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PBL Methodology Applied in Multidisciplinary Projects of Biomedical Engineering

Diogo José Horst[1,2,*], Ederson Cichaczewski[2]

[1]Federal University of São Paulo – UNIFESP, Department of Chemical Engineering, Institute of Environmental, Chemical and Pharmaceuticals, Diadema - SP, Brazil.
[2]International University Center - UNINTER, Polytechnical School, Curitiba - PR, Brazil

***Corresponding author:** Dr. Diogo Jose Horst, Federal University of São Paulo – UNIFESP, Department of Chemical Engineering, Institute of Environmental, Chemical and Pharmaceuticals, Diadema - SP, Brazil. Tel: +5547984492623, E-mail:diogohorst@gmail.com

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Abstract

PBL is a powerful tool for enhancing learning because it encourages students to address real-world issues via a self-discovery process. In this paper, we give some principles for generating successful PBL tasks. Showing how PBL standards might be applied in problem generation, implementation and assessment in multidisciplinary projects.

Keywords: Problem Based Learning, Teaching Strategies, Education, Biomedical Engineering

Introduction

Project-Based Learning (PBL) is a typical student-centered learning technique that has been utilized in engineering education to develop professional skills and to promote student involvement with design. In this strategy, students work in groups to apply their knowledge to a real-world, open-ended challenge, emulating the professional engineering experience [1].

In biomedical engineering education, PBL has demonstrated to be successful in motivating student learning, boosting knowledge retention, and fostering problem-solving, communication, and their collaborative abilities. However, genuine hurdles in successful implementation continue to limit the PBL adoption.

By involving students in the process of developing breakthrough medical therapies and equipment that meet clinical needs, PBL allows biomedical engineering teachers to combine fundamental engineering concepts into the context of disease.

PBL is founded on the idea that knowledge is best grasped and maintained when it is delivered in a real-world setting. The problem is presented first in PBL, and then it serves as motivation for studying the information topic. Students learn how to determine what they need to know to solve the problem, therefore the approach is fundamentally student-centered. The professor acts as a facilitator or guide, assisting students in identifying what they know and don't know, determining their preferred learning style and speed, and critically evaluating knowledge sources. The learner gains subject-matter knowledge and develops critical problem-solving abilities through the PBL process [2].

Methods

To develop crucial problem-solving abilities researchers have used a challenge-based educational technology-based derivative of PBL called the Star Legacy Cycle, the methodology is shown in Figure 1:

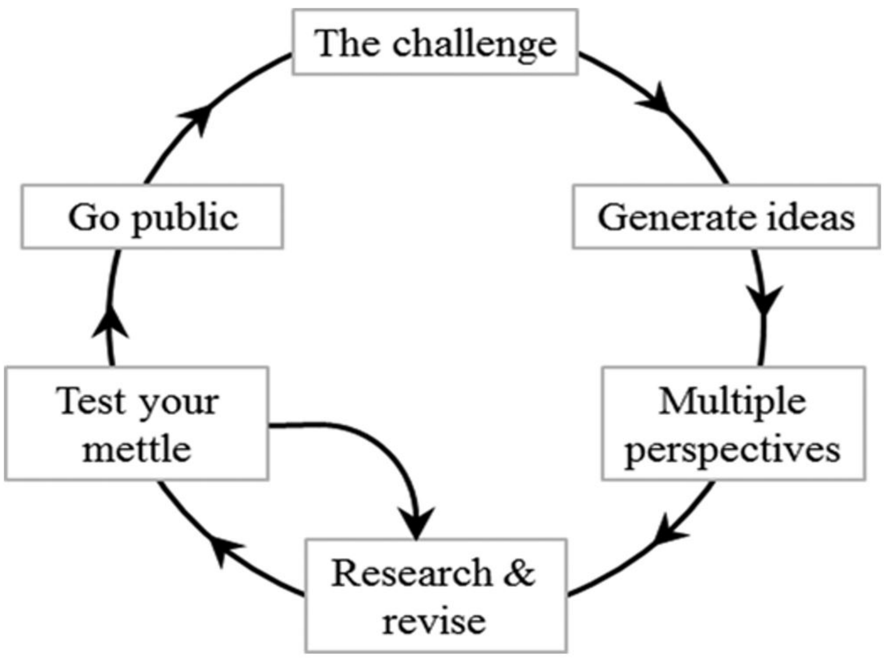

Figure 1. The Star Legacy Cycle (The challenge is the first step in the legacy cycle. In the different perspectives phase, students produce suggestions for how to solve the challenge based on their prior knowledge and then consider expert viewpoints on the challenge. The study and revision phase is driven by the students' initial experiences. Students are then put to the test in an assessment, such as a quiz or a series of problems. Students can return to the research and revision phase if they discover they need to improve their knowledge. Finally, the students submit their solutions to the challenge in front of the class [3]

However, the cornerstone of the STAR or other PBL-based approaches, is that before the start of the course, faculty should thoroughly investigate, assess and amend problems. So an iterative five-step procedure can be used to produce PBL problems [4-5].

Step 1: Consider Course Objectives and Contex

Even before the issues are written, some of the most critical work in developing PBL problems takes place. Before creating course materials, it is necessary to evaluate the course objectives and context. Faculty should take into account the course level and student maturity, because a problem for a freshman-level course should be less complicated, involve less prior knowledge and provide advice in locating credible material, than a problem for a senior-level course. Faculty should also analyze what knowledge and practical experience the students already have, both in terms of lecture and laboratory-based requirements.

Step 2: Identify Learning Objectives

The learning objectives connected with a PBL challenge are defined in the second phase of the process. Learning objectives explain what students should know or be able to do by the conclusion of the issue module. Both content and process-oriented learning objectives are possible. A content-oriented learning objective describes basic knowledge and comprehension of certain ideas or processes in the field and is specific to the course subject.

Step 3: Identify Real-World Context

The next stage is to place the problem in a real-world setting to make it more relevant to the pupils. The problem context should be clear and concise, yet the solution to the problem should be ambiguous, with no correct answer. Instead, the students must consider what they would do if they were in their shoes. Adapting a current textbook issue to match a real-world circumstance is perhaps the simplest approach to generate a genuine challenge.

Step 4: Draft the Problem

A challenge may begin by asking students to recall, comprehend and apply knowledge, so the problem should ultimately force students to develop something new or come to an agreement on a difficult open-ended scenario. To write the problem, the professor should also play the role of a storyteller, and students should be able to relate to and care about the engaging individuals in the issue, and the problem should begin with a hook to lure them in.

Step 5: Evaluate the Problem

The professor should examine the problem, or better yet, have a teaching assistant or a colleague to do it. Before the course, problems can be examined and recast; however, the most meaningful evaluation may occur after the problem has been implemented. When a problem module does not perform correctly the first time, some educators may grow disheartened. Most effective problems, on the other hand, are rewritten several times before and after the course begins, and even successful issues face hurdles with each new group of students.

Results and Discussion

PBL is a useful tool for incorporating a clinical and translational focus into biomedical engineering classes. Faculty like the diversity in teaching and evaluation, as well as the increased connection and involvement with students. Students are eager to put in the time and effort to acquire information in a PBL course if the instructor is a hands-on guide. Students appreciate the hands-on activities and believe the PBL format better prepares them for a career in engineering. Overall, while there are obstacles to PBL adoption in multidisciplinary projects, there are enormous benefits for both students and teachers who support expanding PBL use in biomedical engineering.

Conclusion

PBL demonstrated to be successful in motivating student learning, boosting information retention, and fostering problem-solving, communication, and collaborative abilities. However, genuine hurdles in successful implementation continue to restrict PBL adoption. We conclude that the advantages of PBL in biomedical engineering education benefit both professors and students.

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