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**Case-based
Learning in
Medical Education**

**Preparing Students
for Success in
Clinical Practice**



Red Paper

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Preparing Students for Success in Clinical Practice



Executive Summary

This red paper for faculty and librarians in medical schools, APN programs, and PA programs reviews the research on case-based learning in medical environments and covers:

- ▶ Key elements that define case-based instruction
- ▶ Advantages of this pedagogical approach
- ▶ Evidence of improvement in clinical decision-making
- ▶ Research into its effect on patient outcomes
- ▶ Impact on student engagement and building collaborative skills
- ▶ Influence on student retention and application of knowledge
- ▶ Factors required for successful implementation

Introduction

Case-based learning (CBL) as a pedagogical approach rounds out medical students' education with sessions dedicated to the discussion and exploration of cases. When integrated into medical curricula, case-based education has been demonstrated to improve clinical performance, attitudes, and teamwork.¹

In acknowledgment of the many strengths and advantages of CBL as a pedagogical approach, CBL is playing progressively larger role in the curricula of medical programs worldwide.² In fact, CBL is increasingly expected as part of a robust medical education. This McGraw-Hill Professional red paper explores some of the advantages of CBL, how CBL improves clinical decision-making skills, what makes it attractive to both students and faculty, why quality educational outcomes rely on quality case material, and what it takes to successfully prepare and implement CBL into medical curricula.

Case-based Learning – An Evolving Form of Instruction

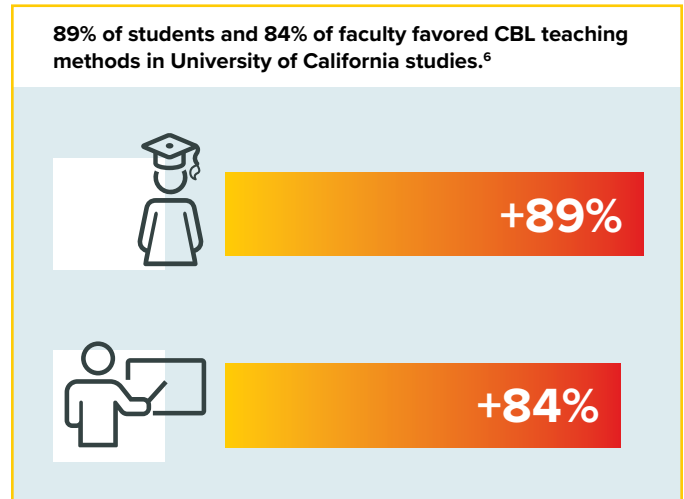
Case-based learning is not a new practice. It's been used to teach medical students since at least 1912 by Dr. J.L. Smith of the University of Edinburgh.³ Yet there's little consensus as to how to define CBL or how to incorporate it into instruction effectively.⁴ Most will state the goal of CBL is to prepare students for clinical practice using real clinical cases, but CBL also “links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods.”⁴ Students develop a higher-order cognition, along with clinical-reasoning, problem-solving, and decision-making skills that often result in more productive outcomes.⁵ Based on extensive research into how CBL has been used in medicine, key elements of CBL have been defined as:²

1. A clinical case
2. Some inquiry by the learner
3. Enough information presented for the learner to begin the clinical reasoning process
4. A faculty guiding the discussion and ensuring the objectives are met.

In addition, a “stated set of learning objectives with a measured outcome” are fundamental elements of modern CBL.² Some of the information necessary to solve the problem must be given prior to beginning a session, but some must be gleaned through student inquiry, otherwise the session would be another form of lecture.

CBL is a Preferred Teaching Methodology in Many Medical Schools

University of California, Los Angeles, and University of California, Davis, were instrumental in testing CBL teaching methodologies with medical students. In small groups, the CBL method included pre-reading and a faculty-guided clinical inquiry discussion. 89% of students and 84% of faculty favored CBL teaching methods citing fewer tangents, less busywork, and better practice of clinical application.⁶ CBL was considered more flexible and less labor-intensive than alternate teaching methods and allowed faculty to target specific learning objectives. Based on this experiment, both medical schools opted to switch to CBL as their preferred method of instruction. Since then CBL has spread in popularity to medical instruction across disciplines such as nursing, occupational therapy, allied health, child development, and dentistry.²



CBL Develops Higher-cognition Learning Skills

There have been numerous studies indicating that CBL is a stronger teaching methodology for developing analytical skills. One such study from a dental school in Turkey showed that students instructed through CBL scored significantly better on higher-order thinking skills such as the ability to evaluate, predict, generalize, create, reflect, or hypothesize than students who were instructed solely through lecture.⁷

“*Students instructed through CBL scored significantly better on higher-order thinking skills such as the ability to evaluate, predict, generalize, create, reflect, or hypothesize.*”⁷

In India, CBL was shown to significantly increase the absorption of knowledge in students of biochemistry. In addition, students were also more motivated to learn by this instruction saying they felt it was more interesting, provided more practice in applying logical thinking, and was more applicable to the work they eventually wanted to perform.⁸

A study of clinical anatomy students versus interdisciplinary students at a graduate school for health sciences in Missouri noted that the interdisciplinary students showed significant

improvements in their critical thinking after being exposed to more complex cases than the anatomy students. This improvement was measured using the Watson-Glaser Critical Thinking Appraisal, a test designed to assess an individual's ability to digest and understand situations and information.¹²

Another study looked at students who had completed a CBL course during their training. Students who had taken the CBL course had higher positive correlations in research competence, interdisciplinary thinking, and practical skills as well as the ability to work in teams and learn independently.⁹

In a study of New York University Langone Medical Center OB/GYN residents, an interactive CBL workshop on reproductive endocrinology and infertility covering four primary Council on Resident Education in Obstetrics and Gynecology (CREOG) objectives was held. Residents' scores on a multiple-choice test administered after the workshop were significantly higher than their scores on the same test taken before the workshop. Residents also self-reported increased confidence in the material after having participated in the workshop.¹⁵

Case-based Learning Improves Patient Outcomes

The ultimate measure of medical training is in patient outcomes, and there have been numerous studies attempting to measure the efficacy of CBL on patient health. One such study included 122 primary care physicians across 18 sites and attempted to evaluate the effect of CBL on the treatment of diabetic patients. Patients whose physicians' training included CBL had a significant decline in hemoglobin A1C measures and a decline in metformin prescriptions, suggesting a positive effect on patient outcomes for those physicians schooled using CBL.¹⁰ Other studies support this connection between CBL and improved results for patients. A study involving 4000 physicians in Portugal whose training included CBL showed improved reporting of adverse drug effects.¹ Another study on physicians trained via CBL showed more effective treatment of HIV patients.¹¹ These studies suggest that CBL can enable a greater understanding of patient needs and treatment and lead to improved patient outcomes.

Case-based Learning Complements Traditional Methods

Medical students exposed to CBL are typically more confident, both in the material and in their abilities to problem-solve than students who don't have CBL as part of their education.¹² Whereas traditional lectures are a useful method of disseminating knowledge, a chief strength of CBL is that it puts that knowledge into practice. In a CBL learning environment, students need to synthesize all the knowledge they've mastered and use it to treat patients.

In this setting, applied knowledge is akin to experience, insofar as it challenges students with realistic scenarios. In other words, CBL requires students to solve problems as they might in real life, albeit in a controlled, safe environment.

As medical students become more comfortable with CBL, they learn to trust themselves to think through complicated situations. They become familiar with the routine of tackling cases, and in doing so learn to ask patients questions to help them correctly interpret symptoms.

Because this learning focuses less on memorization, students also naturally begin to ask more questions in the classroom and comment on the specifics of certain situations, thereby facilitating more engaging classroom discussions. This has been referred to as a dynamic curriculum where students begin to develop a more collaborative, team approach to problem-solving.¹ They're able to do so precisely because CBL facilitates the type of realistic scenarios they're likely to encounter in clinical practice and reinforces creative, collaborative problem-solving skills.

Lecture material is often presented as clear, definitive and factual truth. This is effective when the objective of an examination is to test what students know. In this context, students either know the material, or they do not. CBL helps students move to the next level of learning in applying what they learn to more grey areas. This application of knowledge also helps students remember the material for longer periods of time and make real-world decisions.

Medical Students Engage with Cases like Few Other Pedagogical Approaches

Case-based learning is effective, in part, because students find it enjoyable.¹³ While it can be argued that enjoyment is not a requirement for effective learning, it cannot be denied that when students like the process it removes barriers to learning, improves motivation, and provide students with a more sustained long-term interest in the material.

Students enjoy CBL sessions because they're actively engaged with the material.¹ In CBL, not only is their participation welcome, it's fundamentally important – and therefore valued. Students have freedom to move through and discuss the material at hand while forming opinions and actively challenging one another.¹ Yet they are not expected to have all the answers, precisely because the answers are not necessarily presented as definitive.

“*Students enjoy CBL sessions because they're actively engaged with the material.*”¹

While there is a higher degree of autonomy for students in CBL sessions, they are supported throughout with structure and guidance provided by the instructor. In this way, they are free to explore the content at hand in a relatively low-risk environment. The result is one where students feel comfortable to take risks, engage with new and challenging ideas, and embrace the role of active participant not typically found in other educational approaches.⁴

Quality Educational Outcomes Depend on Quality Cases

As a pedagogical practice, CBL is a clear heavyweight in terms of optimal outcomes for medical students. However, the quality of those outcomes is only as good as the quality of the cases being used. The challenge of writing cases that feel authentic and incorporate the most current medical practices is a tall order. As a result, educators need to be selective in the material they choose for inclusion in their programs. Furthermore, cases should be relevant and level-appropriate to medical students in all disciplines.

Capturing the nuanced details of a case while balancing potential solutions and the capabilities of students is no small feat. Effective cases can be a challenge to develop. Some of the most effective cases weave important skills and themes throughout, including but not limited to:

- ▶ Basic science concepts
- ▶ Specialty medicine
- ▶ Professionalism and communication
- ▶ Ethical considerations and culture sensitivity
- ▶ Epidemiology and statistics
- ▶ Evidence-based medicine
- ▶ Patient safety and quality of treatment
- ▶ USMLE topics

One of the chief advantages of CBL is that it exposes students to real-life scenarios early in their programs. Students grow throughout the course of their studies, meaning relevant, appropriate cases are needed at every level to best engage students based on where they are in the curriculum. That is not to say cases should be watered down; however, case authors should understand the level of their audiences to best reach them. For example, preclinical and clinical students have different needs.

For faculty members considering writing their own cases, incorporating the above elements often requires many hours of work and preparation. Input from a variety of medical specialists—including cardiologists, neurologists, immunologists, anesthesiologists, oncologists, and more—is needed. Contributions from basic science instructors familiar with the level

“One of the chief advantages of CBL is that it exposes students to real-life scenarios early in their programs.”

of material being incorporated is also required. For those considering adopting pre-built cases, it's important to verify that all the factors described here are incorporated into those cases.

It is advisable that educators and those responsible for developing curriculum set clear expectations and prepare for how best to implement CBL in their respective programs.

Preparation is Key to Successful Implementation of CBL

Implementing case-based learning requires laying some groundwork first. Successful implementation requires some training for facilitators.² With CBL, instructors should provide guided discussions and have specific learning outcomes defined before the class. This is a crucial factor to CBL and affects the efficacy and adoption of instruction.²

For best results, faculty and administrators should create and share an implementation plan for CBL in their respective departments and have access to vetted cases with clearly stated learning outcomes. Proper time and funds should be set aside to train faculty in CBL, and students need to be prepared for what they will be expected to do during CBL sessions. CBL is a shift in paradigm from traditional medical lectures and requires proper implementation and training. When rolled out effectively, CBL helps students develop the clinical decision-making skills they need to succeed in medical school, on exams, and as doctors.

Click the links below for more information about and to request free institutional trials of digital case-based learning resources from McGraw Hill Medical.

- ▶ **AccessMedicine** includes 900+ interactive cases covering basic sciences and clinical medicine, with comprehension questions and rationale. **Request free trial.**
- ▶ The **Case Files® Collection** provides the complete collection of 1,100+ basic science, clinical medicine, and post-graduate-level cases from 23 Case Files® series books in an interactive format. **Request free trial.**
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