in the actions of learning, teaching students to look at themselves as beings under constant learning, so that they can understand their learning, identifying their own competences, potentialities and limitations, being able to develop their own learning process, that is, learning to learn (Ahmed *et al.*, 2022; Behling *et al.*, 2022; Daoul *et al.*, 2022; James *et al.*, 2019).

Among the most widely used and known active methodologies, Team-Based Learning (TBL) is an instructional strategy developed by Larry Michaelson in 1992, within the world of business education in an attempt to solve a problem with increasing student enrollment. With the aim of capitalizing on the strengths and addressing the shortcomings of other active learning strategies, TBL has the concept of a “flipped classroom” in which students spend the dedicated classroom time prepared to solve problems and work, instead of observing a didactic lecture (Chitkara *et al.*, 2020; Eksteen, 2019; James *et al.*, 2019; Lancelotti *et al.*, 2020; Moore-Davis *et al.*, 2015).

TBL has gained more and more interest in education in training courses for health professionals. It thus represents a process that focuses on acquiring procedural knowledge and capitalizing on the ability of groups to learn more efficiently, while relying on the student’s ability to articulate explanations and defend the group’s reasoning as part of the assessment of subject mastery (Bailey *et al.*, 2020; Bollela *et al.*, 2014; Espinoza Palma & Guevara Altamirano, 2021; Eksteen, 2019; Fernández-Huerta *et al.*, 2020; Haj-Ali & AlQuran, 2013; James *et al.*, 2019; Kim *et al.*, 2020; Park & Park, 2022; Parthasarathy *et al.*, 2019).

In view of the above, the main aim of the present work is to evaluate the performance and satisfaction of dentistry students enrolled at a Brazilian University with the TBL method.

2. Materials and methods

This cross-sectional study was approved by the Research Ethics Committee (protocol number: 26195519.0.0000.5208) and was conducted in accordance with the Declaration of Helsinki.

For the analysis of academic performance, the statistical calculation of the averages of theoretical assessments of students submitted to the traditional teaching method and the TBL method was used. For the opinion study, the TBL²⁶ Assessment Instrument was applied (Mennenga, 2012).

The sample consisted of students who took the Oral Pathology subject in the 2019.1 and 2019.2 academic semesters of a Dentistry Course. Students over 18 years of age who had completed the respective discipline in classes in which the traditional method and the TBL method were used were included. Students who failed due to insufficient attendance or who missed some of the regular theoretical assessments were excluded from the study.

The discipline is a curricular component of the fourth academic semester of the undergraduate dentistry course, which used TBL as a teaching-learning methodology in the first unit of the discipline and in the second unit, the

traditional teaching method was used. At the beginning of the semester, for the TBL method, the discipline was presented with its methodology, and teams with 6 to 8 students with heterogeneous profile were formed in Unit I, whose composition remained fixed throughout this stage. There are three phases in the TBL method. In phase I, known as pre-class preparation, the teacher indicates readings and provides a study guide with objectives and goals. In phase II, each student answers ten multiple-choice questions (individual knowledge assurance stage) and then students were grouped into their respective teams to take the same test as a team (team knowledge assurance stage). Once these activities have been completed, the teacher gathers the class for content sedimentation – phase III.

At the end of this stage, each student individually answered the Team-Based Learning Student Assessment Instrument/TBL-SAI, which is a self-administered questionnaire developed by Mennenga, (2012), characterized by being an assessment tool specifically designed to analyze students' perceptions of TBL, with 33 questions whose answers are on the Likert scale. The TBL-SAI is composed of three subscales: (1) responsibility, composed of eight items; (2) preference for lecture/traditional classes or TBL, containing 16 items; and (3) student satisfaction, comprising nine items.

In the second Unit in which the traditional method was used, students also answered to a regular theoretical assessment with the content taught in this unit, which generated an individual grade.

Data were entered into an Excel spreadsheet and descriptively analyzed (means, medians, standard deviation). To assess the degree of internal consistency of the questionnaire, Cronbach's Alpha was obtained. In the inferential statistical analyses, statistical significance of $p \leq 0.05$ was considered. The software used to perform inferences was SPSS, version 23.

3. Results

For the study of academic performance, the average of grades was higher in the two semesters evaluated when using the TBL method compared to the traditional method (Table 1). There was a difference between the average grades obtained by the theoretical assessment when using the traditional method versus theoretical assessment when using the TBL method. The latter proved to be more efficient in terms of performance according to grade, with statistically significant difference ($p < 0.01$).

Table 1 - Means, standard deviation and sample number of theoretical assessments of students submitted to the traditional teaching method and the team-based learning method (TBL)

Semester	Learning Method – Mean (SD), n	
	TBL	Traditional
1	7.3 (0.72400), 21	4.9 (0.72400), 21
2	7.62 (0.73399), 14	4.87 (1.79580), 14
Both	7.42* (0.73475), 35	4.89* (1.95342), 35

SD = standard deviation; *Statistically significant difference between methods using the T Test = 8.574, $p < 0.001$.

Source: Authors (2022).

Regarding the analysis of the Team-Based Learning Student Assessment Instrument/TBL-SAI, the following results can be obtained:

A total of 30 students answered the electronic forms, which corresponds to 78.94% of the 38 students enrolled in the subject under study. The reliability assessment (internal consistency) with the application of Cronbach's Alpha test was 0.736, which indicated moderate and acceptable degree of internal consistency.

The results were classified according to the following subscales: responsibility (table 2), method preference (table 3) and student satisfaction with the TBL method (table 4).

In the responsibility subscale, the aspect most mentioned by students was the feeling of responsibility when using the TBL method, especially with regard to the individual contribution to collective learning. Another relevant point was the fact that most of them agree that they make better use of their time with previous studies in order to improve their performance. A considerable portion of students does not feel pressured by the group of colleagues to perform well in team activities (table 2).

In table 3, which analyzes the preference for expository/traditional classes or for the TBL method, only 6.7% of students answered that they are easily distracted or bored or that they seek side conversations unrelated to activities during classes using the TBL method. With regard to remembering past information, only 1 student answered that the TBL method is poor in this aspect. Another positive aspect pointed out by students was the fact that they remember past information better and for longer, and that this system helps to improve their grades in assessments during the semester.

Table 2 – Answers referring to the “Responsibility” TBL-SAI subscale.

Questions	Answers									
	Disagree completely		Disagree		Nor agree nor disagree		Agree		Agree completely	
	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾
P1. Takes advantage of his/her time studying before class in order to be more prepared	1	3.3	0	0	0	0	12	40.0	17	56.7
P2. Feels the need to be prepared for class to achieve good performance	0	0	0	0	2	6.7	8	26.7	20	66.7
P3. Contributes to the learning of his/her team members	0	0	0	0	1	3.3	14	46.7	15	50.0
P4. His/her contribution to the team is unimportant	27	90.0	3	10.0	0	0	0	0	0	0
P5. Do your team members expect you to help them in their learning?	0	0	0	0	9	30.0	11	36.7	10	33.3
P6. Are you responsible for the learning of your group?	6	20.0	3	10.0	6	20.0	12	40.0	3	10.0
P7. Is proud of his/her ability to help the group in learning	3	10.0	0	0	6	20.0	15	50.0	6	20.0
P8. Needs to contribute to the learning of his/her team	1	3.3	0	0	7	23.3	14	46.7	8	26.7

Source: Authors(2022).

Table 3 – Answers referring to the “Preference for lecture/traditional method or TBL” TBL-SAI subscale

Questions	Answers									
	Disagree completely		Disagree		Nor disagree nor agree		Agree		Agree completely	
	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾	N	% ⁽¹⁾
P9. During a traditional class, you almost always find yourself thinking about things unrelated to the class	10	3.3	5	16.7	7	23.3	7	23.3	1	3.3
P10. Easily distracted during a traditional class	12	40.0	5	16.7	6	20.0	6	20.0	1	3.3
P11. Easily distracted during team-based learning activities	15	50.0	8	26.7	4	13.3	1	3.3	2	6.7
P12. It is easier to fall asleep during a lecture than during team-based learning activities	5	16.7	1	3.3	4	13.3	13	43.3	7	23.3
P13. Gets bored during team-based learning activities	16	53.3	8	26.7	4	13.3	2	6.7	0	0
P14. Talks about things not related to the class during team-based learning activities	19	63.3	5	16.7	4	13.3	2	6.7	0	0
P15. Easily remembers what is learned when working in a team	0	0	0	0	11	36.7	11	36.7	8	26.7
P16. Remembers the subject better when the teacher gives a lecture about it	0	0	2	6.7	11	36.7	10	33.3	7	23.3
P17. Team-based learning activities help remember past information	0	0	1	3.3	4	13.3	14	46.7	11	36.7
P18. It is easier to study for tests when the teacher has already given a lecture on the subject	0	0	1	3.3	6	20.0	12	40.0	11	36.7

P19. Remembers information longer when performing/participating in activities: individual test + team test + group discussion + appeal + teacher explanation	0	0	0	0	5	16.7	13	43.3	12	40.0
P20. Remembers the subject better after practice in team-based learning activities	0	0	0	0	3	10.0	18	60.0	9	30.0
P21. Can easily remember subjects taught in lectures	1	3.3	2	6.7	12	40.0	13	43.3	2	6.7
P22. After discussing with team members, he/she finds it difficult to remember what was discussed during class	16	53.3	8	26.7	6	20.0	0	0	0	0
P23. Does better on tests when team-based learning of the subjects to be studied is used	1	3.3	2	6.7	10	33.3	14	46.7	3	10.0
P24. After watching the lecture, the student has difficulty remembering what the teacher said during the class	10	33.3	4	13.3	12	40.0	4	13.3	0	0

Source: Authors (2022).

In the criterion of student satisfaction with the TBL method explained in table 4, there was no inference that the method was a waste of time for students. Other relevant aspects pointed out by interviewees show that most students reported to enjoy TBL activities (83.3%) and that this method constitutes an effective approach to learning (73.3%).

Table 4 – Answers referring to the “Student Satisfaction” TBL-SAI subscale.

Questions	Answers									
	Disagree completely		Disagree		Nor disagree nor agree		Agree		Agree completely	
	N	%(1)	N	%(1)	N	%(1)	N	%(1)	N	%(1)
P25. Enjoys team-based learning activities	0	0	0	0	6	20.0	15	50.0	9	30.0

P26. Learns better when in a group	1	3.3	0	0	9	30.0	12	40.0	8	26.7
P27. Thinks that team-based learning represents an effective approach to learning	0	0	0	0	5	16.7	16	53.3	9	30.0
P28. Does not like working in teams	18	60.0	7	23.3	4	13.3	0	0	1	3.3
P29. Activities of a team-based class are fun	0	0	1	3.3	5	16.7	15	50.0	9	30.0
P30. Activities of a team-based class are a waste of time	17	56.7	11	36.7	2	6.7	0	0	0	0
P31. Thinks that team-based learning has helped improving school performance	0	0	2	6.7	6	20.0	16	53.3	6	20.0
P32. Has positive attitude towards team-based learning activities	0	0	0	0	5	16.7	17	56.7	8	26.7
P33. Had good experience with team-based learning	1	3.3	1	3.3	7	23.3	13	43.3	8	26.7

Source: Authors (2022).

4. Discussion

As previously mentioned, the average grade for topics taught via TBL was significantly higher than the average grade for the same topics didactically taught by the traditional model, with statistical significance between groups ($p < 0.001$). This finding could also be observed in other studies (Ahmed *et al.*, 2022; Cevik *et al.*, 2019; Fernández-Huerta *et al.*, 2020; Joshi *et al.*, 2022; Skhynoll *et al.*, 2021; Sward & Tariq, 2019). On the other hand, some authors, who used similar methodologies, did not find statistically relevant difference (Daoul *et al.*, 2022; Huilaja *et al.*, 2022; Parthasarathy *et al.*, 2019; Smeby *et al.*, 2020).

In addition to being a method with superior results in terms of grade, the individual scores acquired by students in the TBL method can also be used for the early identification of students in difficulties and who need additional support (Carrasco *et al.*, 2019). This relatively new educational strategy in

dentistry education has gained increasing interest due to its potential to promote active learning without requiring a large number of teachers (Haj-Ali & AlQuran, 2013; Saadaldin *et al.*, 2022).

Thus, in relation to the “responsibility” subscale of the questionnaire (Table 2), students evaluated in this study agreed that their contribution to the team was important (100%). Results favorable to this subscale were also found in other studies (Park & Park, 2022; Parthasarathy *et al.*, 2019; Saadaldin *et al.*, 2022), who reported that students favorably accepted several TBL resources, and a high percentage of students strongly agreed that they feel the need to prepare for class and contribute to the learning of their team (Parthasarathy *et al.*, 2019).

When evaluating the “preference for expository/traditional classes or TBL” (table 3), 63.4% agreed that they easily remember what is learned when working in a team; 66.6% agreed that it is easier to fall asleep during a lecture than during classes using TBL activities; 83.3% agreed that they remember the information longer when there is dynamics in activities: individual test + team test + group discussion + appeal + teacher explanation, thus expressing the need for changes in the traditional method. Some studies point out that the TBL method appeared to be more engaging as more students agreed that they were easily distracted in traditional classes compared to TBL, which is a useful review tool, with more students agreeing that they found it easier to remember the content learned after TBL than after conventional classes (Cevik *et al.*, 2019; Huilaja *et al.*, 2022; Ng & Newpher, 2020; Park & Park, 2022; Parthasarathy *et al.*, 2019; Saadaldin *et al.*, 2022; Smeby *et al.*, 2020).

Thus, the method promoted improved critical thinking, demonstrating better retention of learning and professional skills, such as communication, interpersonal skills, teamwork, giving and receiving feedback from colleagues, acquiring knowledge and applying knowledge in case of problems, enabling greater competence in clinical performance (Bollela *et al.*, 2014; Haj-Ali & AlQuran, 2013; Joshi *et al.*, 2022; Park & Park, 2022; Saadaldin *et al.*, 2022; Spencer *et al.*, 2022).

Evaluating “student satisfaction” with the TBL method (Table 4), no interference related to the method that represented a waste of time for students was identified. Other relevant aspects pointed out by interviewees expressed that the majority reported they enjoyed TBL activities (80.0%) and that this method constitutes an effective approach to learning (83.3%). When comparing these results with those found by other authors, it was observed that students exposed to the TBL method, as a new teaching strategy, for the first time, were favored in relation to classes, finding it more engaging. Thus, this method is a strong pedagogical tool that can be used to complement lectures and promote

enthusiasm for learning (Cevik *et al.*, 2019; Espinoza Palma & Guevara Altamirano, 2021; Parthasarathy *et al.*, 2019; Smeby *et al.*, 2020).

Most students were satisfied with TBL sessions, appreciated collaboration, teamwork and critical thinking, as well as their active participation in all components of the process. For this, several authors reported, in their findings, greater involvement during TBL than in traditional methods, especially those who felt more engaged and those who realized that they learned more when using TBL versus traditional methods (Keshani *et al.*, 2015; Skhynoll *et al.*, 2021; Volerman & Poepelman, 2019).

With regard to the student satisfaction criterion, this study showed that students like team-based activities in 80% of cases; in addition, 83.3% agree that TBL represented an effective approach to learning and 70% reported that they had a good experience with TBL, thus exposing great satisfaction and involvement. In this way, students were inserted in realistic scenarios that they will find in their future profession, which not only challenge them intellectually, but promote greater learning when compared to learning built individually, thus increasing efficiency in generating interest, spending less time in the classroom and more time applying knowledge (Burgess *et al.*, 2019; Carrasco *et al.*, 2019).

Despite the satisfactory results, this is a preliminary study carried out during the year 2019. The Coronavirus Disease 2019 (Covid-19) pandemic made it impossible to carry out this study during the years 2020, 2021 and the first half of 2022. The low number of students (30) who participated may be a study limitation.

5. Conclusion

The TBL method is effective, validated through the study of academic performance, with statistically significant difference, and obtained satisfactory adherence by students. In addition, it collaborated to reveal the gaps and challenges that still exist and that can be mitigated with the use of TBL, indicating greater student involvement in constructivist strategies, and providing an immediate means of evaluating knowledge acquisition.

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