AAIM Perspectives

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Adapting Small-Group Medical Education by Fostering Early Clinical Integration: A Student Perspective

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INTRODUCTION

Collaboration and global communication have led to medical advancements at an astonishing rate in the 21st century. It is now time for medical education to follow, to evolve and adequately prepare today’s students for the new age of teamwork, patient-centered care, and rapidly progressing medical knowledge. Medical schools have sought to undertake this task through curricular changes that seek to build active collaboration and discussion in the context of case-based scenarios. 1 An increasingly popular curricular schematic in medical education is problem-based learning (PBL). 2 This teaching method utilizes small student groups to analyze patient cases and identify knowledge gaps, which are subsequently discussed among peers. Problem-based learning aims to foster communication, discussion, and promote active learning within small cohorts of medical students. 3-6 However, despite its attempt to serve as an innovative learning tool, PBL has remained largely unchanged from its inception at McMaster University Medical School in 1969. 5

Independently, evidence supports the premise that student collaboration and the use of clinical scenarios encourage active learning and curiosity within medical students. 7,8 Yet, meta-analyses of traditional preclinical PBL implementation provide incomplete results. These analyses suggest communication skills and teamwork benefit in a PBL curriculum, but found little to no differences in knowledge acquisition despite requiring 3 to 4 times more faculty contact hours compared with traditional lecture. 9,10 These increased time constraints may contribute to amplified perceived student stress as the curriculum continues. 11 Consequently, PBL has transformed into a time-intensive tool used to develop necessary professionalism skills but has not taken full advantage of increased faculty contact hours to expand medical knowledge. However, recent trends in medical education provide the leverage needed to develop PBL; students are still increasingly seeking alternatives to lecture-based learning, and a recent change to Step 1 pass-fail presents an opportunity to integrate broader clinical knowledge into the traditional “preclinical” years. 12-14

In this perspective, we utilize literature review and our own observations to briefly outline advantages and gaps of traditional PBL and then propose a clinically
enhanced PBL (CE-PBL). This format incorporates direct assessment of clinical reasoning by posing clinically based decisions at the conclusion of each session. Accurate decisions will require incorporation of underlying basic science principles taught by peers in the small-group setting. By moving knowledge assessment directly into PBL sessions in which accuracy is dependent on collaboration, rather than incorporated into future independent tests, students may become more motivated to research, discuss, and build on each other’s knowledge.15 Collaboration, the guiding principle of PBL, will become amplified as students are encouraged to solve clinical questions without the anxiety of memorizing details for Step 1. It is our hope that CE-PBL increases student knowledge acquisition by broadening learning goals and by providing a worthwhile interactive alternative to lecture-based learning. Just as PBL was meant to serve as an innovation of medical education in the 1960s, it is time to confront conventional methods once again and tailor our approach to the modern student.

STRENGTHS AND LIMITATIONS OF TRADITIONAL PBL

Traditional PBL, for the purposes of this perspective, is defined congruently with the cited literature.3,5,16,17 In traditional PBL, students start by collectively reading though an adapted clinical case and identify learning gaps along the way. Students discuss points of confusion (ie, learning objectives [LOs]) and independently study a particular basic science LO after the PBL session. Upon return, each student gives a presentation of their LO to provide clarity on the clinical case. Summative assessment of collaboration and professionalism is completed by the facilitator throughout the case. Summative evaluation of medical knowledge acquisition varies among schools from multiple choice examinations to essay questions to simulations. However, the common theme in traditional PBL is that knowledge testing comes after the conclusion of a clinical case, semester, or educational block.18

The benefits of traditional PBL rely on its ability to improve professional communication within a team environment.3,5,10,19 Aligning with traditional PBL described in the literature, our medical school’s PBL involves students who develop basic science LOs, which then become the subject of a student’s formative and summative assessment. This involves a threefold process of building communication and presentation skills: 1) The cohort must work as a unit to interpret a clinical scenario; 2) students communicate questions and allow facilitated discussion to clarify any points of confusion; and 3) students are required on a regular basis to give a structured presentation on each assigned LO. There is a development of mutual respect and understanding within the cohort; if disagreements arise, students work amicably in the professional setting and through feedback to resolve those disagreements. This ability to collaborate, settle disputes, and confidently present a medical topic will help students become more competent members of the health care team.10

A key limitation of traditional PBL curricula stems from its time-intensive nature. Paradoxically, increased contact hours are not accompanied by substantive differences in medical knowledge gained compared with lecture-based education.9,10,20,21 This combination of greater time commitment and confined knowledge acquisition poses a high opportunity cost for medical students.20,21 In traditional PBL, the resource-intensive nature of PBL may be compounded by social group dynamics that could further impact learning. For example, because summative knowledge assessments are conducted beyond the conclusion of PBL sessions, members may be conflicted on balancing extrinsic motivation toward group contributions and intrinsic drives for focusing on testable content.22 A lack of extrinsic motivation may lead to decreased group member performance and reserved effort toward collective discussion, effectively attenuating the purpose of PBL and reducing knowledge acquisition.22 Although traditional PBL is rooted in principles of building collaboration, increased contact hours and a lack of extrinsic motivation pose challenges that must be addressed.

A NEW PROPOSAL: STUDENT-DETERMINED OUTCOMES

In the new format, CE-PBL will begin its case discussion in a similar manner as the traditional PBL organization: a cohort of 6 to 8 students accompanied by a trained facilitator will analyze a clinical scenario and determine knowledge gaps within the case. The case
mirrors a patient scenario that students are likely to see during the clinical years of medical education, but the disease and presentation are novel to their current studies. Identified knowledge gaps can be any aspect of the case that a student is unfamiliar with and would like to possibly research further. Throughout the session, these gaps are transformed into formal, individual LOs that address a novel basic science concept. Learning objectives typically involve concepts such as physiology, anatomy, pharmacology, or pathophysiology. They serve as topics individual students must evaluate to gain a full understanding of the clinical scenario. To this point, CE-PBL aligns with traditional PBL. The most impactful alteration of CE-PBL comes at the conclusion of session day 1.

After collectively determining basic science LOs that adequately address the patient scenario, the group will be presented with at least 1 open-ended decision that evaluates the next step in a patient’s management. This question will be answered during session day 2. The accuracy of the team’s choice will have an impact on each student’s graded summative assessment for the course. Teams should be able to answer the clinical question correctly if each student thoughtfully researches their assigned basic science LO because each objective is vital for clarifying the underlying disease process. On day 2, students will teach the group their respective LOs and synthesize all of the presented information. After discussing all the of LOs, students will converse and deliberate on what they believe would be an appropriate answer to the clinically based question, while providing their rationale to the facilitator. After a hypothesized answer with appropriate reasoning is reached, the facilitator will present multiple-choice answers for the given question from which the group may choose from. If the group correctly selects the answer, they will receive 100% credit and move to the next portion of the case. If the group chooses incorrectly, they will reconvene and select answers until they are correct, losing a certain percentage of points with each wrong decision. A general framework of CE-PBL day 1 and 2 is provided in Figure 1.

By implementing summative clinical assessments within the case session, students are motivated to not only pay attention to their classmates, but encourages the student teaching the LO to be thoroughly versed in the topic. The ability of members to clearly convey a subject is vital for the group to be able to come to an accurate decision. Thus, students not only develop the skills of professionalism and collaboration but also develop a deeper understanding of both the basic sciences and clinical medicine. Clinically enhanced
Figure 2 Case-based example of clinically enhanced problem-based learning. This outline gives a scenario where heart failure is presented to students. The group must research independently and then collaborate to determine the disease etiology and hypothesize clinical decisions.

CE-PBL Session Day 1

Students receive a case presenting a patient with features novel to their education. They read through the case and discuss what information they would like to know next, which is gradually given by the facilitator:

- The 65-year-old male patient presents with a 2-week history of difficulty breathing, fatigue, and ankle swelling. He is a 20-pack-year smoker and has a history of an MI 4 years ago.
- Medications are labetalol and daily aspirin
- Pulse is 110/min and regular, respirations are 22/min and labored, BP is 136/78
- PE: Jugular venous pulsations 6 cm above the sternal angle, crackles are heard bilaterally at the lung bases as well as dullness to percussion, an S3 gallop, laterally displaced apical PMI, and pedal edema

Students develop LO’s necessary to understanding the disease process (i.e. basic sciences and clinical evaluation) which are vital to answering questions presented at the end of the session. Example LO’s could include, but are not limited to:

- Explain the etiology of this constellation of symptoms including pathogenesis
- Describe a proper cardiopulmonary physical exam
- Depict the significance of certain heart murmurs
- Define the indications, contraindications, AE, and mechanism for our patient’s medication
- Outline the next steps in diagnosis

The facilitator reveals open-ended questions to be answered next session. Such questions can include, but are not limited to: (basic science concept presented below, which is not given to the students)

- 1. Further imaging evaluation of this patient is most likely to show what?
  - Students must know pathogenesis of pulmonary edema in HF
  - Students must know the relevant imaging modalities for diagnosis HF
- 2. Which labs would be relevant to order for this patient?
  - Students must understand how HF affects electrolytes in addition to knowing the significance of BNP, creatinine
- 3. Which additional medications are most likely to be of benefit for the patient, including doses?
  - Students must comprehend MOA, indications, and potential interactions of HF drugs

These clinically-based questions require the students to first have a grasp on the basic sciences described in the LO’s. By the next session, students will research their assigned LO’s and reconvene on day 2.

CE-PBL Session Day 2

Students teach peers their assigned LO. Synthesizing presented information is crucial for making an educated decision.

After discussions, the team concludes on their proposed answer to the open-ended questions given in day 1. They explain their reasoning for the hypothesis to the facilitator.

The facilitator reveals the multiple answer choices. For example, our hypothetical group correctly determines the patient has HF, and their research shows that patients will have signs of pulmonary edema and an enlarged left ventricle on imaging. The answer choices given for question 1 (Further imaging evaluation of this patient is most likely to show what?) are:

- CXR with unilateral nodules
- CXR demonstrating bilateral pleural effusions
- Echocardiogram shows RV enlargement with normal sized LV
- Echocardiogram revealing normal LV motion

If the team chooses correctly on the first attempt, 100% credit is awarded. Subsequent answers cause the total possible points achieved to be 75%, 50%, etc. After selecting the correct answers, the clinical case continues with the clinical information elicited from the questions.

- In this scenario, on day 2 the students receive a CXR interpretation, relevant labs, and the medications administered to the patient.
- The clinical vignette moves forward to present new information from which students extract LO’s and relevant clinically-based questions are asked again. This process will continue for the duration of the desired session length.
problem-based learning is not a complete overhaul of the traditional PBL model. Rather, CE-PBL presents a feasible change programs may be able to make to their current curriculum.

A brief overview of a possible clinical case is presented in Figure 2. This example is not meant to be exhaustive, but is meant to serve as a guide for how a typical CE-PBL case may unfold and can be applied to almost any defined disease process. Cystic fibrosis provides another instance where foundational sciences must be gathered prior to fully understanding the pathophysiology and clinical management. The CE-PBL process will remain consistent across all organ systems and disease etiologies; students must have a firm grasp on the basic sciences to make a clinical decision. Clinically enhanced problem-based learning goes beyond traditional PBL to not only build clinical knowledge early in medical education, but also increase discussion and interaction among peers.

Largely unchanged from the late 1960s, PBL now requires renewed tenets that focus on students having greater impact on clinical scenarios, less rigid information presentation methods, and a broader focus on clinical learning in addition to mastering the basic sciences. Our new CE-PBL proposal builds on the traditional model by increasing motivation for correctly interpreting clinical scenarios and synthesizing information.

Rationale for Change

As previously outlined, traditional PBL can be a valuable pedagogy for developing professionalism and collaboration. However, a student’s time in medical school is finite. Evidence demonstrates students enjoy participating in PBL and have more favorable perceptions of their educational experience, but may prefer lectures for deeper content learning.23 The increased contact hours and positive perceptions of PBL present a compelling opportunity to evolve this tool into a cornerstone of learning medical knowledge.

Participation is a central tenant of PBL and is essential for gaining positive outcomes. Unfavorable social group dynamics in traditional PBL can negatively impact meaningful discussion and collaboration.3,16,24 Intrinsic self-interests, such as future test grades, are a more powerful motivator than the extrinsic group contributions.22 Clinically enhanced problem-based learning addresses these concerns by effectively eliminating intrinsic motivators and instead brings summative assessment within the context of group performance. In CE-PBL, each member must contribute toward the ultimate goal of formulating an accurate clinical decision and cannot rely on a future independent summative examination to achieve a desirable grade. In the study of group dynamics, this assessment strategy is referred to as an additive task—each group member’s input is essential to achieving a common goal.22 This type of assessment strategy is regarded as an advantageous way to collectively increase member participation.22,25

As such, CE-PBL may strengthen discussion and enhance the interactive nature of traditional PBL.

Patient-based, clinical education is a theme that can be feasibly bolstered within PBL. In its new format, CE-PBL implements clinical decision-making as a summative assessment within the case sessions. The recent paradigm shift of transforming Step 1 of the United States Medical Licensing Examination from a 3-digit score to pass-fail reinforces the concept that clinical education may be emphasized earlier in education. A previous overemphasis on a 3-digit score restricted medical knowledge to what appears on exams and diverted medical students from establishing other critical competencies.14 In our proposal, we build on this change by increasing student motivation for exploration beyond the basic sciences while still emphasizing these concepts at the core; students should grasp fundamental medical knowledge before they are able to synthesize and apply basic science for a clinical decision. The greater contact hours required for PBL will not change in CE-PBL. Rather, by introducing a novel application for basic science concepts, higher-order critical thinking becomes encouraged and knowledge acquisition may increase.26

Despite this evolution, the primary goal of traditional PBL persists with CE-PBL. Clinically enhanced problem-based learning is not meant to mold professional, collaborative, and competent physicians in a way that didactic seminars or lectures would not be able to achieve. Here, we not only keep these tenets alive, but bring them to the forefront. Students will be more curious and motivated to broaden their clinical perspectives and consequently have more impactful discussions. Students will quickly develop the ability to not only learn the material, but also gain the aptitude to educate their peers and apply the knowledge they learn. By transferring summative knowledge assessment to within the PBL sessions and expanding clinical education, CE-PBL affords an opportunity to modify a pedagogical approach that has been largely untouched for the last half-century.

Limitations and Future Directions

Clinically enhanced problem-based learning is not free from anticipated limitations. Because the CE-PBL format relies more heavily on clinical reasoning, there may be a greater need for physician or doctoral content experts to co-facilitate; the need for increased contact hours poses its own challenges10 and medical schools may struggle to recruit busy clinical faculty for a comparatively large time commitment. Additionally, some other limitations from traditional PBL, such as unfriendliness within groups or non-contributory members, may carry over to CE-PBL.
Our intention is that this overview will stimulate discussion between faculty members to find ways for early integration of clinical reasoning in medical education. The practice of medicine has been rapidly advancing, and it is now time to shift the educational paradigm along with it. In the future, we hope to grow this concept further by creating experimental curricula and developing the details. This idea was born out of necessity to meet the needs of advancing trends in medical education, enhance clinical reasoning, and provide an efficacious alternative to lectures. Just as traditional medical education, PBL was constructed out of a need to oppose educational complacency, we must now too evolve and recognize a need for change.

References