RBEM Revista Brasileira de Educação Médica

ORIGINAL ARTICLE

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

Online Team-Based Learning: perception of health undergraduates and influence of the student's behavioral profile

Team-Based Learning online: *percepção dos graduandos de saúde e influência do perfil comportamental do estudante*

Luciana Vieira Farias[1] lv.farias@hotmail.com
Andréa Gomes da Costa Mohallem[1] andrea.mohallem@einstein.br

ABSTRACT

Introduction: Team-Based Learning (TBL) is an active methodology that has shown to be effective for the training of health professionals. In 2020, due to the COVID-19 pandemic, TBL utilization migrated from the in-person to the synchronous online mode.

Objectives: This study aimed to evaluate the perception of health undergraduate students about online TBL and to analyze whether there is a difference regarding this perception between groups of students with different levels of exposure prior to in-person and online sessions of the teaching method, in addition to verifying whether such perception can be affected by the student's behavioral profile.

Method: This is an observational, cross-sectional, descriptive-exploratory level II comparative study with a quantitative approach, carried out in undergraduate Nursing and Medicine courses between September and December 2021. A questionnaire on sociodemographic data was applied virtually, in addition to the Assessment of Student Perception-Team-Based Learning (ASP-TBL) and the DISC Personality Test instruments.

Results: Of the 241 participating students, most were females (81%), aged between 20.8 and 24.4 years, who had already attended more than 10 sessions of in-person TBL (90%) and online TBL (53%). Of the 24 ASP-TBL questions, 17 obtained an index equal to or greater than 75% in the sum of the answers "I totally agree"/"I agree", values considered as a positive perception in this study. Students exposed to more than 10 online TBL sessions had a significantly more negative perception in three of the four dimensions of the ASP-TBL, when compared to less exposed students. The group that had participated in more than 10 in-person TBL sessions had a significantly more negative perception in only one dimension of the instrument, when compared to the less exposed ones. The main DISC Personality test factor found among the participants' behavioral profiles was submission ("S"). There was no correlation between the student's behavioral profile and their perception of the method in the online version.

Conclusions: There was a favorable perception of health undergraduate students regarding online TBL. Previous prolonged exposure to the method, both online and in-person, represented a significant difference in the students' perception of online TBL. There was no evidence of the influence of the student's behavioral profile on their perception of the teaching method.

Keywords: Teaching; Team-Based Learning; Perception; Behavior; COVID-19.

RESUMO

Introdução: *O Team-Based Learning (TBL) é uma metodologia ativa que tem se mostrado efetiva para a formação de profissionais de saúde. Em 2020, devido à pandemia da Covid-19, a aplicação do TBL migrou da modalidade presencial para online síncrona.*

Objetivos: *Este estudo objetivou avaliar a percepção de graduandos de saúde sobre o TBL online e analisar se existe diferença de percepção dessa modalidade entre os grupos de estudantes com níveis distintos de exposição anterior às sessões presenciais e online do método, além de verificar se tal percepção pode ser afetada pelo perfil comportamental do estudante.*

Método: *Trata-se de um estudo observacional, transversal de caráter descritivo-exploratório, comparativo, relacional, de abordagem quantitativa, realizado nos cursos de graduação em Medicina e Enfermagem, entre setembro e dezembro de 2021. Aplicou-se, virtualmente, um questionário sobre os dados sociodemográficos, além dos instrumentos Avaliação da Percepção do Aluno-Team-Based Learning (APA-TBL) e Teste de Perfil Comportamental DISC.*

Resultados: *Dos 241 estudantes participantes, houve predominância do sexo feminino (81%), na faixa etária de 20,8 a 24,4 anos, que já tinham frequentado mais de 10 sessões de TBL presencial (90%) e TBL online (53%). Das 24 questões do APA-TBL, 17 obtiveram índice igual ou superior a 75% na soma das respostas "concordo totalmente"/"concordo", valores considerados como percepção positiva neste estudo. Os alunos com exposição a mais de 10 sessões do TBL online apresentaram uma percepção significativamente mais negativa em três das quatro dimensões do APA-TBL, quando comparados aos menos expostos. O grupo que havia participado de mais de 10 sessões de TBL presencial apresentou uma percepção significativamente mais negativa em apenas uma dimensão do instrumento, quando comparados aos menos expostos. O principal fator DISC encontrado entre os perfis comportamentais dos participantes foi a estabilidade ("S"). Não houve correlação entre o perfil comportamental do aluno e sua percepção sobre o método na versão online.*

Conclusões: *Observou-se uma percepção favorável dos graduandos de saúde sobre o TBL online. A exposição anterior prolongada ao método, tanto no modo online, quanto presencial, impactou negativamente a percepção dos estudantes sobre o TBL online. Não foi evidenciada influência do perfil comportamental do estudante em sua percepção do método.*

Palavras-chave: *Ensino; Aprendizagem Baseada em Equipe; Percepção; Comportamento; Covid-19.*

[1] Faculdade Israelita de Ciências da Saúde Albert Einstein, Hospital Israelita Albert Einstein, São Paulo, São Paulo, Brazil.

Chief Editor: Rosiane Viana Zuza Diniz. | Associate Editor: Antonio Menezes Junior.

Received on 05/23/23; Accepted on 11/25/23. | Evaluated by double blind review process.

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

INTRODUCTION

The current scenario of higher education in health has brought new challenges and inspired profound transformations to meet the evolutionary changes in student training[1]. In this sense, the National Curricular Guidelines (DCN, *Diretrizes Curriculares Nacionais*)[2,3] for undergraduate courses in Medicine and Nursing recommend active methodologies (AM) as an educational strategy to develop competences and abilities in the training of health professionals. The AM emerged in the 1980s, in contrast to the content transmission model represented by the figure of the "*aulista* teacher" (i.e,. one that only explains the topics of the classes), configuring itself as an alternative to passive learning, which requires proactivity and participation from students to carry out the activities[4].

In AM, the teaching-learning process starts with a problem situation, which provides critical reflection, mobilizing the student to search for knowledge, aimed at solving it. Such mobilization encourages new reflections and the proposition of appropriate solutions, increasingly bringing theoretical and practical reasoning closer together[5,6]. With a student-centered approach, AM encourage their autonomy and self-regulation as protagonists in the construction of knowledge[4,7], removing them from the comfort zone generated by the traditional teaching model and calling on them to be responsible for their learning process, which may explain why the perception of the student body is not unanimous regarding their preference for this type of methodological strategy, when compared to the traditional methodologies[8,9].

Currently, one of the AM used in higher education institutions (HEIs) in health is Team-Based Learning (TBL), whose theoretical basis is constructivism, prioritizing horizontal relationships in the teaching-learning process, of which the teacher is a facilitator. The students' previous repertoire is valued in their cognitive construction, providing significant learning and awareness of this process (metacognition), combined with the development of skills related to initiative, decision-making and clinical reasoning[10,11]. The interaction between peers (student-student) allows them to develop communication and collaborative work skills, which are also characteristic demands of health services and contemplate the Brazilian DCN[2,3,12-16].

Studies show that student learning in TBL depends on factors such as the structuring format of the course, with class division into small groups[17,18] and the type of covered content, which is based on problem situations[19,20]. Regarding student characteristics (such as behavioral profiles and study skills), previous research shows that this factor does not have a significant impact on learning in a TBL environment, although introverted students prefer the traditional teaching method to the detriment of TBL[21-23]. Despite this, another study suggests that this learning can be affected by the students' introversion or extroversion profile[24,25].

In 2020, during the context of the coronavirus disease 2019 (COVID-19) pandemic, a change in Brazilian legislation[26] determined that educational institutions would temporarily switch in-person classes by digital ones. Thus, the TBL method, traditionally applied in-person, started to be implemented by some HEIs as emergency remote teaching (ERT)[27,28]. In this study, the term "synchronous online teaching" was adopted as corresponding to ERT.

In the maximum attempt to reproduce the principles of in-person teaching in the virtual environment, in accordance with the guidelines of the Team-Based Learning Collaborative (TBLC)[29], it was necessary to adapt, from teaching strategies to the implementation of digital platforms, which led to challenges , both to the students' school experience and to the teaching practice[30]. Despite the efforts, online learning brings with it a stigma of lower quality when compared to in-person learning[31]. However, in a comparative study involving 427 students and carried out in the pandemic context, online TBL sessions were evaluated as positively as in-person sessions[32]. Another study on teaching during the COVID-19 pandemic, also comparing in-person and online modalities of TBL, showed that synchronous online sessions can offer a demonstrable benefit to students[33].

In both in-person and online TBL, each main topic ("macro unit") to be worked on in a module is covered in three phases: 1. previous preparation; 2. preparation assurance; 3. application of concepts[34]. The two modalities differ regarding the way the second and third phases are carried out, when the proposed clinical cases are resolved collectively, with the presence of everyone in the classroom, whether physical or virtual.

Based on these considerations, this study aimed to evaluate the perception of healthcare undergraduate students about online TBL and analyze whether there is a difference regarding its perception between groups of students with different levels of exposure prior to in-person and online sessions of the method, in addition to verifying whether such perception can be affected by the student's behavioral profile.

METHOD

The present study was carried out from September to December 2021, at *Faculdade Israelita de Ciências da Saúde Albert Einstein* (FICSAE), encompassing undergraduate courses in Medicine and Nursing. The first was offered in 2016 with TBL already implemented, the year in which the institution started to systematically employ the method in its undergraduate courses. The second operated with the traditional teaching method for 26 years, until the introduction of TBL in 2015. The implementation of the method has institutional support, both

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

in terms of personnel, infrastructure and technological support, which has intensified since 2020, with the need to migrate to the synchronous online mode and consequent use of online classrooms on the *Zoom*® platform, replacing FICSAE physical classrooms. The specificities of applying the in-person and online modalities are described in Chart 1.

It is worth emphasizing that, in the aforementioned experience of transposing the in-person TBL to the synchronous online modality, the time allocated to each phase was maintained from one modality to the other, as shown in Chart 1. Moreover, the materials selected for the previous preparation remained the same, both in format and content, since phase 1 of the TBL is originally configured for pre-class and online individual study. Another element that was not changed was the type of questions that made up the following phases, with the more direct exercises being maintained in the individual and team tests in phase 2, and the resolution of cases in phase 3.

Study design

This was an observational, cross-sectional, descriptive-exploratory study, of a relational comparative nature, with the following inclusion criteria: students enrolled in the institution of choice to carry out the research, in all periods of undergraduate courses in Medicine and Nursing, over 18 years of age, who had participated in at least one online TBL session, up to the start of the study.

Sampling and data collection

The research used the non-probability convenience sampling technique. Initially, a survey was carried out of students eligible to comprise the research sample. Once these names were collected, the population consisted of 998 possible respondents, who were invited by email, via the *Research Electronic Data Capture* (*REDCap*®) virtual platform, to participate in the study on a voluntary basis. If the student accepted it, the

Chart 1. Comparison between phases, of in-person and synchronous online teaching modalities, of Team-Based Learning practiced at *Faculdade Israelita de Ciências da Saúde Albert Einstein*

Team-Based Learning phases	Teaching modalities	
	In-person	**Synchronous online**
1. Previous preparation (pre-class)	The teacher selects the material for the students, makes it available on the *Canvas* academic platform and assigns the task corresponding to the chosen content.	The teacher selects the material for the students, makes it available on the *Canvas* academic platform and assigns the task corresponding to the chosen content.
2. Preparation assurance	Individual preparation assurance test carried out in the classroom, using the *Canvas* academic platform on the student's computer or tablet, within a period of 10 to 15 minutes; Preparation assurance team test, lasting 10 to 20 minutes, with discussion held in the classroom, followed by immediate feedback; Survey of responses from all teams, discussion among everyone in the class, immediate feedback and appeal; Brief review by the teacher for clarification and general feedback; Total time for this phase: between 60 and 75 minutes, with the tests having a pre-determined duration, as mentioned.	Individual preparation assurance test carried out remotely through the *Canvas* academic platform, within a period of 10 to 15 minutes; Preparation assurance team test, in a period of 10 to 20 minutes, with discussion held in the Breakout online rooms on the *Zoom*® platform, followed by immediate feedback; Survey of responses from all teams, discussion among everyone in the class in the main online room, immediate feedback and appeal, whose debate also takes place in the main online room; Brief review by the teacher for clarification and general feedback in the main online room; Total time for this phase: between 60 and 75 minutes, with the tests having a pre-determined duration, as mentioned.
3. Application of concepts	The case is presented by the teacher in the classroom through projection or in printed form; The resolution of the case is carried out as a team, with discussion in the classroom so that each group arrives at the answer considered most adequate to the proposed problem situation. The teacher circulates to follow the discussions in each group. The teams' answers are presented simultaneously to the entire class in the classroom, with the leader of each group raising the sign with the chosen alternative; The teams are brought together for broad discussion among everyone in the class, with immediate feedback and the possibility of a written appeal; Total time for this phase: between 30 and 60 minutes.	The case is posted by the teacher on the *Canvas* platform; The case is resolved as a team, with discussion in the online rooms using the *Zoom*® platform, so that each group reaches the answer considered most adequate to the proposed problem situation. The teacher enters the rooms to follow the discussions in each group. The teams' responses are simultaneously posted on the *Canvas* platform, being accessed and checked by the teacher; Team members are taken to the main online room, where the teacher leads the discussion, with immediate feedback and the possibility of a written appeal; Total time for this phase: between 30 and 60 minutes.

Source: Prepared by the authors.

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

link was sent to answer, first, through the *REDCap*® platform, two instruments: the sociodemographic questionnaire and the Assessment of Student Perception-Team-Based Learning (APA-TBL)[35]. After completing this step, a separate link was sent, specific to the DISC Behavioral Profile Test[36], which was applied on a specific online platform, under a commercial license to use the tool, through exclusive access for each participant.

To characterize the participants of this study, in addition to variables such as gender, age, course and academic period, the sociodemographic questionnaire measured the participation of students at in-person TBL and online TBL sessions, up to the moment the research was carried out. For this purpose, the participants' level of exposure to the method was divided into two intervals, for each one of the modalities: "of 1 to 10 sessions" and "more than 10 sessions". The establishment of these intervals was due to the pandemic context in which the research was carried out, as, in the second half of 2021, it was not yet known when in-person activities would be resumed; thus, the second interval remained open ("more than 10"), encompassing such temporal uncertainty when applying the questionnaire.

The APA-TBL was developed and validated in Brazil, in 2018, by Cunha et al., consisting of 24 questions based on the *Likert* scale and distributed in four dimensions: 1. team influence on individual performance (Q6, Q8, Q12, Q13, Q14, Q15, Q18, Q19, Q20, Q23 and Q24); 2. performance/role of the teacher in applying the method (Q2, Q3, Q21 and Q22); 3. student commitment (Q1, Q4, Q5 and Q11); 4. team responsibility and performance (Q7, Q9, Q10, Q16 and Q17)[35].

The DISC Test, in turn, is a behavioral profiling technique created by North American author Marston, in the 1920s, measuring four factors: "D" (dominance); "S" (submission); "I" (influence); and "C" (compliance). It consists of 24 objective multiple-choice questions, with adjectives that describe behaviors as answer options, to be chosen following the "more" and "less" parameter in relation to the respondent's self-identification. The percentages resulting from the application of the DISC Test indicate the intensity of each factor in the individual's behavior, being related using the "high" and "low" metrics to define the behavioral profile. This characterization makes it possible to outline the motivations, strengths and weaknesses of the profiled individual, in addition to their way of acting in general and with other people[37].

Of the 998 students invited to participate in the study, 241 (24%) voluntarily agreed to answer the sociodemographic questionnaire and the APA-TBL, and, of these students, 108 (11% of the study population) subsequently accessed and answered the DISC Test. As these are convenience samples, it was not possible to calculate their representativeness, but it was possible to determine the minimum detectable *effect size* through the obtained sample. Considering the 241 participants answering the APA-TBL, the minimum detectable *effect size* in the percentages of *Likert* scale responses is w = 0.22 for a *Chi-square* test of adherence to a uniform distribution. For the calculations, the following was established: a significance level of 5% and a test power of 80%. Cohen (1988) proposed the following interpretation of *effect size* values: w = 0.1, w = 0.3 and w = 0.5 represent small, medium and large *effect sizes*, respectively[38]. Considering the 108 participants answering the DISC test, the minimum detectable *effect size* of the difference between the scores of the four instrument groups is f = 0.16 for *ANOVA* and f = 0.17 for the *Kruskal-Wallis* test. For the calculations, the following was established: a significance level of 5% and a test power of 80%. Cohen (1988) proposed the following interpretation of *effect size* values: f = 0.1, w = 0.25 and w = 0.4 represent small, medium and large *effect sizes*, respectively[38].

Data analysis

Initially, the data were described considering, for the quantitative variables, the following elements: mean, standard deviation, minimum value, maximum value, median and 1st and 3rd quartiles. For the qualitative variables, only frequencies were considered[39]. To analyze the results of the APA-TBL, the scores were calculated for each of the four instrument dimensions and the analysis per question was also considered, based on determining the combination of the answers "I agree" and "I totally agree" as a favorability, which achieved rates of 75% or more.

The comparison between the APA-TBL scores between the groups of interest was performed using *Mann-Whitney*, *Kruskal-Wallis*[40] or *ANOVA* tests for data with normal distribution[38]. *Dunn's post-hoc* test was used to determine which groups differed from each other when there was significance in the *Kruskal-Wallis* test[41]. Variable normality verifications were performed using the *Shapiro-Wilk*[42] test. The analyses were performed using the software *R*, version 4.1.143, with a significance level of 5%.

Ethical aspects

All study participants answered the survey only after being informed of the purposes and procedures of the research and having voluntarily filled out the Free and Informed Consent Form (TCLE, *Termo de Consentimento Livre e Esclarecido*) approved by the Ethics Committee of Hospital Israelita Albert Einstein: Certificate of Presentation for Ethical Assessment (CAAE) N. 42142620.0.0000.0071 and Opinion N. 4,890,810. This study is in accordance with Resolution N. 466/201244,

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

approved by the National Health Council (CNS), exclusively using the collected data and keeping them confidential.

RESULTS

The study sample consisted of 241 students, 44% of whom were undergraduate students of Medicine and 56% of Nursing, with a predominance of females (81%), aged between 20.8 and 24.4 years. Still regarding the sample profile, the participants' level of exposure to in-person and online TBL modalities was investigated up to the moment of data collection. Most students had participated in more than 10 in-person TBL sessions (90%). Regarding participation in online TBL sessions, there was a balance between classes in the total sample: 47% of undergraduate students had participated in 1 to 10 sessions and 53% had participated in more than 10 sessions.

Regarding the answers to the APA-TBL instrument, in the dimension "team influence on individual performance", the highest favorability index was found in item Q24 (95%), with this being the maximum percentage also in relation to the results of the other APA-TBL dimensions. Although the other items in this dimension do not have such high levels of positive perception, students' favorability towards the method was observed, since only one (Q14, 74%) of its 11 questions was below the established limit of 75% in the sum of the answers from the "I totally agree" and "I agree" classes (Graph 1).

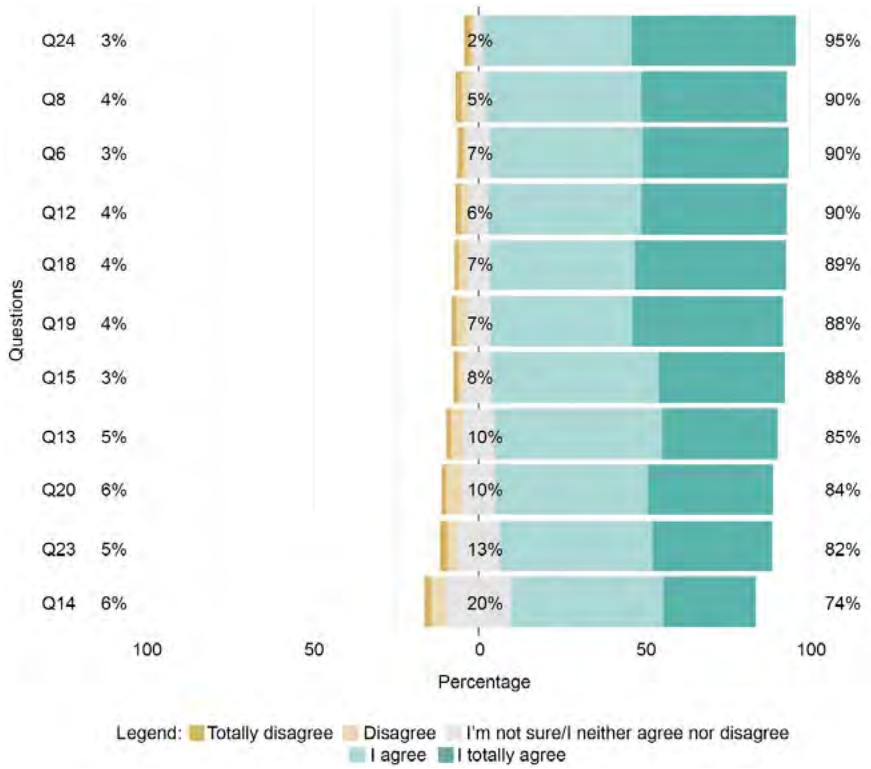
In the dimension "teacher's performance/role in applying the method", items Q2 and Q3 had the lowest favorability rates, in descending order, with both having less than 75% of respondents indicating "I totally agree" or "I agree" (Graph 2).

A high rate of favorability in relation to the method was also observed in the "student commitment" dimension, in which all questions had more than 85% of respondents indicating "I totally agree" and "I agree" (Graph 3).

In the "team responsibility and performance" dimension, item Q16 had the lowest favorability index (43%), followed by items Q7, Q10 and Q17, in descending order. Item Q9 was the only one to attain more than 75% in the sum of responses in the "I totally agree" or "I agree" classes (Graph 4).

To analyze the results related to the four dimensions of the APA-TBL, scores were generated for each of them.

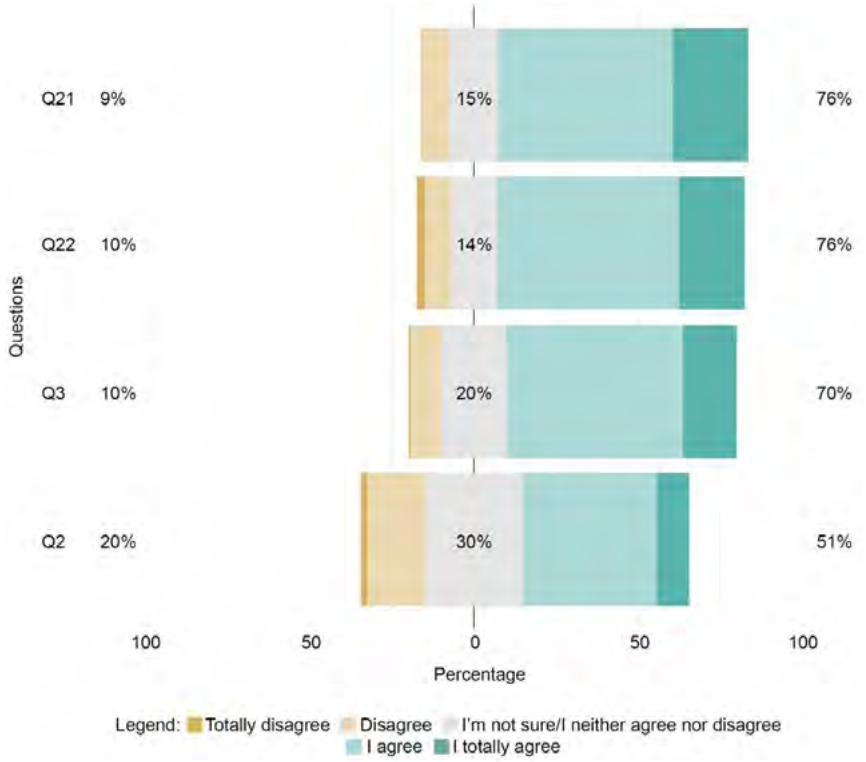
Graph 1. Percentages of responses to the "team influence on individual performance" dimension of the APA-TBL instrument.



Abbreviations: Q6: "Did the group test help me develop teamwork skills?"; Q8: "Did taking the test as a team improve my understanding of the subject?"; Q12: "Did dialogue and debate on my team help me learn about decision making?"; Q13: "Did dialogue and debate with other teams help me learn about decision making?"; Q14: "Did dialogue and debate with the other teams help me to become deeply involved with the presented content?"; Q15: "Did the team activities allow applying theoretical concepts to solve the clinical case?"; Q18: "Did the discussion of the clinical case promote my learning and development?"; Q19: "Did the discussion of the clinical case make me realize how important teamwork is for solving real problems?"; Q20: "Did discussing the clinical case as a team help me realize my strengths and weaknesses as a team member?"; Q23: "Did the team activities allow solving problems that will be faced in professional practice?"; Q24: "Will the team learning experience help my professional future?".
Source: Prepared by the authors.

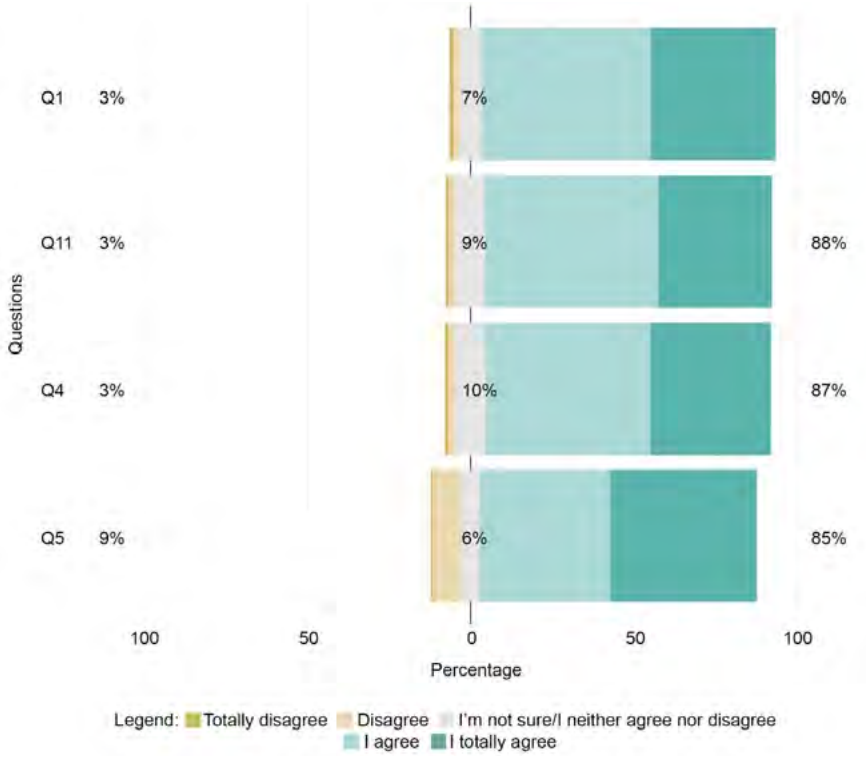
DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

Graph 2. Percentages of responses in the "teacher's performance/role in applying the method" dimension of the APA-TBL instrument.



Abbreviations: Q2: "Was the amount of content available for individual preparation adequate?"; Q3: "Was the quality of the content available in line with the proposed objectives?"; Q21: "Did the team activities increase my responsibility with studying?"; Q22: "In the discussion of the clinical case, did I realize the teacher's role as a facilitator of learning?".
Source: Prepared by the authors.

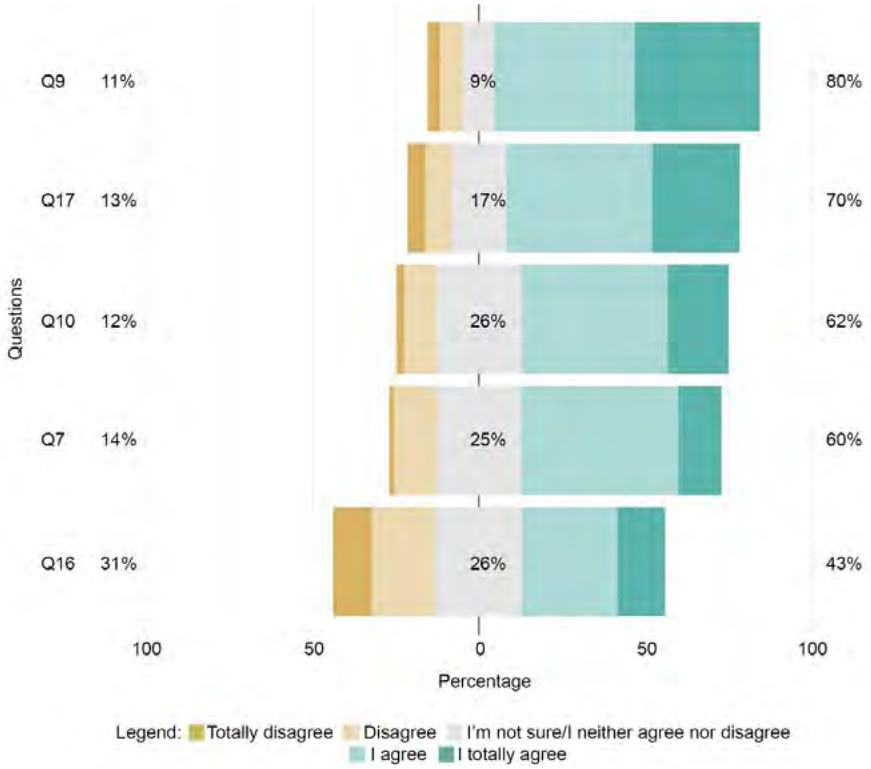
Graph 3. Percentages of responses to the "student commitment" dimension of the APA-TBL instrument.



Abbreviations: Q1: "Did I read the available content before class?"; Q4: "Did prior reading help promote my learning?"; Q5: "Did my individual performance depend on how well prepared I was?"; Q11: "Did I prepare and contribute as much as I could to make my team successful?".
Source: Prepared by the authors.

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

Graph 4. Percentages of responses to the "team responsibility and performance" dimension of the APA-TBL instrument.



Abbreviations: Q7: "Did the success of the team depend on how much I was able to collaborate with the group?"; Q9: "Did team activities increase my responsibility with studying?"; Q10: "Did the team's good performance depend on how much I collaborated as a team member in solving the case?"; Q16: "Were team members appropriately selected to maintain homogeneity between the groups?"; Q17: "Did immediate feedback favor the interaction between the teams?".
Source: Prepared by the authors.

As these scores did not follow a normal distribution, the preferred descriptive measure for data interpretation were the median value and quartiles (1st and 3rd). The dimensions had very similar medians, with values between 3.8 (for "team responsibility and performance" dimension) and 4.3 (for the "student commitment" dimension), as well as the quartiles. Moreover, all dimensions showed downward discrepant values, that is, greater concentration in higher scores.

The APA-TBL dimension scores were compared regarding the number of students' participation at in-person TBL sessions and online sessions (whether "of 1 to 10 sessions" or "more than 10"). The students who participated in more in-person TBL sessions (n = 186) showed a more negative perception of the teacher's performance in online TBL when compared to those who had participated in fewer in-person TBL sessions (n = 19), with the score values in 1st and 3rd quartiles of students participating in more than 10 sessions (4.0 [3.5-4.3]) lower than those of students with 1 to 10 sessions (4.0 [4.0-4.5]), p-value = 0.039.

Of the four dimensions that comprise the APA-TBL instrument, in three of them the tests showed statistical significance among students who had participated in 1 to 10 sessions (n = 96) and more than 10 online TBL sessions (n = 106). The median score and interquartile range values of the group more exposed to the method were lower than those of the less exposed one: 3.8 [3.5-4] and 4 [3.8-4.5], p-value = 0.001 ("teacher's performance/role in applying the method"); 4.3 [3.8-4.5] and 4.3 [4-4.8], p-value = 0.028 ("student engagement"); 3.6 [3.0-4.0] and 3.8 [3.4-4.2], p-value = 0.042 ("team responsibility and performance"). Students who participated in more than 10 online TBL sessions had a more negative perception regarding the teacher's performance in applying the method, student commitment and team responsibility and performance when compared to the perception of those who participated in less than 10 TBL sessions. online.

The results obtained from the 108 respondents of the DISC instrument were grouped around the four most prevalent behavioral factors among students: dominance (D), influence (I), submission (S) and compliance (C).

The main behavioral profile found was type "S", corresponding to 38% of students. The individual with submission highlighted in their behavior has, as main descriptors, the ability to be a good listener, patient, sincere, constant and a team member, being a relevant element and showing the possibility of having difficulties in demonstrating their emotions[36].

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

"I" was seen as the second behavioral profile, represented by 31% of respondents. Influence can indicate someone's ability to deal with people and influence them, with this ability being greater the higher this behavioral profile was. The main descriptors are confident, inspiring, popular and sociable behavior, with optimism generally being a markedly present emotion[36].

The third profile found was "C", corresponding to 24% of study participants who answered the DISC questionnaire. People with prevalent compliance are focused on dealing better with rules and procedures established by others, having, as their main behavior descriptors, more precise skills in relation to analysis and perfectionism, and demonstrating more careful and detailed behaviors. In this behavioral profile, the fear of making mistakes is a possibly frequent emotion[36].

The least prevalent profile among the 108 DISC Test respondents was "D", corresponding to 7% of students. The prevalent dominance in behavior indicates that the person has greater ability to deal with problems and challenges, with the main descriptors of their behavior being competitiveness, decision-making capacity, objectivity and focus on results. They generally have the emotion of anger as a driver of their capacity to solve problems[36].

These four DISC groups were compared in relation to the APA-TBL dimension scores and did not show any statistical difference (p-value > 0.05).

Based on the results found in this study, an instructional material in digital format entitled "Recommendations for applying Team-Based Learning in the online modality" was prepared, whose PDF file is available for free access and download at the link https://tinyurl.com/comoaplicartblonline.

DISCUSSION

In the present study, students from the participating undergraduate Medicine and Nursing courses showed a favorable perception regarding online TBL, since only seven of the 24 APA-TBL questions had less than 75% of respondents indicating "I agree " or "I totally agree." This observed favorability corroborates a recent study on the effectiveness of online TBL, in which more than 80% of the students perceived the sessions as being pleasant and beneficial to active participation and engagement in group discussions[45]. Another study also on the application of online TBL during the pandemic period showed a positive influence of the online mode on the students' responsibility, who preferred it to the in-person modality[46].

The highest favorability index (Q24, 95%) found in the study is related to the idea that team learning benefits the future professional, showing that most participants recognize the importance of collaboration in healthcare professions, as stated in previous studies[15,16].

The positive perception in 10 of the 11 questions in the "team influence on individual performance" dimension showed students' favorability towards the method. This finding corroborates a study that showed an improvement in students' individual performance based on teamwork developed in online TBL[46].

Two of the APA-TBL questions that showed a favorability ratio lower than the established limit are in the dimension "teacher's performance/role in applying the method" (Q2, 51%; Q3, 70%). Another four questions belong to the "team responsibility and performance" dimension: Q7 (60%); Q10 (62%); Q16 (43%); and Q17 (70%). It is worth highlighting, however, that items Q2, Q3 and Q16 are related to actions that are independent of the TBL modality, whether in-person or online, as the stages of selection and provision of content by the teacher occur prior to the TBL session, as well as the selection of teams, which is carried out at the beginning of each semester and does not change throughout the period. Therefore, this finding does not seem to represent a specific deficiency of online TBL. This result confirms a previous study on the importance of the administrative aspect present in the role played by the teacher in online TBL, planning the sessions and defining the composition of the groups, among other functions that are required for the satisfactory development of the course[47].

The lower favorability result also obtained in items Q7, Q10, Q14 and Q17 may be related to the synchronous online modality of TBL sessions that took place during the COVID-19 pandemic, since group participation may have been affected by the specificities of the interactive dynamics in the virtual environment. In this sense, once again, the role of the teacher organizing the online rooms, managing the interaction mechanisms in them and clarifying the rules that regulate the online TBL sessions is relevant[47].

The lowest favorability index in the entire study was found in item Q16 (43%), which concerns the composition of online TBL discussion teams, therefore highlighting the relevance of student-student interaction in the perception of the method, which, together with the student's interactions with the teacher and with teaching materials and resources, constitutes the collaborative environment of active methodologies[4]. Also in this sense, the results showed that item Q11 had 88% of responses "I agree" and "I totally agree". In other words, the students seem to have prepared adequately, but they realize that their contribution to the group, during the synchronous online TBL session, could have been greater, as indicated by the responses to items Q7 and Q10, previously discussed.

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

One factor that may have impacted this perception is the limitations of interaction in the digital environment between members of the same group. A recent study carried out in a distance learning (EaD, *Educação à Distância*) course identified that, although students are aware that interaction is important and that help from colleagues contributes to their learning, they are not always able to satisfactorily engage in these relationships[48]. Moreover, the findings of this study confirm how important the collaborative aspect is in organizing online rooms and managing groups in TBL synchronous online sessions. Since virtual learning environments are not collaborative in nature, these tasks are the responsibility of the teacher, who takes on this extra challenge in order to encourage student participation and interaction between them[47].

It is also up to the teacher to pay attention to their interaction with students, a prominent factor in the complex and multifactorial process that constitutes learning[49]. In an in-person TBL session, students and teachers share the same physical space, which allows the teacher to interact frequently with the groups, encouraging the members' engagement in solving the issues and, mainly, the assessed case. In online TBL, however, to interact with the groups, the teacher needs to virtually enter and leave the online rooms in which the discussions take place, which imposes spatial-temporal differences that need to be assimilated by both the teacher leading the session and the students.

In addition to these limitations regarding the way of interacting with students, teaching practice in the digital environment resulted in a need for abrupt adaptation by teachers, who were forced to use technology in teaching and deal with the difficulties found in handling these new tools. An integrative review study that analyzed the implementation of online learning from the perspective of the medical educator concluded that teachers require strong institutional support, with detailed guidance on how to implement the technological devices in question. There was also a strong need for collaboration between teachers for the more cohesive development of online teaching[50].

The students' perception of online TBL was analyzed in relation to their level of exposure prior to in-person and online TBL sessions. Students exposed to more than 10 in-person TBL sessions had a significantly more negative perception in the dimension "teacher's performance/role in applying the method", compared to less exposed students, who participated in 1 to 10 sessions. This finding indicates that the mediation performed by the teacher in online sessions seems to have been insufficient in the students' perception with prolonged exposure to in-person TBL.

The frequency of participation in online TBL sessions also resulted in a significantly more negative perception in this same dimension, in addition to the "student commitment" and "team responsibility and performance" dimensions. In other words, prolonged exposure to online TBL seems to have negatively impacted the students' perception of the method. Although a previously mentioned recent study concluded that online TBL is effective for the teaching-learning process[45], it is worth highlighting that the aforementioned finding of the present study can be justified by the physical and cognitive strain caused by factors such as excessive screen time (both in pre-class study, as well as during online sessions) and a constant state of readiness required for interaction mediated by digital tools.

Therefore, it is possible to observe the effectiveness of this teaching method and the importance of alternating its application in the in-person and online modalities, with diversification of teaching resources, in order to prevent student exhaustion due to technologically mediated teaching.

With the attenuation of the pandemic context, in July 2022, the National Education Council (CNE, *Conselho Nacional de Educação*) decided in favor of approving the "General National Guidelines for the development of the hybrid teaching and learning process in Higher Education" (Opinion CNE/CP n. 14 /2022), considering that, due to the exceptional situation created by the new coronavirus, the search for new ways to reorganize the teaching and learning dynamics in Brazilian higher education institutions was accelerated. For the CNE, the flexible conception of the teaching-learning process, mixing in-person and online activities, through the use of digital technologies, was made possible by the increasing connectivity, bringing new demands to higher education.

Furthermore, according to the council's opinion, the development of studies, research, experiments and innovations related to hybrid education underway throughout the country could bring valuable contributions to its consolidation[51]. This document was approved by MEC Ordinance n. 558, of August 2, 2022, highlighting the value of the online modality, even though the need to carry out educational activities at home has ended[52]. Thus, the new pedagogical approach advocates, by definition, the student's leading role in the teaching-learning process, with the teacher acting as an advisor, monitor and mentor, just as TBL is configured, which proves to be an appropriate and interesting method to be incorporated in this current context of hybrid education.

Regarding the mapping of the behavioral profile of the participants in the present study, data collection with the DISC Test showed a smaller number of respondents (n = 108), when compared to the number of APA-TBL respondents (n = 241),

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

possibly because it was sent to students only after filling out the TCLE and APA-TBL online on the *REDCap*® platform, in which it cannot be included like other questionnaires and terms due to the agreement signed with the instrument's developer.

When comparing the different behavioral profiles of the participants with the perceptions of the four dimensions of the APA-TBL, these did not show results with statistical significance (p-value > 0.05). Thus, it was demonstrated that the DISC factors of student behavior did not influence the evaluation of the assessed method.

As limitations of the study, it is highlighted that it was not possible to compare the results obtained with previous studies whose objective was the evaluation of in-person TBL. Moreover, due to the non-probabilistic convenience sampling technique used in the study, the calculation of representativeness of the samples cannot be carried out, and it is only feasible to determine the minimum *effect size* detectable for each obtained sample. On the other hand, the interference of the level of participation in online sessions on the students' perception of the method must be highlighted. The relevance of studies like this lies in the fact that knowing how students evaluate the method allows teachers and educational managers to meet student demands regarding the application of TBL online and the structuring of the course and its human, pedagogical and technological resources[53].

CONCLUSIONS

The present study showed a favorable perception of health undergraduate students about online TBL in 17 of the 24 APA-TBL questions. Students exposed to more than 10 online TBL sessions had a significantly more negative perception in three of the four APA-TBL dimensions, when compared to those with less exposure. The group that had participated in more than 10 in-person TBL sessions showed a significantly more negative perception in just one dimension of the instrument, when compared to that less exposed. Moreover, the study showed that there was no correlation between the student's behavioral profile and their perception of online TBL.

AUTHORS' CONTRIBUTIONS

Luciana Vieira Farias prepared the research project; was responsible for the collection, organization, analysis and interpretation of data; writing and reviewing of the manuscript; approval of its final version to be published. Andréa Gomes da Costa Mohallem guided the research project, data analysis and writing of the manuscript; critical review of its content; review of the manuscript and approval of its final version to be published.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

SOURCES OF FUNDING

The authors declare no sources of funding.

ACKNOWLEDGEMENTS

We would like to thank the Medicine and Nursing undergraduate students at Faculdade Israelita de Ciências da Saúde Albert Einstein (FICSAE) who contributed to this study. We would also like to thank the Researcher's Support Center of Instituto Israelita de Ensino e Pesquisa (IIEP) for their invaluable statistical support, especially Anderson Paulo Scorsato, Elivane da Silva Victor and Thais Talarico Hosokawa.

REFERENCES

1. Mitre SM, Siqueira-Batista R, Girardi-de-Mendonça JM, Morais-Pinto NM, Meirelles CA, Pinto-Porto C, et al. Metodologias ativas de ensino-aprendizagem na formação profissional em saúde: debates atuais. Ciênc Saúde Colet. 2008;13(supl 2):2133-44.
2. Brasil. Resolução CNE/CES nº 4, de 7 de novembro de 2001. Institui Diretrizes Curriculares Nacionais do Curso de Graduação em Medicina. Diário Oficial da União; 2001.
3. Brasil. Resolução CNE/CES nº 3, de 7 de novembro de 2001. Institui Diretrizes Curriculares Nacionais do Curso de Graduação em Enfermagem. Diário Oficial da União; 2001.
4. Mota AR, Rosa CT da. Ensaio sobre metodologias ativas: reflexões e propostas. Revista Espaço Pedagógico. 2018;25(2):261-76.
5. Sobral FR, Campos CJ. Utilização de metodologia ativa no ensino e assistência de enfermagem na produção nacional: revisão integrativa. Rev Esc Enferm USP. 2012;46(1):208-18.
6. Berbel NA. As metodologias ativas e a promoção da autonomia de estudantes. Semina Ciênc Soc Hum. 2012;32(1):25-40.
7. Fujita JA, Mecena EH de, Carmona EV, Shimo AK. Uso da metodologia da problematização com o Arco de Maguerez no ensino sobre brinquedo terapêutico. Rev Port Educ. 2016;29(1):229-58.
8. Huggins CM, Stamatel JP. An exploratory study comparing the effectiveness of lecturing versus Team-based Learning. Teach Sociol. 2015;43(3):227-235.
9. Roh YS, Lee SJ, Choi D. Learner perception, expected competence, and satisfaction of Team-Based Learning in Korean nursing students. Nurs Educ Perspect. 2015;36(2):118-20.
10. Chhabra N, Kukreja S, Chhabra S, Chhabra S, Khodabux S, Sabane H. Team-based Learning strategy in biochemistry: perceptions and attitudes of faculty and 1st-year Medical students. Int J Appl Basic Med Res. 2017;7(suppl 1):S72-S7.
11. Marques A, Message C, Gitahy R, Sousa S. A experiência da aplicação da metodologia ativa Team Based Learning aliada a tecnologia no processo de ensino e de aprendizagem. Anais do Congresso Internacional de Educação e Tecnologias: Encontro de Pesquisadores em Educação a Distância; 2018; São Carlos. São Carlos: Universidade Federal de São Carlos; 2018.
12. Hrynchak P, Batty H. The educational theory basis of team-based learning. Med Teach. 2012;34(10):796-801.
13. Branson S, Boss L, Fowler DL. Team-based learning: application in undergraduate baccalaureate nursing education. J Nurs Educ Pract. 2015;6(4):59-64.
14. Currey J, Eustace P, Oldland E, Glanville D, Story I. Developing professional attributes in critical care nurses using Team-Based Learning. Nurse Educ Pract. 2015;15(3):232-8.

DOI: https://doi.org/10.1590/1981-5271v48.1-2023-0129.ING

15. Earnest M, Williams J, Aagaard E. Toward an optimal pedagogy for teamwork. Acad Med. 2017;92(10):1378-81.
16. Riegel F, Martini JG, Bresolin P, Mohallem AG, Nes AA. Desenvolvendo o pensamento crítico no ensino de Enfermagem: um desafio em tempos de pandemia de Covid-19. Esc Anna Nery. 2021;25(esp):e20200476.
17. Moore KD. Effective instructional strategies: from theory to practice. 2nd ed. Thousand Oaks, CA: Sage; 2009.
18. Fink LD. Creating significant learning experience: an integrated approach to designing college courses. San Francisco, CA: Jossey-Bass; 2003.
19. Goetz T, Bieg M, Lüdtke O, Pekrun R, Hall N. Do girls really experience more anxiety in mathematics? Psychol Sci. 2013;24(10):2079-87.
20. Rabia Z, Irum N. Personality traits and learning styles among students of mathematics, architecture, and fine arts. J Behav Sci. 2011;21(1):92-108.
21. Ackerman PL, Heggestad ED. Intelligence, personality, and interests: evidence for overlapping traits. Psychol Bull. 1997;121(2):219-45.
22. Breckler J, Joun D, Ngo H. Learning styles of physiology students interested in the health professions. Adv Physiol Educ. 2009;33(1):30-6.
23. Schunk DH, Zimmerman BJ. Motivation and self-regulated learning: theory, research, and applications. New York: Lawrence Erlbaum Associates; 2008.
24. Hutchinson M, Gul F. The interactive effects of extroversion/introversion traits and collectivism/individualism cultural beliefs on student group learning preferences. J Account Educ. 1997;15(1):95-107.
25. Ramsay A, Hanlon D, Smith D. The association between cognitive style and accounting students' preference for cooperative learning: an empirical investigation. J Account Educ. 2000;18(3):215-28.
26. Brasil. Portaria MEC nº 343, 17 de março de 2020. Dispõe sobre a substituição das aulas presenciais por aulas em meios digitais enquanto durar a situação de pandemia do Novo Coronavírus – COVID-19. Diário Oficial da União; 18 mar 2020. Seção 1, p. 39.
27. Hodges C, Moore S, Lockee B, Trust T, Bond M. The difference between emergency remote Teaching and Online Learning. Educ Rev [Internet]. 27 mar. 2020. Disponível em https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning
28. Vieira VB, Teo CR. O ensino a distância na formação em saúde: uma revisão integrativa de literatura. Revista de Educação Popular. 2018;17(1):114-25.
29. Team-Based Learning Collaborative. Webinars "Experiences in Moving TBL Online". Vimeo: TBLC; 2020.
30. Sun A, Chen X. Online education and its effective practice: a research review. Journal of Information Technology Education: Research. 2016;15:157-90.
31. Leigh J, Vasilica C, Dron R, Gawthorpe D, Burns E, Kennedy S, et al. Redefining undergraduate nurse teaching during the coronavirus pandemic: use of digital technologies. Br J Nurs. 2020;29(10):566-9.
32. Costa-e-Silva E, Lino-Neto T, Ribeiro E, Rocha M, Costa M. Going virtual and going wide: comparing Team-Based Learning in-class versus online and across disciplines. Educ Inf Technol (Dordr). 2022;27(2):2311-29.
33. Anas S, Kyrou I, Rand-Weaver M, Karteris E. The effect of online and in-person team-based learning (TBL) on undergraduate endocrinology teaching during Covid-19 pandemic. BMC Med Educ. 2022;22(1):120.
34. Krug RR, Vieira MS, Maciel MV, Erdmann TR, Vieira FC, Koch MC, et al. O "bê-á-bá" da Aprendizagem Baseada em Equipe. Rev Bras Educ Med. 2016;40(4):602-10.
35. Cunha ML, Amendola F, Samperiz MM, Mohallem AG. Evaluation of student perception of the Team-based Learning method (APA-TBL): instrument construction and validation. Nurse Educ Pract. 2018;33:141-7.
36. Marston W. As emoções das pessoas normais. São Paulo: Success For You; 2014.
37. Matos J de. Análise dos aspectos comportamentais através da ferramenta DISC [dissertação]. Lisboa: Instituto Superior de Ciências do Trabalho e da Empresa – ISCTE Business School; 2008.
38. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale, NJ: Erlbaum Associates; 1988.
39. Costa Neto PL. Estatística. 2a ed. São Paulo: Blücher; 2002.
40. Siegel S, Castellan Jr NJ. Estatística não-paramétrica para ciência do comportamento. Porto Alegre: Artmed; 2016.
41. Dunn OJ. Multiple comparisons using rank sums. Technometrics. 1964;6(3):241-52.
42. Royston JP. An extension of Shapiro and Wilk's W Test for normality to large samples. Journal of the Royal Statistical Society Series C (Applied Statistics). 1982;31(2):115-24.
43. R-Core-Team. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2018.
44. Brasil. Resolução nº 466, de 12 de dezembro de 2012. Aprova as diretrizes e normas regulamentadoras de pesquisa envolvendo seres humanos. Diário Oficial da União, 13 jun 2013. Seção 1, p. 59.
45. Sannathimmappa M, Nambiar V, Aravindakshan R, Kumar A. Are online synchronous Team-Based-Learning (TBL) pedagogy effective?: perspectives from a study on medical students in Oman. J Adv Med Educ Prof. 2022;10(1):12-21.
46. Vannini V, Alberti S, Epifani C, Valentini O, Ferri P. The effects of online Team-Based Learning on undergraduate nursing students' performance, attitudes and accountability during Covid-19 pandemic. Acta Biomed. 2022;93(6):e2022346.
47. Elias C, Silva K da, Araújo J de. O papel do professor em ambientes virtuais de aprendizagem. Anais do Seminário de Pesquisa; 2010; Goiânia. Goiânia: Universidade Federal de Goiás; 2010.
48. Kilis S, Yildirim Z. Posting patterns of students' social presence, cognitive presence, and teaching presence in online learning. Online Learning. 2023;23(2):179-95.
49. Gusso HL, Archer AB, Luiz FB, Sahão FT, Luca GG, Henkain MH, et al. Ensino superior em tempos de pandemia: diretrizes à gestão universitária. Educ Soc. 2020;41:e238957.
50. O'Doherty D, Dromey M, Lougheed J, Hannigan A, Last J, McGrath D. Barriers and solutions to online learning in medical education – an integrative review. BMC Med Educ. 2018;18(1):130.
51. Brasil. Parecer CNE/CP nº 14/2022, aprovado em 5 de julho de 2022. Diretrizes Nacionais Gerais para o desenvolvimento do processo híbrido de ensino e aprendizagem na Educação Superior.
52. Brasil. Portaria MEC nº 558, de 2 de agosto de 2022. Aprova Diretrizes Nacionais Gerais para o desenvolvimento do processo híbrido de ensino e aprendizagem na Educação Superior. Diário Oficial da União; 3 ago 2022. Seção 1, p. 49.
53. Persky A, Henry T, Campbell A. An exploratory analysis of personality, attitudes, and study skills on the learning curve within a team-based learning environment. Am J Pharm Educ. 2015;79(2):20.