New teaching strategies in dentistry: an experience in a Brazilian dental school

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ABSTRACT

The need for new teaching-learning strategies stems from the great change society is going through. The so-called digital natives are part of a generation that lives in a hyperactive rhythm making it increasingly difficult to adapt to traditional classrooms. In Dentistry Courses, new strategies and pedagogical tools have been used, such as active learning methodologies. In this context, the Discipline of Histology of the Dentistry Course has been proposing the use of some innovative pedagogical strategies. This work will present the experience with team-based learning (TBL), which articulates individual (iRAT) and group activities (gRAT), stimulates the application of concepts and can articulate with other methodologies such as flipped classroom, case study and problematization. This study also analysed students' performance in iRAT and gRAT with the application of TBL and discussed the results achieved. It was conducted by analysing the scores of 240 first-year students of the Histology course in 2016, 2017 and 2018. Student scores, individually and in groups, were statistically analysed by the paired student t-test. Comparisons were made between the iRAT and gRAT activities about gender and the full-time and night classes by the one-way ANOVA and Kruskal-Wallis test. All students obtained higher group scores when compared to individual test results (p <0.001). There was no significant difference between sexes and study period. Group performance exceeds individual performance. From this, it can be inferred that TBL can be a good strategy to use in dentistry, as an interaction between students leads to higher performance and problem-solving capacity.
Descriptors: Teaching. Dentistry. Histology. Diffusion of Innovation.

1 INTRODUCTION

Advances in information and communication technology (ICT), and the profile of new generation students, the so-called "digital natives" have changed the education scenario, mainly regarding the learning process[1]. Furthermore, most graduation courses still have a curriculum tied to traditional teaching methods[2]. In this context, it is necessary to reflect on teaching performance and pedagogical practices for the improvement of the teaching/learning process. New strategies and pedagogical tools, such as ICT's[3,4], active learning[5,6], hybrid teaching[7], and even virtual reality have been used in dentistry courses[8]. The active learning breaks with traditional teaching models by encouraging students to be part of their learning process, leading to self-reliance and meaningful learning[1]. The teacher is no longer the center of knowledge and the holder of information, but acts mainly as a tutor, healer, intermediary, contributing to the promotion of student autonomy.

According to Berbel (2011)[9], the new pedagogical proposals of graduation courses, especially those from health sciences, were designed to encourage the use of active learning, based on new generations student's profile.

Team-based learning (TBL) is an active-learning method based on core learning, with an appreciation of students' responsibility for team working and a motivational component, based on a resolution of real-life professional practice problem[10,11]. Currently, this method has been widely used in health courses, especially medicine, dentistry, veterinary medicine and nursing[11-15].

The structure of a TBL is divided into a period of prior study; student guarantee assessment (RAT) with iRAT (individual) and gRAT (group); and the application of concepts[10]. In dentistry, Takeuchi et al. (2015)[6] reported the TBL as a more efficient methodology compared to traditional teaching. Studies from other health science courses have also shown an overall improvement in student performance who went through TBL [12-14, 16]. Hendricson (2013)[17] emphasized that the best teaching/learning practices should be more evident for dentistry educators and their students [2,17].

This study aims to report an experience of TBL applied in the course of histology in the dentistry course at a public university of São Paulo.

2 METHODS

This study was approved by the Research Ethics Committee of the Institute of Science and Technology of the São Paulo State University (ICT - UNESP) at São José dos Campos, Brazil (CAAE protocol number 3.027.191).

The scores from the database of first-year students enrolled in the Histology course, during the full and evening period of the ICT - UNESP Dentistry course (2016 to 2018) were included in this study. Scores from students with unavailable data, such as age and gender were not included. Scores of students who did not attend to all stages of TBLs were excluded.

Data of iRAT and gRAT from eight TBL activities with a total of 240 full-time and evening students are shown in table 1.

Data of iRAT and gRAT were compared by paired Student's t-test. Comparisons between gender and course period were performed by One-way ANOVA and Kruskal-Wallis, both with $\alpha = 0.05$ (GraphPad Prism software, version 6.01).

3 RESULTS

The database allowed the analysis of 648 TBL scores from one hundred and seventy-five women (72.9%) and sixty-five men (27.1%), aged between eighteen and thirty-seven years

old. Among them, 80% were between 18 and 21 years old (table 2).

Table 1. Experimental design considering eight TBLs applied over the three years

Year	Course period	Content	Student's number	Question's number
2016	Full-time	Basic Histology	47	20
	Night-time	Basic Histology	32	20
	Full-time	Oral Histology	52	20
2017	Night-time	Oral Histology	32	20
	Full-time	Basic Histology	53[a]	10
	Night-time	Basic Histology	32[a]	10
2018	Full-time	Basic Histology	48	20
	Night-time	Basic Histology	29	20
Total			**240**	**140**

[a] Students not counted in the total number because they were the same group in first and second TBL of 2017. In the second TBL applied, one of them was excluded because it failed inclusion criteria.

Table 2. Student's demographic data (enrolled in 2016, 2017 and 2018)

Variables	n (%)
Gender	
Female	65 (27.1%)
Male	175 (72.9%)
Age in years	
18-21	192 (80.0%)
22-25	30 (12.5%)
26-29	11 (4.6%)
30-33	06 (2.5%)
> 33	01 (0.4%)

In the year of 2016, seventy-nine students from both periods attended to a TBL activity, with a significant difference between mean iRAT and gRAT scores, 4.25 and 7.3, respectively ($p < 0.001$) (figure 1 - A). In 2017, TBL was applied in two classes, including 84 students. In the first activity, students achieved a mean iRAT of 5.10 and gRAT of 8.88. In the second, a mean score of 5.40 were obtained for iRAT and 9.18 for gRAT ($p < 0.001$) (figure 1 - B). In 2018, seventy-seven students participated in a TBL activity with an average iRAT of 4.76 and gRAT of 7.67 ($p < 0.001$) (figure 1 - C).

Overall, over the three years, students performed better in group activities (gRAT - 8.35) compared to individual performance (iRAT - 4.89), with significant this statistical difference ($p < 0.001$) (figure 1 - D). The mode was 5.5 and 9.5 for iRAT and gRAT, respectively. There was no significant

difference in performance when comparing gender or period of study (p = 0.08).

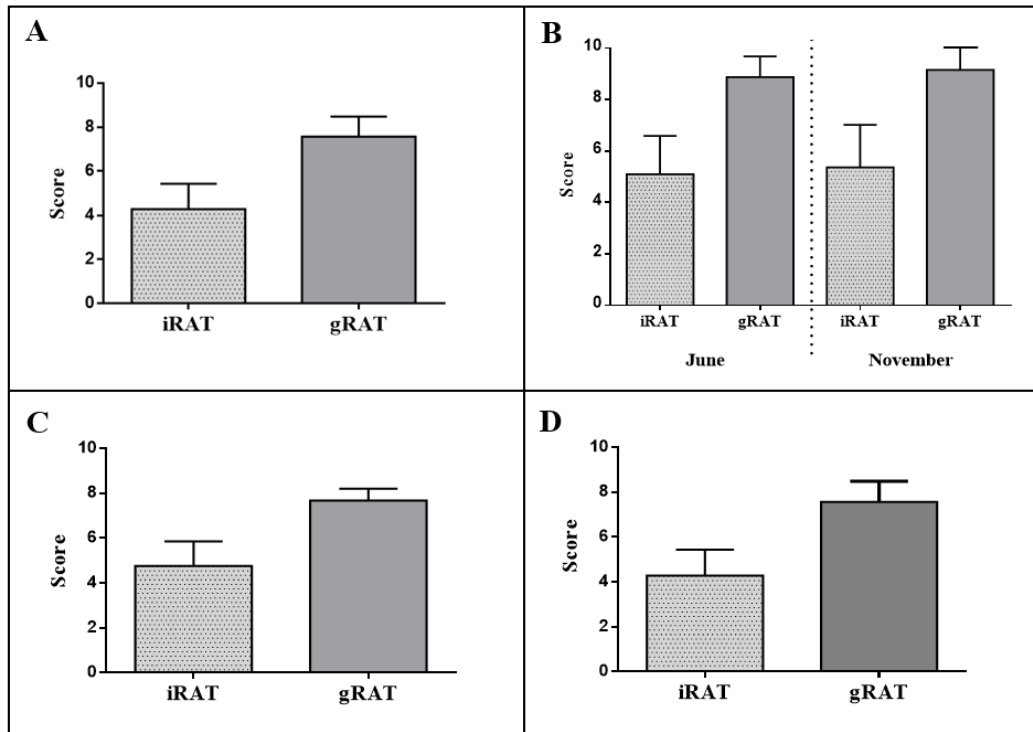
Figure 1. Comparison between students' average scores in iRAT and gRAT in 2016 (A), 2017 (B), 2018 (C), and over three years (D).

4 DISCUSSION

In 2016, TBL was introduced into Histology course, which was the only one in the first-year curriculum to apply this methodology. Before this, Histology was taught almost entirely using traditional teaching methods, essentially lectures in which students acted only passively, receiving unidirectional knowledge.

The results showed that 100% of students improved their performance by participating in group activities compared to individual, suggesting that the possibility of discussion, argumentation, and team collaboration is essential for learning, development of critical thinking, and problem-solving. It is in accordance with Ramesh et al. (2014)[18], where 95.5% of students also had group scores greater

than or equal to individual tests. Other studies have shown that iRAT correlates with better performance in the final tests since students with the best individual results get better grades in the final exams[10,16,19]; gRAT is related to the improvement of interpersonal relationships, exchange of experiences and knowledge[12-14].

Jafari (2013)[20] compared traditional classes to TBL, with higher student performance using active learning. We believe that it can be possibly related to stimulating previous preparation and commitment to the team, which improved the learning process and increased the degree of satisfaction.

TBL is largely used in clinical courses to promote students' discussion of collaborative multi-professional care case studies, teaching the

importance of teamwork and interaction between professionals[15]. However, active learning is also appropriate for preclinical curriculum, such as anatomy[21], infectious disease nutrition[22], pharmacology[23], and physiology[24].

According to Takeuchi et al. (2015)[6], TBL promotes greater understanding and content attachment by students with consequent better performance in their final exams. Persky and Pollack (2011)[24] found that students submitted to TBL in preclinical courses present a better performance in latter clinical courses. One of limitations of the present study is that no data about students' performance in latter clinical courses were available for correlation with previous exposure to TBL methodology.

Another limitation of this study was that no comparison between traditional methodology and the TBL is presented. Thus, there is an open subject for further studies.

5 CONCLUSION

According to the results, it was concluded that student's performance was higher in gRAT when compared to iRAT. Thus, TBL can be a useful methodology to improve the teaching/learning process in histology courses in Dentistry.

RESUMO

Novas estratégias de ensino em Odontologia: experiência em uma universidade brasileira

A necessidade de novas estratégias de ensino-aprendizagem decorre da grande mudança pela qual a sociedade está passando. Os chamados nativos digitais fazem parte de uma geração que vive em um ritmo hiperativo tornando cada vez mais difícil a adaptação às salas de aula tradicionais. Nos cursos de Odontologia, novas estratégias e ferramentas pedagógicas têm sido utilizadas, como metodologias ativas de aprendizagem. Nesse contexto, a Disciplina de Histologia do Curso de Odontologia tem proposto a utilização de algumas estratégias pedagógicas inovadoras. Este trabalho apresentará a experiência com a aprendizagem baseada em equipe (TBL), que articula atividades individuais (iRAT) e em grupo (gRAT), estimula a aplicação de conceitos e pode se articular com outras metodologias como aula invertida, estudo de caso e problematização. Este estudo também analisou o desempenho dos alunos no iRAT e gRAT com a aplicação da TBL e discutiu os resultados alcançados. Foi realizado por meio da análise das notas de 240 alunos do primeiro ano do curso de Histologia em 2016, 2017 e 2018. As notas dos alunos, individualmente e em grupos, foram analisadas estatisticamente por meio do teste t-student pareado. As comparações foram feitas entre as atividades iRAT e gRAT sobre gênero e as aulas em período integral e noturno pelo teste ANOVA *one way* e teste de Kruskal-Wallis. Todos os alunos obtiveram pontuações mais altas do grupo quando comparados aos resultados dos testes individuais (p <0,001). Não houve diferença significativa entre os sexos e o período de estudo. O desempenho do grupo excede o desempenho individual. A partir disso, pode-se inferir que o TBL pode ser uma boa estratégia para uso em odontologia, pois uma interação entre os alunos leva a um maior desempenho e capacidade de resolução de problemas.

Descritores: Ensino. Odontologia. Histologia. Difusão da inovação.

REFERENCES

1. Paiva, MRF; Parente, JRF; Brandão, IR; Queiroz, AHB. Metodologias ativas de ensino-aprendizagem revisão integrativa. SANARE. 2016;15(2):145-53.

2. Toohey SL, Wray A, Wiechmann W, Lin M, Boysen-Osborn M. Ten tips for engaging the millennial learner and moving an Emergency Medicine Residency curriculum into the 21st century. West J Emerg Med. 2016;17(3):337-43.

3. Silva MAD, Pereira AC. Utilização das TIC no ensino complementar da histologia nas

faculdades de odontologia do Estado de São Paulo. Scientia Plena 2013;9(10):109901.

4. Mohamed AM, Aik TC, Yi LP, Abdullah D, Dom TNM. Dental students'attitudes and perceptions towards ICT resources and skills. Procedia Soc Behav Sci. 2011; 18:400-3.

5. Park SE, Howell TH. Implementation of a flipped classroom educational model in a predoctoral dental course. J Dent Educ. 2015 May;79(5):563-70.

6. Takeuchi, DDSH et al. Effects of Team-Based Learning on Fixed Prosthodontic Education in a Japanese School of Dentistry. J Dent Educ 2015;78(4):417-23.

7. Gadbury-Amyot CC, Singh AH, Overman PR. Teaching with technology: learning outcomes for a combined dental and dental hygiene online hybrid oral histology course. J Dent Educ. 2013 Jun;77(6):732-43.

8. Roy E, Bakr MM, George R. The need for virtual reality simulators in dental education: a review. Saudi Dent J. 2017;29(2):41-7.

9. Berbel NAN. As metodologias ativas e a promoção da autonomia de estudantes. Semin Ciênc Soc Hum. 2011;32(1):25-40.

10. Bollela VR, Senger MH, Tourinho FS V, Amaral E. Aprendizagem baseada em equipes: em baseada em equipes: em baseada em equipes: da teoria à prática. Med. 2014;47(3):293-300.

11. Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE Guide No. 65. Med Teach. 2012;34(5):e 275-87.

12. Brandler TC, Laser J, Williamson AK, Louie J, Esposito MJ. Team-based learning in a pathology residency training program. Am J Clin Pathol. 2014;142(1):23–8.

13. Jabbar, HA; Jarrahi, AH; Vamegh, MH; Alhabahbeh, DAM; Mahmoud, NA; Eladl, MA. Effectiveness of the team-based-learning (TBL) strategy on medical student's performance. J Taibah Univ Med Sci. 2018;13(1):70-86.

14. Doshi N. Effectiveness of team-based learning methodology in teaching transfusion medicine to medical undergraduates in third semester: A comparative study. Asian J Transfus Sci. 2018;11(2):87-94.

15. Kumar V, Gadbury-Amyot CC. A Case-Based and Team-Based Learning model in Oral and Maxillofacial Radiology. J Dent Educ 2012;76(3):330-7.

16. Park HR, Kim CJ, Park JW, Park E. Effects of team-based learning on perceived teamwork and academic performance in a health assessment subject. Collegian. 2015;22(3):299-305.

17. Hendricson WD. Changes in educational methodologies in predoctoral dental education: finding the perfect intersection. J Dent Educ. 2012 Jan;76(1):118-41.

18. Ramesh A, Ganguly R, Qualters DM. An interdisciplinary, Team-Based design for an Oral and Maxillofacial Radiology course for postdoctoral dental students. J Dent Educ 2014; 78(9):1339-45.

19. Michaelsen, LH; Parmelle, DX; McMahon, KK; Levine, RE. Team-Based Learning for health professions education: a guide to using small groups for improving learning. J Chiropr Educ. 2009;23(1):47-8.

20. Jafari Z. A comparison of conventional lecture and team-based learning methods in terms of student learning and teaching satisfaction. Med J Islam Repub Iran 2014;28(5):1-8.

21. Ghorbani N, Karbalay-Doust S, Noorafshan A. Is a Team-based Learning approach to anatomy teaching superior to didactic lecturing? Sultan Qaboos University Med J 2014;14(1):120-5.

22. Behling KC, Rose K, Matthew G, Osvaldo L. Does team-based learning improve performance in an infectious diseases course in a preclinical curriculum? Int J Med Educ. 2017; 8:39-44.

23. Pogge E. A Team-Based Learning Course on Nutrition and Lifestyle Modification. Am J Pharm Educ 2013;77(5):103.

24. Persky AM, Pollack GM. A modified Team-Based Learning Physiology Course. Am J Pharm Educ 2011;75(10):204.

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