



## REVIEW ARTICLE

## The Benefits and Limits of Case-Based Learning (CBL): A Concise Review

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## ABSTRACT

Although medical care has become much more sophisticated over the past century, little has changed in terms of medical education methodologies. Currently, traditional clinical education mostly depends on a single modality, i.e., the lecture-based learning (LBL) teaching technique, where students listen while their teacher lectures. To compensate for the drawbacks of the LBL teaching mode, medical teaching reform has established a range of teaching modes: Problem-Based Learning (PBL), Case-Based Learning (CBL), and Team-Based Learning (TBL). The most employed of which are Problem-Based Learning (PBL) and Case-Based Learning (CBL), both were promoted and used in medical schools in the United States, Europe, Britain, and other countries. Human cases are utilized as a teaching technique in several medical professions to help relate theory to practice and impart relevance through case-based learning. CBL is the term used to describe the use of clinical cases as tools for learning. Currently, CBL is applied extensively in a variety of healthcare settings, including medicine, dentistry, child development, allied health, nursing, occupational therapy, and other allied health fields. In this review, we explore the advantages and disadvantages of CBL.

**Keywords:** Active learning; Case-based learning; Dental education; Medical education; Small group learning

## 1 INTRODUCTION

## “Learning how to learn”- Allchin D

Several teaching strategies have been developed to encourage active learning in health professions education.<sup>(1)</sup> In recent years, theoretical courses have transitioned from traditional to blended teaching methods. A model like problem-based learning (PBL) and case-based learning (CBL) and other online applications have been added.<sup>(2)</sup> To help students develop critical thinking and problem-solving skills autonomously.<sup>(3,4)</sup>

Since the beginning of the twenty-first century, global medical education, including dentistry, has placed a greater emphasis on the development of realistic clinical competencies as well as educational milestones for graduates.<sup>(5)</sup> Lorrain Smith of the University of Edinburgh first introduced CBL in 1912, and Harvard Business School embraced it in the 1920s. It was not widely used in health and medicine education until the 1990s. CBL approaches often use a diverse set of medical and clinical scenarios to

teach students about actual patient care circumstances. In these curricula, teachers primarily lead students in applying their gained knowledge foundation to make decisions on situations that they may face in practice. So, the student-teacher connection continues as follows: students take on learning responsibilities by studying the presented case and devising successful treatment strategies, while the instructor serves as a prompter and guide to assist students in justifying their interpretations.<sup>(5–8)</sup> The purpose of this paper is to provide an overview of active learning in case-based learning (CBL).

## 1.1 Definitions of CBL:

There is no universally accepted definition of CBL. In a recent assessment of case-based learning (CBL), Thistlewaite et al. noted that there is no international consensus on its description, which differs from PBL in terms of structure, and found that CBL is a sort of inquiry-based learning that falls between structured and guided learning.<sup>(9)</sup>

a) Case-based learning is an active-learning strategy, much like problem-based learning, involving small groups in which the group focuses on solving a presented problem.<sup>(10)</sup>

b) Active learning strategies can be defined as “instructional activities involving students in doing things and simultaneously thinking about what they are doing.”<sup>(11)</sup>

c) The goal of CBL is to prepare students for clinical practice using authentic clinical cases. It links theory to practice through the application of knowledge to the cases, using inquiry-based learning methods.<sup>(9)</sup>

d) Discussing a clinical case related to the topic taught, students evaluated their own understanding of the concept using a high order of cognition. This process encourages active learning and produces a more productive outcome.<sup>(12)</sup>

e) Case-based learning is a long-established pedagogical method that focuses on case study teaching and inquiry-based learning; thus, CBL is on the continuum between structured and guided learning.<sup>(13)</sup>

f) The case-based learning is structured so that trainees explore clinically relevant topics using open-ended questions with well-defined goals.<sup>(14)</sup>

g) The latest definition of CBL: it is a form of learning that involves a clinical case, a problem or question to be solved, and a stated set of learning objectives with a measured outcome. Included in this definition is that some, but not all, of the information is presented prior to or during the learning intervention, and some of the information is discovered during the problem solving or question answering. The learner acquires some of the learning objectives during the CBL session, whether it is live, web-based, or on paper.<sup>(15)</sup>

h) CBL is defined as an inquiry-based learning experience that uses actual or simulated patient cases to solve or investigate a clinical problem under the supervision of a teacher and stated learning objectives.<sup>(15)</sup>

### 1.2 Implementing of CBL: guidelines for case-based learning

Medical schools have recognized the importance of embracing clinical work early on, referring to the combination of basic and clinical sciences as “vertical integration.” Human health disciplines have recognized the value of using real or simulated cases to explain educational concepts. Numerous novel teaching methods have been developed in recent times, including small group learning modalities like problem-based learning (PBL), case-based learning (CBL), and team-based learning (TBL). Using clinical cases to aid teaching has been termed case-based learning (CBL). Of these methods, PBL and CBL have attracted the most attention.<sup>(16–18)</sup> Case-based learning (CBL) is the utilization of clinical situations to improve educational outcomes.<sup>(15,19)</sup> In 1912, Dr. James Lorrain Smith used CBL to teach the case method of teaching pathology at the University of Edinburgh. CBL is widely used worldwide in a variety of medical fields. CBL

was used at several educational levels, from undergraduate to graduate. CBL sessions were given utilizing a range of media, including many live formats, paper and pencil, and web-based media.<sup>(6,15)</sup> CBL is utilized for imparting knowledge in healthcare and medicine. The use of CBL in several sectors includes medicine, dentistry, pharmacology, occupational and physical therapy, nursing, allied health, and child development.<sup>(20)</sup> Implementing CBL needs careful planning, teamwork, and a commitment to continuous enhancement. Each phase should be specific to the students’ learning environment and requirements.

The basic rules and its implementation procedures are summarized in Tables 1 and 2.

### 1.3 How to create a scenario (Finding and Writing Cases)<sup>(32)</sup>

There are two alternatives to create a scenario:

1. Consider utilizing or adapting open access cases from the journals: The availability of open resources and databases containing cases that instructors can download makes this approach even more accessible in the classroom.<sup>(32)</sup>

2. Consider writing original cases: If an instructor is unable to find open access cases relevant to their course learning objectives, they may choose to write their own.<sup>(32)</sup> The examples can be the cases from specialty textbooks, or the cases reported to the faculty/universities/college hospital.<sup>(33–37)</sup>

### 1.4 Formatting of the cases (Queens University)<sup>(21)</sup>

- **“Finished”** situations based on facts: for analysis only, as the solution is given, or alternative solutions are proposed.
- **“Unfinished”** open-ended cases: the results are not yet evident (either because the case did not reach a factual conclusion or because the instructor deleted the final facts). Students must make predictions, decisions, and proposals that will influence the outcome.
- **“Fictional cases”**: fully written by the instructor; can be open-ended or completed. Cautionary note: the case must be complicated enough to imitate reality while not having too many “red herrings” that confuse the exercise’s purpose.
- **“Original documents”** include news stories, reports, summaries, historical texts, artifacts, literary passages, audio and video recordings, ethnographies, and more. With the appropriate inquiries, these can turn into problem-solving opportunities. Comparing two original documents on the same topic or theme is a strong strategy for encouraging both analysis and synthesis. This allows for the presentation of multiple sides of a debate, increasing the complexity of the conflicts.

**Table 1: Clyde Freeman Herreid provides eleven basic rules for case-based learning (Queen's University's Centre for Teaching and Learning)<sup>(21)</sup>**

Sl. No.	Basic rules for case-based learning
a)	Tells a story.
b)	Focuses on an interesting problem.
c)	Set within the last five years.
d)	Creates empathy for the main characters.
e)	Includes quotes. There is no better method to understand a situation and develop empathy for the characters.
f)	Relevant for the reader.
g)	Must have pedagogical value.
h)	Inciting conflict.
i)	Forcing decisions.
j)	Has generality.
k)	Is short.

**Table 2: The implementation procedure of CBL can be summarized as follows (Zhang SY)<sup>(22)</sup>**

Sl. No.	The implementation procedure
a)	Establishing the case (scenario).
b)	Grouping and analysing it.
c)	Brainstorming.
d)	Creating teaching goals.
e)	Discovering new findings.
f)	Exchanging results amongst groups.
g)	Reaching a learning consensus.
h)	Incorporating it into clinical practice.

**Table 3:**

Sl. No.	Advantages of CBL: <sup>(1,5,8,15,20,22–25)</sup>
1.	Enhance critical thinking to improve teaching effectiveness.
2.	Provide hands-on learning and experience for professional decision-making.
3.	Enhance practical knowledge through conversation, simulation, and reflection.
4.	Reinforce and consolidate earlier professional preparation.
5.	Offer a diverse instructional medium
6.	Analyze difficult circumstances from many perspectives and levels of abstraction
7.	Easier to elicit feedback from learners compared to traditional teaching methods.
8.	Enhance learners' analytical and problem-solving abilities.
9.	Promote reflection and decision-making for action, and familiarity with the process.
10.	Involve learners in their own learning.
11.	Promotes an organized, deeper learning. Learning that involves critical thinking, behavioral adjustments, and generalizability to different situations, rather than just identifying correct answers and critical approach to clinical problem-solving
12.	higher confidence, enhanced communication skills and improved clinical thinking and decision-making
13.	Small group learning (in groups of six to ten)
14.	Empower students to engage in peer learning and apply new knowledge to real-world clinical situations while guided by a facilitator.
15.	Takes less time since the facilitator directs students' attention to crucial parts of the clinical case.
16.	Sessions frequently follow a similar trajectory to what is encountered in the real world when exploring a clinical case <ul style="list-style-type: none"> <li>● formulation of differential diagnoses.</li> <li>● proposal and interpretation of relevant investigations.</li> <li>● generation of treatment plans.</li> </ul> They can also be tailored to focus discussion on any of these aspects of the case. Thus, the CBL format is adaptable and can be used in a variety of time-restricted scenarios.

**Table 4:**

Sl. No.	Limitations/disadvantages of CBL: (5,23,25–31)
1.	A major barrier to successful implementation is the lack of skilled and enthusiastic teaching teams, which raises teacher requirements and increases to the workload of educators.
2.	It is also a resource-intensive process that requires adequate time, space, and funds to coordinate, with class sizes exceeding 100 students, most schools demand a minimum of ten groups, which necessitates the availability of ten or more professionally thought-out small group rooms as well as ten or more properly qualified facilitators.
3.	Unlike in advanced nations CBL has not been a standard pedagogical approach Dentistry is a multidisciplinary dental course including restorative dentistry, preventive dentistry, periodontology, prosthodontics, paediatric dentistry, and oral medicine in many countries including China. which is completely different from the dental education patterns in developed countries, such as the United States.
4.	CBL may not provide an organized perspective of knowledge since it places knowledge in real-world contexts in a piecemeal fashion.
5.	For many students, discussing and analysing a case is an unfamiliar experience. It is rare that all students in a case discussion will be eager to participate and state their views without hesitation, the larger the class size, the higher the probability of additional distractions occurring.
6.	Students' reactions to a strange environment vary. For example, the flow and depth of the discussion may be disrupted by students being unsure of how to respond to prompts from the case leader or other students; class members may fail to assimilate the highly nuanced discussion and debate that case analysis often engenders, resulting in frustration or frequently perplexed.
7.	The biggest issue is minimal or non-existent participation. For a various reasons, student's may be reluctant to participate, despite the best efforts by the Case instructors, student either contribute very little or never speak at all.
8.	Students may spend a significant amount of time preparing, as well as more time looking for information, resulting in a reduction in extracurricular activities.
9.	The labour-intensive process of preparing cases for instruction is always changing based on the use of the case and the course material it is connected to. It is rare for teachers to be able to use the same case preparation for multiple classes and learning objectives concurrently.
10.	The complexity of each case differs. A lack of information limits the types of scenarios, issues within them, and levels of case complexity.
11.	Case teachers also need to be ready to intervene when a student tries to control the conversation at the expense of other students' participation and the case discussion.
12.	Unexpected, unusual, but intriguing topics could come up and tempt the teacher to alter the direction of the conversation. While in certain cases this could be helpful, it frequently means that the case's original intent and objectives of learning may be lost.
13.	The analytical levels within instances require time to uncover. The length of time required is determined by the complexity of the individual case. It is therefore critical to limit the depth of case analysis in accordance with both teaching objectives and time limits.
14.	The instructor should be exceptionally adept at modelling case discussion and interpersonal communication abilities. Not every instructor has or is willing to learn these crucial characteristics, which can lead to poor case teaching.
15.	Another challenge of using many facilitators is the difficulty of standardizing experiences across groups. Each facilitator adds his or her own style, experience, and knowledge to the CBL session, which gives many great opportunities but also guarantees that no two groups will share the same educational experience.

## 2 DISCUSSION

Medical and health-care education is currently evolving.<sup>(38)</sup> Traditional educational paradigms, in which a teacher delivers knowledge to a class of students, are being challenged by innovative and individualized learning approaches. These alternative education techniques aim to address each student's unique learning styles, interests, and requirements, resulting in a more comprehensive and interesting learning experience. (stand together) Learning in any setting may be improved so that students are actively engaged in the process. Lectures, when combined with small group learning, may be

more effective in boosting knowledge and confidence.<sup>(39,40)</sup>

To promote student learning, participation, and motivation, educators must devise a variety of ways for improving the educational experience. Understanding students' diverse learning styles and modifying educational tactics to accommodate them is critical for enhancing student performance.<sup>(20)</sup>

CBL is widely used throughout all continents.<sup>(15)</sup> CBL is used in a variety of fields and levels of healthcare training. In general, CBL is also employed at several levels, including undergraduate education in the professions,

graduate education, and postgraduate education.<sup>(15)</sup> CBL curricula cover nearly all dental disciplines, including oral medicine, periodontology, prosthodontics, paediatric dentistry, orthodontics, preclinical training, etc. CBL has been emerging as an outstanding start to transit students from more traditional and theoretical textbook-orientated methodologies to practical scenarios.<sup>(25,41)</sup> CBL fosters active learning by employing case scenarios to imitate real-life situations that students may encounter in the future. Many dental schools throughout the world have reported challenges in acquiring adequate undergraduate teaching material, like treating fewer complete denture cases before graduation.<sup>(42)</sup> Exposing students to a variety of cases can help them gain valuable clinical experience. Case-based scenarios may benefit clinical decision-making.<sup>(43–45)</sup>

In the CBL literature, mixed findings are reported. There were fifty-nine studies that found active learning to be better than lectures, five that found no difference between these two methods, and only one that found lectures to be better than active learning. Previous studies found that CBL was ineffective in transferring existing knowledge systems. The literature on the influence of various active learning strategies (PBL, CBL, and TBL) is varying and sometimes contradictory. This is perhaps not surprising given that studies evaluate a wide range of outcomes and use a number of study designs, including comparisons between groups, within groups, and pre/post modifications ranging from single sessions to full curricula.<sup>(8)</sup> In addition to effectiveness concerns, there are also unanswered questions about who, when, and how active learning could be useful in dental education.<sup>(1,9,28,29,46)</sup> Case-based teaching continues to gain popularity as a viable approach in preservice and in-service teacher preparation. Despite its growing popularity, individuals considering utilizing the method should realize that, while this offered numerous benefits<sup>(23)</sup> Successful teaching in new model like CBL requires teachers with excellent learning abilities, a strong sense of responsibility, patience, and the confidence to experiment with new technology and methods.<sup>(29)</sup>

Meanwhile, the LBL modes can be used in theoretical medical lessons so that teachers could provide a systematic state of the etiology, pathophysiology, clinical characteristics, imaging expression, and disease course, and this information could be used as prior knowledge, saving students hours of searching for basic knowledge, may be more helpful for the student during CBL Session. Mobile phones and the internet enable asynchronous and nonlocalized learning leading to reduced reliance on classroom learning alone.<sup>(47,48)</sup>

### 2.1 Possibilities to overcome the limitations of CBL:

1. Need teachers with outstanding learning abilities, a strong sense of responsibility, patience, and the confidence to experiment with novel methods and technologies.

2. Orientation and training programs should be conducted for the faculty to sensitize and implement different teaching approaches.

3. It takes time for both teachers and students to get used to the new teaching method and evaluation system.

4. The facilitators play a major role in making the discussion interesting and stop the students if they are distracting from the scenario. The smaller groups of students (10) help him to involve all the students to interact.

5. Students should be provided enough time for preparation (7 days) so active learning doesn't take up their extracurricular activities time.

6. Each teaching mode has its own advantages and limitations, including lecture-based learning (LBL) or it being CBL, Implementing CBL necessitates meticulous preparation, teamwork, and a commitment to ongoing improvement.

However, assessing competencies can be more subjective than traditional grading; not having adequate staff can increase the workload of educators, and their interest in adapting new teaching skills can still be a challenge.

## 3 CONCLUSION

What to learn and how to learn effectively is of a concern.<sup>(25)</sup> It takes time for new teaching methods to become effective; both teachers and students must actively participate and provide feedback to consistently achieve positive changes on a continuous basis. Each teaching modes have their own advantages. The dental education system has been dominated by the traditional teacher-centred approach, which has almost created predetermined learning experiences for both teachers and students. Therefore, a long-time adaptation will be required to modify the CBL teaching pattern and assessment system for both teachers and students. It is more effective to undertake a faculty development program based on specialization because each department has its own unique training scenarios. When considering literature that evaluate the impact of the CBL, no clear picture emerges.<sup>(5,45,48)</sup>

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