Difference Between Learning Strategıes of Team-Based Learning and Case-Based Collaborative Learning Methods In Intern Physicians

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ABSTRACT

The aim of this study was to investigate the effects of resident physicians' participation in team-based learning (TBL) and case-based collaborative learning (CBCL) methods on their learning strategies and motivation.

Our study is a mixed methods study in which both qualitative and quantitative data collection tools were used. Both methods were applied over a four-week period in the practices carried out on 169 intern physicians in the Public Health Internship Istanbul Medeniyet University Faculty of Medicine in the 2021-2022 academic year, and the results were evaluated using the Motivation and Learning Strategies Scale (MLSS). Frequency and percentage distributions were used to interpret the data. Correlation tests were performed to determine whether there was a relationship between the scale scores. In addition, a focus group study was conducted by interviewing the students face-to-face after the application.

Our study showed that the CBCL method obtained higher scale scores than the TBL method in terms of internal goal organisation and self-efficacy (p<0.05), but no significant difference was found in terms of other sub-dimensions. Results indicated that CBCL had a slightly higher effect on students' internal goal organization and self-efficacy compared to TBL. However, both methods were similarly effective in other aspects of learning, such as peer collaboration, critical thinking, and metacognitive strategies. Focus group feedback highlighted that CBCL's realistic case approach enhanced students' motivation and practical understanding. Conversely, TBL was appreciated for making theoretical knowledge more engaging through clinical case tracking.

Both TBL and CBCL fostered a supportive, collaborative learning environment, with CBCL having a stronger impact on motivation.

Keywords: Medical Education, Educational Techniques, Active Learning, Teaching Methods

Introduction

In recent years, the use of active learning methods that encourage and facilitate student participation in medical education, both globally and in our country, has been rapidly increasing. Active learning is an instructional strategy that involves students in the learning process by engaging them in meaningful learning activities and prompting them to reflect on what they are doing. In active learning, the goal is for students to move beyond passive knowledge acquisition and reach a higher level of cognitive engagement, enabling them to construct knowledge in a meaningful way. Additionally, this learning process fosters a sense of organization, progress, and control over their own learning. This provides students with the opportunity to test their ideas and thoughts on the subjects they are learning. During this testing process, the aim is for students to create concrete experiences by connecting their ideas with one another. In this sense, active learning enhances metacognitive function and gives individuals insight into how they learn (1).

Team-Based Learning (TBL), developed by Larry K. Michaelsen in the 1970s, is an active learning strategy where students collaborate in small groups to achieve learning goals. It aims to enhance student engagement, teamwork, and skills like communication, problem-solving, and critical thinking. TBL consists of structured stages, which include preparation (pre-reading), readiness assurance, feedback, and problem-solving. A unique feature is the "readiness assurance" phase, which involves individual and team assessments with immediate feedback (2).

TBL is particularly effective in fields like pharmacy, nursing, and medicine, where teamwork

and communication are essential (3). It enables the benefits of small group learning in large classes with high student-faculty ratios (4), increasing student satisfaction, motivation, and engagement (7). By allowing students to apply theoretical knowledge to practical situations, TBL enhances critical thinking, decision-making, and knowledge retention (10). It fosters a collaborative and interactive learning environment, preparing students for the teamwork and communication demands of professional settings (8). Additionally, TBL supports competency-based education by emphasizing practical skills needed in the workforce (9).

Case-based collaborative learning (CBCL) in medicine has emerged as a learning method that has garnered significant attention in recent years due to its effectiveness. This approach involves students working in groups of 6-10 to analyze and solve clinical cases, integrating theoretical knowledge with practical applications. By engaging in collaborative learning, students can actively participate in discussions, share perspectives, and collectively develop solutions to complex medical cases (12). A key aspect of CBCL is its alignment with social learning theory, where students demonstrate their application of knowledge in patient cases and issues through small group discussions that are shared openly with the entire class. This approach enhances students' understanding of medical concepts and fosters teamwork, communication skills, and critical thinking abilities, all of which are essential for future medical practice. Furthermore, the integration of smartphone applications into case-based learning designs has been shown to improve residents' knowledge in specific medical fields, such as contraceptive care (13).

In the context of medical education, understanding the interplay between learning strategies and motivation is crucial for fostering effective educational environments. Various studies have highlighted the importance of intrinsic motivation and its relationship with learning strategies among medical students. For instance, Karthikeyan et al. emphasize that improved collaboration among medical educators can enhance motivation to create assessment items, which in turn can foster intrinsic motivation among students (14). This intrinsic motivation is vital as it encourages students to engage deeply with the material, leading to better academic outcomes. Moreover, the choice of learning strategies significantly impacts students' motivation levels. Lerchenfeldt and Nyland's pilot study indicates that students who adopt a deep

learning approach—characterized by seeking meaning and relating new information to prior knowledge—tend to perform better academically (15). This aligns with findings from Kusurkar et al., who argue that motivation influences study strategies and ultimately academic performance, particularly in the demanding field of medical education (16). The need for effective learning strategies is further supported by Norouzi et al., who identify various motivational regulation strategies that medical students employ to monitor their academic motivation (17). The role of self-efficacy in motivating medical students is also significant. Ommering et al. suggest that higher self-efficacy correlates with increased motivation for research activities among first-year medical students, reinforcing the idea that confidence in one's abilities can enhance motivation (18). This is consistent with Bandura's Social Cognitive Theory, which posits that self-efficacy is a critical determinant of motivation across various contexts. Furthermore, the integration of e-learning and blended learning approaches has been shown to improve motivation by providing students with flexible and engaging learning environments. Additionally, the motivational dimensions of learning are influenced by the teaching methods employed in medical education. For example, the use of cooperative learning techniques, such as the Jigsaw method, has been shown to enhance motivation and academic performance by fostering collaboration among students. This cooperative approach not only supports individual learning but also builds a sense of community, which is essential in the high-pressure environment of medical education.

The landscape of medical education is increasingly characterized by the adoption of innovative pedagogical strategies that foster critical thinking and clinical reasoning. Among these strategies, Case-Based Learning (CBL) and Team-Based Learning (TBL) have emerged as effective methods for enhancing student engagement and learning outcomes. This paper explores the differences in learning strategies and motivation between CBL and TBL, utilizing the Motivated Strategies for Learning Questionnaire (MSLQ) as a framework for analysis. This paper investigates the differences in learning strategies and motivation between Case-Based Learning (CBL) and Team-Based Learning (TBL) as assessed by the Motivated Strategies for Learning Questionnaire (MSLQ). While both pedagogical approaches aim to enhance student engagement and learning outcomes, they employ different strategies that influence students' motivation and learning

experiences. This analysis highlights the implications of these differences for educational practice in medical education. Features common to the pedagogies of both CBCL and TBL include the use of an authentic clinical case, active small group learning, activation of prior knowledge, and the application of newly acquired knowledge. Our study aims to identify the differences in learning strategies and motivation between trainings conducted using CBCL and TBL.

Materials and Methods

Study Design: The study was an non-randomized experimental study conducted in mixed-methods design, incorporating both quantitative and qualitative data. Before starting the research, faculty members of the Department of Medical Education at Marmara University provided training on TBL and CBCL to faculty members from the Department of Public Health at Istanbul Medeniyet University. Educational materials suitable for both learning models were prepared for the applications. During the Public Health internship, the same content was taught to the intern student group of the Istanbul Medeniyet University Faculty of Medicine using two different learning methods over a total of four weeks.

Settings and Participants: The study population consisted of 169 sixth-year medical students enrolled in a public university in a major city in Turkey during the 2021-2022 academic year. The Public Health rotation students from Istanbul Medeniyet University were divided into two groups. The public health course content was delivered to the internship groups using two different learning methods.

CBCL group: The Public Health internship groups were divided into CBCL teams of 7-10 students. At least one week before the session, the case and preliminary study resources were distributed to the students. Each CBCL session was held online via Zoom, with cameras turned on, and lasted 1.5 hours. All students were encouraged to actively participate in these sessions. During the sessions, the facilitator played an active role in guiding discussions and student learning. The session consisted of presenting the clinical problem, providing additional information to solve the problem, and a discussion lasting at least 30 minutes at the end.

TBL group: TBL sessions were held once a week for 2.5 hours (including 40 minutes for the Readiness Assurance Process and 1 hour 45 minutes for clinical problem-solving activities). Approximately 30 students were assigned to each TBL class, and each small group consisted of 5-8 students. Each TBL class had a facilitator composed of instructors. The TBL method included pre-class preparation, a team readiness assurance test, feedback, and clinical problem-solving activities, as previously described.

Study size: The sample consisted of students who met the study criteria and agreed to participate. A literature review suggested a standardized effect size (Cohen's d) of 0.5. The probability of making a type I error (α) was set at 0.05, and the power (1-β) was set at 0.85. To ensure balanced or equal group sizes in experimental group comparisons, the sample size was determined to be in a 1:1 ratio, and the hypothesis for the independent samples t-test was accepted as two-tailed. Based on these results, the minimum required sample size was determined to be 59 participants per group, with a total of 118 participants.

Data Sources/Measurement: Students were informed about the study's purpose and procedures, and written consent was obtained from those who agreed to participate.

1.The MSLQ was administered to students at the end of the training.

2. Focus group interviews were conducted with Public Health intern students.

The Motivated Strategies for Learning Questionnaire (MSLQ): The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich et al. (27), was administered via Google Forms at the end of the internship. The scale consists of 10 positive items scored on a 7-point Likert scale (1 = Not at all true of me, 7 = Very true of me). The item-total score correlation ranged from 0.67 to 0.78, with a Cronbach's alpha coefficient of 0.86.

The Motivated Strategies for Learning Questionnaire (MSLQ) is a widely recognized instrument designed to assess students' motivational orientations and the use of learning strategies. The MSLQ consists of two primary dimensions: motivation and learning strategies. Specifically, it is structured into two major sections:

Motivational Beliefs: This section includes various scales that measure students' beliefs about their motivation, such as intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, and self-efficacy for learning and performance. This component encompasses six motivational subscales that reflect different aspects of motivation. Motivational Beliefs: intrinsic goal orientation (4 items), extrinsic goal orientation (4 items), task value (6 items), control of learning beliefs (4 items), self-efficacy for

learning and performance (8 items), and test anxiety (5 items).

Learning Strategies: The second section focuses on the strategies that students employ in their learning processes. It includes scales for rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time and study environment management, and effort regulation. This section consists of nine learning strategies scales. Learning Strategies: rehearsal strategies (4 items), elaboration strategies (6 items), organization strategies (4 items), metacognitive strategies (12 items), critical thinking strategies (5 items), help-seeking (4 items), effort regulation (4 items), peer collaboration (3 items), and time and study environment management (8 items).

validity of the Turkish version and reliability study of the scale was conducted by Büyüköztürk et al. (22), and the item-total score correlation ranged from 0.64 to 0.78, with a Cronbach's alpha coefficient of 0.89. In this study, the Cronbach's alpha coefficient for the scale was found to be 0.87. Factors constituting the MSLQ include;

1.Motivational Beliefs

Control of Learning Beliefs: Refers to the student's belief that they can control their learning process and outcomes. Students with high control of learning beliefs believe that their success is dependent on their efforts, making them more motivated and determined.

Intrinsic Goal Orientation: Refers to the student's focus on internal sources of motivation (e.g., curiosity, desire to learn, personal satisfaction) when setting goals in the learning process. Intrinsic goal orientation encourages students to engage in deep learning and understanding.

Extrinsic Goal Orientation: Refers to the student's focus on external sources of motivation (e.g., grades, rewards, social approval) when setting goals. Extrinsic goal orientation refers to students' use of external incentives to achieve specific goals.

Self-Efficacy: Refers to the student's belief in their ability to successfully complete a task or learning process. Students with high self-efficacy are more resilient in coping with difficult tasks.

Task Value: Refers to how important, interesting, or valuable the student perceives a particular task or learning process. Students with high task value show greater engagement and motivation in the learning process.

2. Learning Strategies

Effort Management: Refers to the student's ability to plan and manage their time and energy effectively. Effective effort management facilitates the achievement of learning goals.

Peer Collaboration: Refers to students learning by collaborating with each other. This method involves sharing knowledge and skills through group work, discussions, and collaborative projects.

Rehearsal: Refers to the repetition of learned information. Rehearsal helps transfer information to long-term memory, increasing the retention of learning.

Metacognitive Strategies: Refers to the student's ability to recognize and manage their learning processes, strategies, and thinking patterns. Metacognitive strategies include processes such as planning, monitoring, and evaluating.

Elaboration: Refers to simplifying complex concepts or problems, making them easier to understand and remember.

Organization: Refers to the ability to organize and structure learning materials and the learning environment, making learning more effective and efficient.

Time and Study Environment Management: Refers to the student's strategies for selecting and utilizing appropriate time and environments for learning. This includes creating a quiet study area, managing time effectively, and increasing motivation.

Critical Thinking: Refers to the ability to question, evaluate, and analyze information, developing skills for logical reasoning and problem-solving.

Help-Seeking: Refers to the student's strategy of seeking support or guidance when necessary. This can include seeking help from teachers, peers, or other resources.

The theoretical framework of the Learning Strategies dimension includes cognitive strategies such as rehearsal, elaboration, organization, and critical thinking, and metacognitive strategies such as planning, monitoring, and regulation. The resource management dimension includes time and study environment management, effort management, peer collaboration, and help-seeking. The Motivation dimension is structured around values, with intrinsic and extrinsic goal orientations and task value, reflecting learners' beliefs about the importance and interest of their goals and tasks. The expectation sub-dimension includes self-efficacy and control of learning beliefs, reflecting learners' performance-related perceptions and beliefs.

dimension includes test anxiety.

Theoretical Substructure Scores of Learning Strategies Dimension

Value

o   Intrinsic Goal Orientation

o   Extrinsic Goal Orientation: Pertains to external rewards or pressures, such as grades or recognition.

o   Task Value Represents the learner's belief in the importance and relevance of the task.

Expectancy

o   Self-Efficacy Beliefs: Learners' confidence in their ability to succeed and perform well.

o   Control of Learning Beliefs Belief in the ability to influence learning outcomes through personal effort rather than external factors.

Affective

o   Test Anxiety Emotional responses such as worry or stress related to tasks like exams.

Cognitive Strategies

- Repetition Strategies
- Elaboration Strategies
- Organization Strategies
- Critical Thinking Strategies

Metacognitive Strategies

- Planning
- Monitoring
- Regulation

Resource Management

- Time and Study Environment Management
- Effort Management
- Peer Collaboration Management
- Seeking Help

Focus groups interview: To gain a deeper understanding of students' perspectives and experiences related to the CBCL and TBL sessions, three focus group interviews were conducted with students after the implementation of each learning method. Focus group questions were semi-structured and aligned with the survey items and theoretical framework. The focus groups were recorded and transcribed verbatim. The thematic analysis method suggested by Braun and Clarke (2006) was used in the study. Firstly, the data obtained were carefully read and the researchers noted the salient statements and potential themes during the process of familiarisation with the data. Then, the data were systematically analysed and divided into meaningful units and codes were assigned to these units. The coding process was carried out manually and themes were formed by bringing all codes together. The themes were reviewed according to the degree of representation of the data set and refined when necessary. Each theme was defined in detail and care was taken to name the themes in a way that best reflects their contribution to the research question. In the final stage, the findings of the analyses were reported, supported by direct quotations from the data, and related to the theoretical framework of the research.

Statistical Analysis: Data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS v.22) and OpenMeta (analyst) with a 95% confidence interval and a significance level of 0.05. Since the number of data points exceeded 30, the Kolmogorov-Smirnov test was used for the normality test. Results showed that the data followed a normal distribution ($p>0.005$). Descriptive statistics were used for quantitative data, and paired and independent t-tests, Pearson's chi-square, and Yates' correction were used for comparisons. A thematic analysis of the qualitative data was performed in each category. Frequency and percentage analyses were performed to determine to what extent the themes created in the thematic analysis process represented the overall data set. The number of codes under each theme and the percentage of these codes in the total coding were used to understand the importance and distribution of the themes. In order to evaluate the general findings of the study in a broader context, descriptive statistics (mean, standard deviation, percentage distributions) were presented on demographic data and these data were associated with themes.

Results

Between 01.07.2021 and 30.06.2022, 169 medical interns at the Istanbul Medeniyet University Faculty of Medicine's Public Health rotation were trained using CBCL and TBL methods. The average age of the participants was 23.81±0.94 years, with 43.7% (n=74) being female and 54.3% (n=95) being male students. After the training, the medical interns who agreed to participate in the study were administered the MSLQ via Google Forms.

Regarding the motivational dimension, there is no statistically significant difference between the TBL and CBCL groups in terms of the sub-dimensions of control belief, external goal organization and task value of the sub-dimensions of the motivation scale of the MSLQ used after the training methods. (Table1). In terms of internal goal organization and self-efficacy sub-dimensions, the mean of the CBCL group was statistically significantly higher than the mean of the TBL group ($p<0.05$).

Table 1: Scores of Motivation Scale Sub-Factors

	Group	N	Mean	Standard deviation	p value
Locus of control	TBL	78	20,95	3,05	0,199
	CBCL	91	21,14	3,42	
Intrinsic goal setting	TBL	78	21,23	4,65	0,021
	CBCL	91	21,66	3,38	
Extrinsic goal setting	TBL	78	16,10	5,14	0,545
	CBCL	91	15,42	5,34	
Self-Efficacy	TBL	78	43,45	7,36	0,038
	CBCL	91	43,92	5,69	
Task value	TBL	78	29,60	6,21	0,493
	CBCL	91	29,92	5,71	0,199

TBL: Team based learning, CBCL: Case based collaborative learning

There is no statistically significant difference in the sub-dimensions of Effort Management, Peer Cooperation, Repetition, Metacognitive, Paraphrasing, Regulation, Time and Working Environment, Critical Thinking and Help Seeking sub-dimensions of the Learning Strategies Scale used after the training methods (Table 2,3,4).

Group Experiences: Student feedback provides different perspectives on CBCL and TBL approaches. Regarding CBCL, students noted that systematically addressing cases offers them diverse viewpoints and contributes to the integration of theoretical knowledge with practical application. They reported feeling as though they were in a real simulation environment, and that with the support of instructors, they were able to develop different thinking styles (Table CBCL 5a).

For TBL, students emphasized that the approach made theoretical knowledge more meaningful and increased their interest in classes by allowing them to follow clinical cases from start to finish. However, some students expressed discomfort with the limited participation in discussions and noted that group interactions both increased and sometimes decreased their motivation (Table TBL 5b).

Time and environment management have been significant discussion topics for both methods. In CBCL, students mentioned that time seemed to pass quickly and that some topics were not sufficiently discussed. In contrast, feedback for TBL indicated that class durations should be longer. This suggests that both methods offer an intensive learning experience for students but highlight the need for improved time management.

In the recommendations section, it was noted that the complexity of cases in CBCL sometimes led to distractions and that preparatory materials should be better shared. For TBL, it was mentioned that the length and variety of pre-class materials could complicate the learning process. These suggestions underscore the importance of improvements to make both methods more effective.

Discussion

In this study, the effects of TBL and CBCL on motivation and learning strategy scores and students' feedbacks about the application after these sessions were analyzed. TBL and CBCL are two distinct educational methodologies aimed at enhancing student engagement, critical thinking, and collaboration skills. Although both approaches aim to facilitate learning through behavioral modification, they differ in their execution and organization. TBL is characterized by its student-centered approach where students work in teams to actively engage with course material, apply knowledge, and solve complex problems (23). This method emphasizes active learning through collaborative teamwork and the development of higher-order thinking skills (24). On the other hand, CBCL integrates case-based learning (CBL), problem-based learning (PBL), and TBL to encourage independent inquiry and the development of clinical skills among students (25).

One fundamental difference between TBL and CBCL lies in the core principles of the learning methods. TBL is characterized by its focus on thematic content, where learning is organized around specific themes or topics. This approach encourages students to engage deeply with a subject matter, promoting critical thinking and the integration of knowledge across different disciplines. This method allows students to explore various aspects of a theme, fostering a holistic understanding and encouraging connections between concepts. (26). integrates collaborative learning with case-based learning, emphasizing the importance of teamwork and

Table 2: Scores of Learning Strategies Scale Sub-Factors

	Group	N	Mean	Standard deviation	P Value
Effort Management	TBL	78,00	17,83	3,12	0,78
	CBCL	91,00	17,69	3,12	
Peer Collaboration	TBL	78,00	12,24	3,80	0,67
	CBCL	91,00	12,97	3,97	
Repetition	TBL	78,00	17,90	4,74	0,44
	CBCL	91,00	18,29	5,07	
Metacognition	TBL	78,00	58,49	10,14	0,96
	CBCL	91,00	58,71	9,90	
Elucidation	TBL	78,00	31,97	6,24	0,32
	CBCL	91,00	31,40	5,80	
Regulation	TBL	78,00	45,37	8,31	0,73
	CBCL	91,00	45,80	8,31	
Time and Work Environment	TBL	78,00	39,01	6,40	0,59
	CBCL	91,00	37,61	6,75	
Critical Thinking	TBL	78,00	25,32	4,38	0,56
	CBCL	91,00	25,94	4,34	
Seeking Help	TBL	78,00	18,41	4,17	0,44
	CBCL	91,00	17,41	4,32	

TBL: Team based learning, CBCL: Case based collaborative learning

Table 3: Theoretical Substructure Scores of Learning Strategies Dimension

Main Sub Dimension	Factor	Group	N	Mean	Std. Deviation	p
Value	İnternal Target Organization	TBL	78	66,93		
	Extrinsic Target Missing Value				12,14	0,31
		CBCL	91	67	11,03	
Expectancy	Self-efficacy Perception	TBL	78	64,4	8,88	
	Learning Control Belief	CBCL	91	65,06	7,83	0,17
Affective	Examination Anxiety	TBL	78	24,15	6,35	
		CBCL	91	23,26	6,12	0,83

TBL: Team based learning, CBCL: Case based collaborative learning

real-world problem-solving. CBCL involves students working together in groups to analyze and discuss specific cases, which enhances their analytical skills and promotes a deeper understanding of the subject matter (25). The collaborative aspect of CBCL is crucial, as it not only facilitates knowledge sharing among peers but also encourages the development of interpersonal skills and critical thinking. Research indicates that CBCL can lead to improved ethical competencies and decision-making skills, particularly in fields such as medicine and social work. In our study, no significant differences were observed in the sub-dimensions of peer collaboration, intrinsic goal regulation, and extrinsic goal regulation on the scale used to assess teamwork and motivation among students for both teaching methods.

While both methods involve collaborative learning, TBL emphasizes active engagement with course content through team activities, quizzes, and problem-solving tasks (27), whereas CBCL integrates case studies to promote critical thinking and decision-making skills (28). Our study did not reveal differences in the critical thinking, peer collaboration, and metacognitive sub-dimensions on the scale used. We attribute this to the fact that the problems used in team work are often common issues encountered in real life. Another significant difference lies in the structure of the learning activities. TBL typically involves a more structured approach, where students follow a predefined curriculum centered around a theme.

This structure can sometimes limit the spontaneity of discussions and the exploration of diverse perspectives.

Table 4: Theoretical Background (Model) of Learning Strategies Dimension

	Group	N	Mean	Std. Deviation	p Value
Cognitive	TBL	78	95,25	17,24	0,934
	CBCL	91	95,50	17,80	
Metacognitive	TBL	78	58,50	10,14	0,964
	CBCL	91	58,72	9,90	
Resource Management	TBL	78	87,49	11,60	0,27
	CBCL	91	85,68	13,05	

TBL: Team based learning, CBCL: Case based collaborative learning

Table 5a: 'How were your experiences with CBCL?'

Theme	Examples of Student Comments
Thoughts and feelings	The cases were very systematic, giving us different perspectives. The questions made us think very broadly. The positive communication among my peers contributed positively to our learning. We felt like we were in a real-life simulation. It was helpful to combine theoretical and practical knowledge. I think the instructors helped us gain different ways of thinking about case solutions. It was very practice-oriented.
Motivation	Solving real-life cases under the guidance of clinicians increased our motivation. Facing potential problems we may encounter in our future medical careers and overcoming them was great. It was very good in terms of seeing where we were lacking, and I think we filled these gaps with the instructors.
Time/ Environment Management	We didn't realize how time passed. Compared to other courses, it progressed quickly, and sometimes there wasn't enough time to discuss the problems. We created a very good learning and discussion environment with my peers. It was nice that the cases were ordered from simple to complex.
Challenges and Suggestions	The students in the case study groups were not all at the same level, and some students did not participate. We went through some of the case questions quickly. Some cases were very complicated, which sometimes caused us to lose focus. Some questions were repetitive. I think it would be beneficial to share pre-study information related to the cases with us. This would make it easier to answer the questions in this course.

Conversely, CBCL is inherently more flexible, allowing for dynamic interactions among students as they navigate through complex cases. This flexibility can lead to richer discussions and a more profound engagement with the material (24,27,28,31). In our study, we specifically observed that students had higher levels of curiosity, willingness to learn, personal satisfaction, and confidence in their abilities to successfully complete the learning process with the CBCL method. We believe this is due to the use of real-life cases in case-based learning and the increased confidence of students after solving these cases.

Moreover, the assessment methods differ between the two approaches. TBL often employs formative assessments that focus on individual understanding and mastery of the thematic content, while CBCL assessments are more likely to evaluate group dynamics and collaborative processes, emphasizing the importance of teamwork and collective problem-solving. This distinction highlights the varying educational goals of each approach: TBL aims for individual mastery of content, whereas CBCL seeks to cultivate collaborative skills and collective knowledge construction. In our study, we did not observe differences in the evaluation scores of the sub-dimensions of control beliefs and task values of the groups' own learning and evaluation processes.

The implementation of TBL and CBCL may differ in terms of technological integration and adaptability to online learning environments. TBL has been successfully adapted to online platforms by leveraging synchronous participation and asynchronous flexibility to facilitate collaborative activities and maintain student engagement (27). The online implementation continuation of active learning practices and team-based interactions in virtual classrooms (30). In contrast, CBCL may face challenges in transitioning to online platforms due to its reliance on face-to-face interactions and

Table 5b: 'How were your experiences with TBL?'

Theme	Examples of Student Comments
Thoughts and feelings	Following the lessons through problems and cases was very enjoyable for me.
	Theoretical knowledge became more meaningful, and it caught my attention while following the clinical picture from beginning to end.
	Some of my group members restricted my participation in the discussion, which bothered me.
	TBL was very enjoyable, and I had no difficulty staying focused during the lesson.
Motivation	Even though I didn't agree with all the answers, we were able to reach a conclusion as a group, which boosted my motivation.
	Being active rather than passive made me happy, which increased my motivation.
	It helped me reinforce and build upon clinical and laboratory knowledge.
	During the application, I learned about different situations, research, and preventive healthcare services.
	Using textbook knowledge in clinical practice motivated me.
Time/ Environment Management	Even though I didn't agree with all the answers, we were able to reach a conclusion as a group.
	The information given in the lesson no longer felt abstract, and discussing it through cases was great.
	Clinical discussions during the application had a very positive effect on learning.
	Asking questions and receiving feedback was an effective use of time.
	We interacted throughout the entire application, which fostered different ways of thinking.
	I think we used time more efficiently compared to clinical lessons.
Challenges and Suggestions	Even though I didn't agree with all the answers, we were able to reach a conclusion as a group.
	Being active rather than passive made me happy, which increased my motivation.
	The information given in the lesson no longer felt abstract, and discussing it through cases was great; it could have lasted longer.
	The pre-class resources were too long.

in-depth discussions for effective implementation (24). Our study also did not observe differences in the sub-dimensions of effort management and peer collaboration among students based on the learning method used.

In conclusion, while both TBL and CBCL aim to enhance student engagement, critical thinking, and collaboration skills, they differ in their core principles, teaching methods, assessment strategies, and adaptability to online learning environments. TBL emphasizes structured, team-based activities to promote active learning and higher-order thinking skills, whereas CBCL integrates case-based learning approaches to encourage independent inquiry and clinical skill development. Understanding these differences is crucial for educators to select the most appropriate methodology based on learning objectives, student needs, and learning environments. Our study reveals that both TBL and CBCL have similar effects on students' learning strategies. Both methods positively impact students' learning strategies. The limitations of our study include the short-term intervention with students and the use of predominantly passive learning methods throughout their university education.

Limitations: Our study was conducted with 169 intern doctors at a medical school, and this limited and homogeneous sample restricts the generalizability of the results. Studies conducted with different faculties and larger participant groups may contribute to more reliable results. The online data collection method also carries the risk of data loss or incompleteness. The observation period of the study was a 1-month internship, and the long-term effects of the educational methods on learning retention and success were not assessed. Feedback from students regarding CBCL and TBL methods is subjective and may vary based on individual motivation and interests, which can lead to interpretative variability. Additionally, the limitation of our study includes the insufficient discussion of some topics by different instructors during the implementation of CBCL and TBL methods.

Processing (HHM,IM,MC,SYİ), Analysis and/or Interpretation (HHM,IM,MC,SYİ)

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