

How to Use Problem-Based Learning in the Classroom

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Introduction

All young children ask parents what could be called “why” questions. Why is the sky blue? Why do things fall down? And many times, children ask the same questions again a few days later. Even though children may not understand the answers, the questions themselves show that children are thinking about the world and developing habits of thought.

Similarly, in our adult lives, we build understanding largely through what we experience. We create meaning as much from efforts to answer our own questions as from what we read or hear. In that sense, it is often said that our greatest challenges become our greatest learning experiences.

That is the principle behind problem-based learning (PBL), a teaching technique that educates by presenting students with a situation that leads to a problem for them to solve. It is not just a way to get students to find a correct answer. Frequently the problems have no single “right” answer. Instead, students learn through the act of trying to solve the problem. They interpret the question, gather additional information, create possible solutions, evaluate options to find the best solutions, and then present their conclusions.

Originally designed for students at medical schools, problem-based learning made the leap to high school when the faculty of the BioPrep Program at the University of Alabama developed a high school program to increase the number of qualified minority and economically disadvantaged candidates accepted into medical schools. Although the faculty did not use PBL themselves, their research into effective science teaching convinced them that PBL could be adapted to high school science classes. Intrigued by the idea of introducing PBL to high schools, Howard Barrows, a pioneer in the development of PBL, agreed to work with the Alabama schools

to develop an anatomy/physiology course for high school juniors and seniors.

PBL took hold in Alabama schools affiliated with the Macy Foundation, though without the involvement of anyone at the Foundation. Affiliation with the Foundation meant that the schools already had a collaborative network in place, unlike many U.S. schools that aren't linked with an organization.

Word of this innovative teaching quickly spread among the teachers and school leaders working in other Macy-sponsored high school programs in Alabama and throughout the United States, even though PBL was not an official part of the Macy program. At conferences and professional exchanges, teachers and school leaders talked about Barrows's course and wanted to start their own anatomy/physiology courses using PBL. Making their own arrangements, these schools used Macy Foundation grant money to train each other. Macy money was used to support improvement of science instruction in high schools, with the idea of encouraging students to think about health careers. But there was no formal sustained relationship between the schools and Barrows other than the initial training in Alabama. On their own, the schools built PBL courses and developed problems, supporting each other.

This problem-based learning movement became more organized when a new nonprofit group, Ventures In Education (VIE), was formed to work with the Macy-sponsored high school programs and to expand their achievements into other schools nationwide. Macy schools were working on improving the performance of students in science, and VIE wanted to spread such efforts to other schools. VIE also wanted to encourage schools to use problem-based learning in a variety of curriculum areas.

In conferences held in 1990 and 1991, I was astonished at the number of school leaders who were practicing PBL by themselves and who were asking Ventures to help them further develop PBL across the disciplines to achieve the same high results with student performance and interest as in the anatomy/physiology course. Although this development was not part of the original Ventures In Education plan, it was impossible to ignore so many independent requests, which were soon echoed by Ventures staff members who had seen PBL in action. As a direct response to this teacher demand, PBL now has become integral to school improvement efforts,

enabling schools to successfully place students from diverse backgrounds into more rigorous academic courses.

This book was written to make information about problem-based learning available to a greater number of teachers and to show them how to use these methods in their own classrooms. It shows how teachers can use PBL to replace passive listening and rote memorizing with active investigation, participation, and problem solving. This book serves as a guide to how classroom instructors can challenge their students by providing them with a structured opportunity to share information, prove their knowledge, and engage in independent learning. These skills are especially important for urban students who are too frequently stereotyped as unable or unwilling to achieve at high levels.

MAXINE BLEICH

President, Ventures In Education

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What Is Problem-Based Learning?

To organize education so that natural active tendencies shall be fully enlisted in doing something, while seeing to it that the doing requires observation, the acquisition of information, and the use of a constructive imagination, is what needs to be done to improve social conditions.

—Dewey 1916, 1944, p. 137

All education involves either problem solving or preparation for problem solving. From mathematical calculations (“What does this equal?”) to literary analysis (“What does this mean?”) to scientific experiments (“Why and how does this happen?”) to historical investigation (“What took place, and why did it occur that way?”), teachers show students how to answer questions and solve problems. When teachers and schools skip the problem-formulating stage—handing facts and procedures to students without giving them a chance to develop their own questions and investigate by themselves—students may memorize material but will not fully understand or be able to use it. Problem-based learning (PBL) provides a structure for discovery that helps students internalize learning and leads to greater comprehension.

Origin of Problem-Based Learning

The roots of problem-based learning can be traced to the progressive movement, especially to John Dewey’s belief that teachers should teach by appealing to students’ natural instincts to investigate and create. Dewey wrote that “the first approach to any subject in school, if thought is to be aroused and not words acquired, should be as unscholastic as possible”

(Dewey 1916, 1944, p. 154). For Dewey, students' experiences outside of school provide us with clues for how to adapt lessons based on what interests and engages them:

Methods which are permanently successful in formal education . . . go back to the type of situation which causes reflection out of school in ordinary life. They give pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results (Dewey 1916, 1944, p. 154).

More than 80 years after that was written, students still learn best by doing and by thinking through problems. Educators who use problem-based learning recognize that in the world outside of school, adults build their knowledge and skills as they solve a real problem or answer an important question—not through abstract exercises. In fact, PBL originally was developed for adults, to train doctors in how to approach and solve medical problems.

Traditionally, medical schools taught doctors by requiring them to memorize a great deal of information and then to apply the information in clinical situations. This straightforward approach did not fully prepare doctors for the real world where some patients might not be able to identify their symptoms or others might show multiple symptoms. Though students memorized basic medical information for tests in their courses, they did not know how to apply the information to real-life situations and so quickly forgot it.

Recognizing that Dewey's maxim held true for medical education, Howard Barrows, a physician and medical educator at McMaster University in Hamilton, Ontario, Canada, wanted to develop methods of instructing physicians that fostered their own capabilities for reflection outside of school in ordinary life. For Barrows, the ultimate objective of medical education was

to produce doctors capable of managing health problems of those who seek their services, in a competent and humane way. To do this, the doctors . . . must have both knowledge and the ability to use it (Barrows 1985, p. 3).

While most medical schools focused on providing knowledge, Barrows thought this was just the first of three interdependent elements: