


A 10-Step Process to Align Problem-Based Learning With Accreditation Expectations for Self-Directed and Lifelong Learning

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Ghaith Al-Eyd¹ , Tsugio Seki² and Daniel P Griffin¹

¹Department of Medical Education, Dr Kiran C Patel College of Allopathic Medicine, Nova Southeastern University, Fort Lauderdale, FL, USA. ²Department of Medical Education, School of Medicine, California University of Science and Medicine, Colton, CA, USA.

ABSTRACT

OBJECTIVE: Self-directed and lifelong learning (SDLL) skills are essential skillsets in both undergraduate and graduate medical education (UME and GME). Hence, medical schools' accreditation bodies emphasize the requirements to acquire these skills in their accreditation standards. For example, in the United States, the Liaison Committee on Medical Education (LCME) clearly defines the components of the SDLL process in Element 6.3 of Accreditation Standard Six. Among the active learning pedagogies, problem-based learning (PBL) provides ample learning opportunities where SDLL skills are effectively applied. The aim of this article is to streamline the process of developing, delivering, and evaluating PBL sessions in line with the SDLL accreditation requirements through a 10-step design and implementation process.

METHODS: Our 10-step process, detailed in the article, starts with developing learning objectives that inform the content of the PBL case and the required embedded learning triggers. The process carefully addresses the components of the SDLL process and other aspects of the accreditation needs within the framework of PBL. The approach to implementation, feedback, assessment, and evaluation is explicitly described to meet the regulatory expectations.

DISCUSSION: In addition to the essential role in UME and GME, SDLL skills are vital requisites for continuing medical education of all physicians. Instilling this skillset early in medical students helps to cultivate their ability to apply these skills in their future professional roles. Using accreditation standards as a foundation for creating learning experiences, for example, PBL, requires careful content development and sequencing. Such a process needs explicit standardized steps that should not only be feasible, but also transferable for usage by different medical schools.

CONCLUSION: Our streamlined 10-step process of designing and delivering an SDLL-oriented PBL experience can easily be adopted by other medical schools to address the SDLL skills acquisition as well as meeting the accreditation requirements.

KEYWORDS: Problem-based learning, self-directed learning, accreditation, lifelong learning, learning strategies

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CORRESPONDING AUTHOR: Ghaith Al-Eyd, Department of Medical Education, Dr Kiran C Patel College of Allopathic Medicine, Nova Southeastern University, 3200 South University Drive, Fort Lauderdale, FL 33328-2018, USA. Email: galeyd@nova.edu

Introduction/background

The evolving needs in medical education as well as the accreditation regulations have made it vital for medical schools to develop learning experiences that help acquire skills of self-directed and lifelong learning (SDLL).¹ Knowles described the SDLL as “a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.”² Similarly, the Liaison Committee on Medical Education (LCME), the accrediting body of medical education programs leading to the doctor of medicine (MD) degree in the United States, explicitly requires MD programs to include 4 components of the SDLL process in MD curricula. In Element 6.3 of the LCME Standards, the LCME requires the medical schools to list the courses in which the students

are engaged in the 4-component SDLL process in a unified sequence. The 4 SDLL components in the LCME Data Collection Instrument (DCI) for Full Accreditation Surveys in the academic year 2022 to 2023 are “1—Self-assessment of their learning needs; 2—Independent identification, analysis, and synthesis of relevant information; 3—Independent and facilitator appraisal of the credibility of information sources; and 4—Assessed on and receive feedback on their information-seeking skills.”³

The medical education needs and the accreditation requirements focusing on the SDLL arise from the fact that SDLL skills are essential to enhance physicians' ability to become lifelong learners. The SDLL skill acquisition process needs to start as early as possible in medical curricula and should be implemented regularly and repeatedly for progressive skill cultivation throughout undergraduate medical education (UME) and graduate medical education (GME). In UME, the



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development of SDLL skills needs to be started in the pre-clerkship phase to prepare learners for the clerkship phase and then residency. To provide opportunities to learn and hone translatable skills, the pre-clerkship curricula must provide multiple opportunities to address the 4 SDLL components in a short period of time and frame them as they would be experienced in the clinical setting. Moreover, the SDLL skills are vital for all practicing physicians to update and maintain their medical knowledge and skills required to cope with the emerging scientific and medical advances throughout their careers.

Among all active learning pedagogies, problem-based learning (PBL) provides a comprehensive learning experience where students are engaged in activities that address and incorporate the integral elements of the SDLL process.^{4,5}

The instructional methodology that led to the development of PBL originated at McMaster University, Toronto, Canada.⁶ Many other universities adapted the original McMaster PBL methodology to fit their curricular and regulatory needs. Maastricht's 7-jump process is an example of how the PBL methodology is streamlined into 7 steps to facilitate self-directed learning and meet the needs of the curriculum.⁷ With the evolving needs of medical education, especially those related to accreditation requirements, core education methods, including PBL, undergo parallel reviews and adjustments.

Although PBL provides many opportunities to be modified to suit the needs of and be integrated into an institution's curriculum, at its core, PBL has a few key elements.⁸ It starts with a problem or problem scenario, which in medical education, is most often a clinical case where a patient presents with a clinically relevant problem. A given case will often take multiple days/sessions to complete. During the sessions, students pace themselves through the case to manage the amount of information they process at a time while effectively addressing the key PBL steps. This can be done through facilitated sequential case information disclosure where a faculty facilitator assists with pacing the group. As students review information in the clinical case, they identify the pertinent information, that is, learning triggers. As they critically analyze the information presented, they ask questions that are relevant to their learning needs, and then they develop hypotheses accordingly. The hypotheses often are in the form of a broad differential diagnosis that they scrutinize as they progress through the case. Once they have completed a given day, they review their questions and create learning objectives that they self-research and study to gain expertise for presenting the information to other members of the group in a subsequent session.

PBL provides unique opportunities for students to self-directed problem solving where there is no one correct solution, and students can learn not only content but also skills that contribute to their lifelong learning.^{8,9} With the intentional development of an SDLL-oriented PBL experience, a medical school can capitalize on the PBL process to meet the

expectations and requirements of the LCME Element 6.3: Self-Directed and Lifelong Learning.³ Students engage in "1—Self-assessment of their learning needs" and "2—Independent identification, analysis, and synthesis of relevant information" as part of the standard PBL process. While introducing student self-reflection on 1 and 2; and engaging faculty facilitators for a timely evaluation of student performance in these areas, which includes direct feedback in a narrative and/or written format, an institution can achieve "3—Independent and facilitator appraisal of the credibility of information sources" and "4—Assessed on and receive feedback on their information-seeking skills."

The self-directed learning design of the PBL also enhances student evidence-based critical judgment and problem-solving skills that are addressed in LCME Element 7.4.³ These skills together with the SDLL skills will overarchingly enable the students to recognize opportunities for student-driven reflection and discussion on psychosocial aspects and societal problems (LCME Element 7.5).³ These skills and content areas can be included in the case objectives allowing for their formal assessment.

Here we describe a 10-step process to streamline the process of developing, delivering, assessing, and evaluating PBL sessions in line with the LCME accreditation requirements of Element 6.3. Our curriculum development was guided by best practices and other related institutional and programmatic accreditation standards. The described PBL methodology is designed to fit similar integrated hybrid medical school curricula beside other teaching/learning methods.

Methods

The SDLL-oriented PBL experience is developed based on the following 10 sequential steps (also outlined in Figure 1):

1. Case objectives: Through a backward design, start by writing the case learning objectives that address topics related to the weekly curricular theme(s). The case topics and learning objectives should address the relevant knowledge, skills, and values included in the learning objectives of the ongoing system-based courses and those of the parallel longitudinal courses, as appropriate. The cases may include content that are new to the students, and they do not need to revisit topics already addressed in other learning events of the week.

For a more holistic approach to the different aspects of the case topics, include a case objective that addresses elements from the psychosocial and societal aspects of medicine, e.g., social determinants of health, and cultural competence. Making this a standard for every case promotes student consideration and reflection of psychosocial considerations and implications in their encounters.

2. The case: By recognizing the case learning objectives, develop a clinical problem scenario that gradually

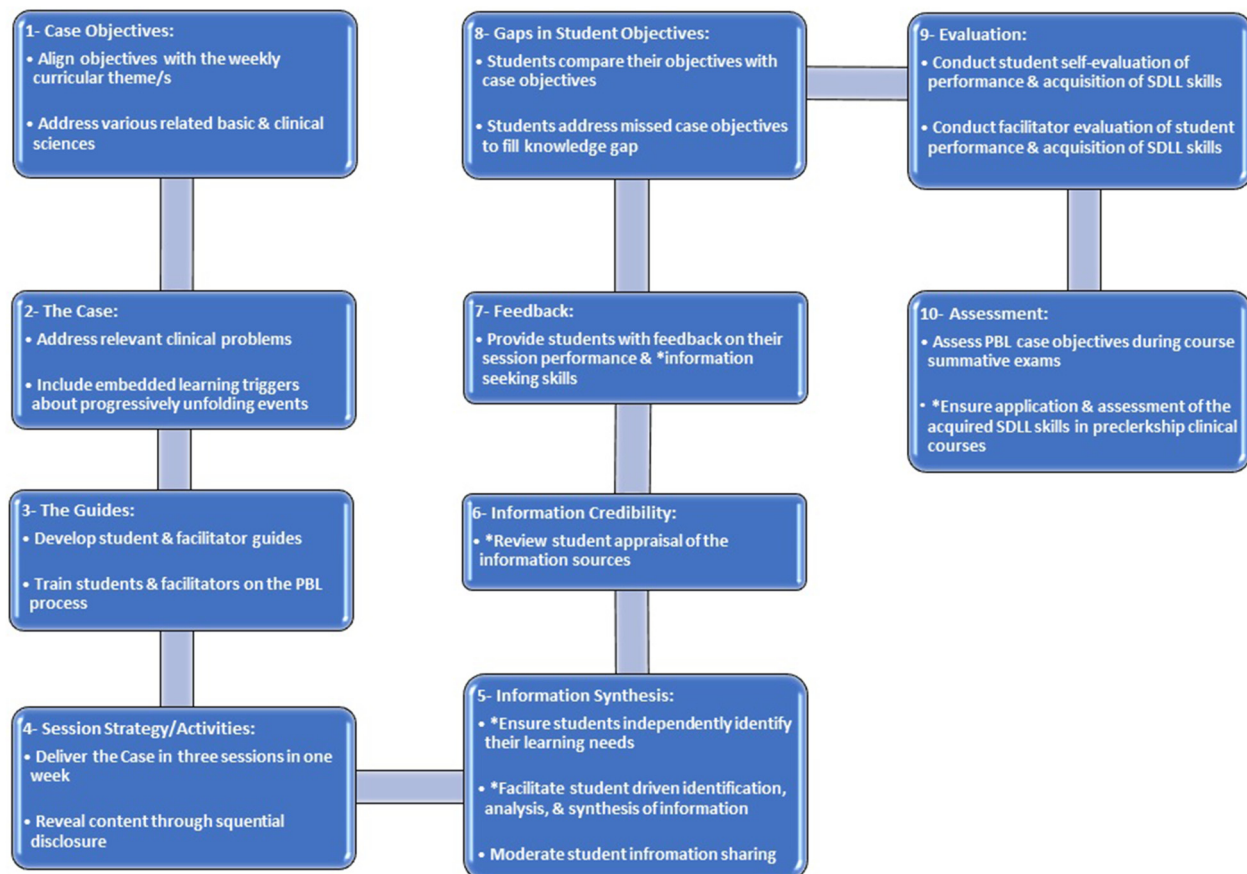


Figure 1. The 10-step process of developing an SDLL-oriented PBL experience. The illustrated process aligns PBL development steps with the SDLL components and their sequence as described in LCME Element 6.3 *Directly addresses the LCME requirements on SDLL. Abbreviations: SDLL, self-directed and lifelong learning; PBL, problem-based learning; LCME, Liaison Committee on Medical Education.

unfolds and introduces the learners to the case findings through a blend of embedded learning triggers. These triggers are carefully developed and sequentially embedded in the scenario to stimulate students' curiosity and enhance their independent identification of relevant learning needs. These triggers can be included creatively, and can take many forms including, but not limited to dialogue between characters in the case and in the patient history.

- The guides: By recognizing that PBL is a student-centered type of learning, develop student and facilitator guides that outline the PBL process and describe how to effectively perform the roles of self-directed learners and faculty facilitators. Training the students on PBL, including guiding them on how to write measurable learning objectives, can be effective for standardizing the process to identify and meet their learning needs. Since not all facilitators are content experts, a detailed case guide that includes the case objectives, scenario, and prompt questions and answers is also provided. In the facilitator guide, the case scenario is divided into sections with all embedded learning triggers highlighted and correlated to their relevant

learning need items. To provide optimum guidance to the facilitators, a training and orientation session is organized for all new facilitators (introductory session) and existing facilitators (maintenance session).

- Session strategy/activities: Once all facilitators and students are trained and oriented, schedule the delivery of 3 small group sessions (6-8 students; 2 hours each) within one week of the course. The facilitators need to review the case prior to the session delivery. While delivering these sessions, ensure that the case contents are progressively revealed through sequential delivery during the 3 sessions.
- Information Synthesis: One of the critical aspects of the PBL process is to prompt students to self-assess their learning needs while navigating the case, and eventually formulate those needs into learning objectives. This independent identification of learning needs is followed by analysis and synthesis of relevant information to answer the questions of the formulated learning objectives. Facilitators need to continuously recognize this critical aspect and ensure that the group discussion is steered toward that direction. Students are required to share their acquired knowledge through group

presentations scheduled during the second and third PBL sessions.

6. **Information credibility:** As part of the students' presentations to the group (see Step 5), they are required to list all references/resources used and independently appraise their credibility. This should be done in a narrative format included as part of their presentation. The appraisal of the references/resources should include, but not be limited to, why they selected them, how they performed their search, how they determined their credibility, potential limitations of the information they used, and challenges they faced. Facilitators also need to appraise the credibility of the references/resources. Having students submit their presentations prior to the PBL session can provide valuable time for facilitators to review and plan for their feedback to the students in this regard.
7. **Feedback:** Facilitators are to provide the students with real-time feedback on their performance as members of the PBL team and their information-seeking skills (including areas from Steps 5 and 6). Feedback on information-seeking skills is ideally done immediately following the student's presentation and can include feedback from other members of the group. General feedback on overall performance should be given at the end of every session. This can be done by reserving a set amount of time at the end of every session for student self-reflection, student-to-student feedback, and student-to-team feedback on performance. After students provide feedback, then facilitators can add their own feedback.

Facilitators can ensure that all students receive feedback over time, but random selection at the start of each session is important so that all students perform their required tasks, so each is ready to present and receive feedback every session.

8. **Gaps in Student Objectives:** At the conclusion of a case, require the students to compare their list of learning objectives to the faculty-developed ones to address any missed case objectives. This should be sequenced at the end of the PBL case when the students have already completed their independent identification and analysis of their learning needs and synthesized the relevant information. To streamline this task, a rubric is provided to the students (Supplemental Appendix 1) to allow them to judge how extensively they covered the faculty-developed objectives. This rubric helps the students to identify parts of the faculty-developed objective they missed and those of their own that were not covered in the faculty-developed objectives.

When completing the rubric, students should reflect on their performance identifying pertinent information in the case, the

questions that they raised during the case sessions, and the ultimate decisions on their learning objectives. This can provide valuable evidence of how groups and individuals can improve their performance. Members of a group will be responsible for submitting to the facilitator a document covering the missed case objectives in preparation for course assessments.

Facilitators can use this process to reinforce that students' objectives created beyond the faculty developed case objectives are still of great importance and value. It is most likely that students will create more objectives than those developed by the faculty. While these additional objectives may not be assessed for the case, they are still valuable in the students learning and honing of their SDLL skills. Collective information from all group rubrics will also be used by faculty to guide the review and revision of the case for future iterations.

9. **Evaluation:** Plan a formal one-on-one evaluation of student acquisition of SDLL skills and their overall performance at the middle (formative) and end (formative/summative as appropriate) of the course of time dedicated to PBL. Prior to these evaluation meetings, the student completes the student part of an evaluation rubric (Supplemental Appendix 2) as a self-reflection on their own performance. The facilitator completes the faculty part of this evaluation rubric for each student as well. At the start of the one-on-one meeting, the student presents their self-reflection followed by the facilitator providing additional comments from their feedback as appropriate. The one-on-one meeting at the mid-course should end with an action plan to address any need for improvement in student performance over the second half of the course to satisfy the LCME Element 9.7 (Formative Assessment and Feedback) requirement.³ The end-of-course one-on-one meeting should review how the student responded to the mid-course feedback.
10. **Assessment:** Assess medical knowledge addressed in the PBL case learning objectives as part of course summative exams, following institution-approved methods of assessment, such as NBME style questions or essay/short answer questions. Once students have had time to develop SDLL skills, these skills can be further applied and assessed through simulated patient encounters and/or simulation exercises in the pre-clerkship curriculum. This provides opportunities for narrative assessment of SDLL skills in clinical situations that simulate real clinical scenarios and ensures students are prepared to apply skills of SDLL, critical thinking, and problem-solving they developed in upcoming clerkships and eventually residency.

Generalizability

Developing and delivering PBL sessions in the described 10 sequential steps enhance the acquisition of SDLL skills and contribute toward fulfilling LCME Element 6.3 requirements.

This 10-step process of a tailored PBL redesign can easily be adopted by other medical schools to create PBL experiences that address not only all aspects of the SDLL process, but also other LCME requirements: critical judgment and problem-solving skills (LCME Element 7.4); and as appropriate, psychosocial aspects and societal problems (LCME Element 7.5).

Discussion

The overarching goal of emphasizing SDLL skills in medical curricula is to enhance physicians' ability to continue acquiring new and updated medical knowledge and skills over time after they graduate from medical school.

Literature has documented a progressive decline in physicians' knowledge and clinical performance over time after graduation. This decline is attributed to inefficiency in acquiring new or updated information rather than due to time gap-related difficulty in recalling previously acquired knowledge.¹⁰ This is powerful evidence that opportunities to hone SDLL skills need to be available throughout a physician's training and professional career in Continuing Medical Education (CME). There is continual rapid evolution of resources and methods used to acquire new information and practicing physicians need to stay current with utilizing them. In addition, they must be able to competently evaluate the quality, credibility, and reliability of these information sources. To address this vital issue in physician performance over time, it is essential to instill and cultivate SDLL skills in medical students, which can act as a driver for future utilization of CME to stay proficient and current. Thus, pedagogies like PBL, which hone SDLL skills, are very effective in cultivating this important skillset of physicians when they are introduced early and continuously reinforced throughout the medical education continuum (UME and GME).

The learning process in PBL is student-centered where students take responsibility for their own learning; and independently identify their learning needs, as well as the related credible information resources while they critically think to solve a problem.¹¹ Studies have shown persuasive evidence that PBL provides benefits to student learning and recall in medical school courses¹²⁻¹⁴ and improved performance on Step 1 and Step 2 United States Medical Licensing Examinations (USMLE)¹⁵ over more traditional methods such as lectures. A systematic review of PBL methodology by Trullàs et al,¹³ found that, in addition to the majority of studies showing improvements in academic performance and knowledge retention, PBL has also enhanced non-medical knowledge outcomes such as communication and self-learning skills.¹³

There is compelling evidence that, when students have had enough SDLL opportunities through PBL, they find their learning to be meaningful and satisfying.¹³ A perspective commentary by Chang,¹⁶ a medical student at Harvard, also

highlights that the practice of using scholarly searches to obtain information is an effective way to build lifelong learning skills.

Creating a PBL experience that provides ample SDLL opportunities to address both curricular and student learning needs, requires a deliberate design guided by a streamlined process to meet the accreditation requirements. Such a process can explicitly elucidate the steps of creating and implementing a successful PBL experience while minimizing potential compliance issues with accreditation standards. Using the accreditation standards as tools to guide relevant curriculum content development and delivery is one of the effective approaches to address potential compliance challenges as discussed below.

The timing of revealing faculty-developed learning objectives to the students has been an ongoing challenge in the PBL process when it is used as an example of SDLL experiences based on LCME Element 6.3 guidelines. In our process, we sequenced that step at the end of the PBL sessions to avoid any interference with the required independent student assessment of their learning needs. If the students find some gaps in knowledge, after they compare their list of learning objectives with that of the faculty, they are required to submit a supplemental document that addresses those identified gaps.

Another challenge that may emerge while implementing the PBL process in line with Element 6.3, is the appraisal of student information-seeking skills as well as the credibility of the sources used. Requiring that both students and faculty critically evaluate the information sources used, is a key step in the SDLL process.^{3,5} In addition, the faculty also appraise the student's skills in searching for and collecting the required information. These LCME SDLL requirements were specifically addressed in the redesigned PBL process described here. It is an important addition to the traditional PBL process to require an appraisal of the credibility of information sources during the student presentations as they share and address the answers to their learning needs questions (student learning objectives). Faculty appraisal of the information resources as well as their evaluation of students' information-seeking skills, using a dedicated rubric (Supplemental Appendix 2), is another important SDLL requirement added to the PBL process.

A key element in the SDLL process in LCME Element 6.3 is the self-assessment of learning needs. This critical facet can be pursued in multiple ways in the PBL process presented here. The act of student small group members working together to ask questions throughout the sessions, followed by the formation of student-generated learning objectives by consensus, provides students with important early experience toward asking critical thinking questions. These questions are ultimately framed in a learning objective format at the appropriate levels of thinking for students' current stage of education and session learning expectations (eg, by using Bloom's

Taxonomy).¹⁷ When a student is responsible for presenting a learning objective created by group consensus, the student presenter can be charged with asking their own case-relevant question(s) based on their research to address the group consensus objective. The student can present their question(s) and answer(s) (as feasible) along with a description of their “independent identification, analysis, and synthesis of relevant information” used to answer their question(s). This can take the form of questions related to foundational or clinical science, patient care, psychosocial topics, societal problems, etc.

These adjustments to the traditional PBL process would further align the PBL applicability as a major pedagogy that enhances the acquisition of SDLL skills in line with LCME Element 6.3. Students are also provided with the opportunity to self-evaluate their information-seeking skills as well as their overall PBL experience using a rubric. Results of the faculty appraisals and student self-evaluations can be considered for formative assessment of the PBL experiences, while the learned knowledge, based on the session learning objectives, is assessed as part of the course summative assessments.

Conclusion

Our 10-step process of designing and delivering a PBL experience that effectively addresses the SDLL components of LCME Element 6.3, can easily be adopted to fit other medical schools’ curricular and accreditation needs. In addition, the described method allows for an effective curricular design that enhances the coverage of the curricular content addressed in LCME Elements 7.4 and 7.5. The described PBL design enhances the acquisition of SDLL skills that are ultimately invaluable for physicians who need to keep up with the advancement of medicine throughout their careers.

Ethical Approval

Nova Southeastern University Institutional Review Board identified that this report does not require IRB review. The report does not contain any primary or secondary data derived from identifiable private information or from intervention or interaction with human beings as part of a research study.


Author Contributors

Ghaith Al-Eyd: method design, tools development, and manuscript writing. Tsugio Seki: method design and manuscript writing. Daniel P. Griffin: method design, tools development, and manuscript writing.

Author’s Note

Daniel P Griffin is currently affiliated with Department of Medical Education, School of Medicine, The University of Texas at Tyler, Tyler, TX, USA.

ORCID iD

Ghaith Al-Eyd  <https://orcid.org/0000-0003-1227-7368>

Supplemental Material

Supplemental material for this article is available online.

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