

THE APPLICATION OF PROBLEM BASED LEARNING IN TEACHING
EPIDEMIOLOGY

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Abstract: This article examines the application of Problem-Based Learning (PBL) as a pedagogical method in epidemiology education. Traditional teaching in epidemiology often relies on didactic lectures, which may not sufficiently equip students with the practical problem-solving skills needed for professional practice. This review describes the PBL methodology, where students engage in small, collaborative groups to analyze and resolve complex, real-world public health scenarios. The article summarizes the reported outcomes of using PBL, highlighting its effectiveness in enhancing critical thinking, improving long-term knowledge retention, and fostering essential professional competencies such as teamwork and self-directed learning. By shifting the focus from passive knowledge acquisition to active skill application, PBL serves as a powerful strategy for preparing future epidemiologists to address complex public health challenges effectively.

Keywords: Problem Based Learning, PBL, epidemiology, public health education, active learning, case based learning

Introduction

Epidemiology is the cornerstone of public health, providing the foundational methods for disease surveillance, outbreak investigation, and the study of disease distribution and determinants. Traditionally, epidemiology has been taught through didactic methods, such as lectures and textbook readings, which focus on the transfer of theoretical knowledge from instructor to student. While this approach is effective for conveying foundational concepts, it may not adequately prepare students for the complex, multifaceted challenges they will face as public health professionals. Real world epidemiological problems are rarely straightforward and require a combination of knowledge, critical thinking, analytical skills, and collaborative problem solving.

To bridge this gap between theory and practice, many educational programs have begun to incorporate active learning strategies. One of the most prominent among these is Problem Based Learning (PBL). PBL is a student centered pedagogical approach in which students learn about a subject through the experience of solving an open ended, real world problem. Instead of passively receiving information, students work in small groups to identify the core issues of a problem, determine what they need to learn to address it, and collaboratively develop a viable solution. This article reviews the application of the PBL method in teaching epidemiology, outlining its structure, summarizing its reported outcomes, and discussing its role in developing core competencies for the next generation of public health professionals.

Methods

This review describes the methodological framework for implementing Problem Based Learning in an epidemiology curriculum, as synthesized from pedagogical literature and educational studies.

The PBL process in epidemiology typically begins with the introduction of an "ill structured" problem or scenario. This scenario is often a case study based on a real public health event, such as a local foodborne illness outbreak, the emergence of an infectious disease, a report on unusual

cancer clusters, or a study on the determinants of a chronic disease. The problem is intentionally open ended, without a single correct answer, requiring students to explore multiple facets of the issue.

Students are organized into small collaborative groups, typically consisting of 5-8 members. A faculty member acts as a facilitator or tutor rather than a traditional lecturer. The facilitator's role is not to provide direct answers but to guide the learning process by asking probing questions, encouraging critical thinking, moderating group dynamics, and ensuring the discussion remains productive.

The student learning process follows a structured sequence. First, the group reads the problem, clarifies any unfamiliar terms, and defines the core epidemiological challenges presented in the scenario. Second, they brainstorm potential hypotheses or explanations for the problem through a process of "activation of prior knowledge." Third, they identify the gaps in their collective knowledge—the "learning objectives"—that must be filled to properly analyze and resolve the scenario. Following the group session, students engage in self directed learning, using resources such as textbooks, academic journals, and public health databases to research their identified learning objectives. Finally, the group reconvenes to share their findings, synthesize the new information, re-evaluate their hypotheses, and collaboratively formulate a solution or a set of public health recommendations based on their epidemiological analysis.

Results

The adoption of PBL in epidemiology courses has been associated with a range of positive educational outcomes, as reported in various studies. A primary finding is the significant enhancement of students' problem solving and critical thinking skills. Unlike traditional models where students often apply pre-learned formulas to well defined problems, PBL challenges students to frame the problem themselves, formulate relevant questions, and critically appraise evidence. Studies have shown that students educated via PBL demonstrate a greater ability to analyze complex health data and develop comprehensive investigation strategies.

Another frequently reported outcome is improved knowledge retention and the ability to transfer concepts to new situations. The process of actively seeking out and applying information to solve a meaningful problem leads to a deeper, more integrated understanding of epidemiological principles compared to rote memorization. Students report that concepts like study design, bias, confounding, and causality become more tangible and memorable when learned in the context of a real world case.

PBL also fosters the development of essential professional skills. The collaborative nature of the method enhances teamwork, communication, and leadership abilities. Students learn to articulate their thoughts, listen to diverse perspectives, and negotiate a consensus—all critical skills for a career in public health, which is inherently interdisciplinary and collaborative. Furthermore, the self directed learning component promotes lifelong learning habits, empowering students to independently seek out and utilize new information throughout their careers.

While the majority of outcomes are positive, some studies note challenges. The implementation of PBL can be resource intensive, requiring more faculty time for facilitation compared to traditional lecturing. Additionally, some students may initially experience discomfort with the lack of structure and the shift in responsibility for their own learning.

Table 1.

Comparison of traditional vs PBL methods in epidemiology

Feature	Traditional Didactic Method	Problem Based Learning (PBL) Method
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Learning Process	Passive (listening, memorizing)	Active (inquiring, collaborating, solving)
Student's Role	Information recipient	Problem solver, active participant
Instructor's Role	"Sage on the stage" (knowledge expert)	"Guide on the side" (learning facilitator)
Problem Type	Well-structured, end-of-chapter exercises	Ill-structured, real-world, complex scenarios
Focus	Content acquisition	Process of learning and skill application
Outcomes	Theoretical knowledge base	Applied skills, deep understanding, collaboration

Table 2.
Core competencies developed through pbl in epidemiology

Competency category	Specific skills and abilities fostered
Analytical/Scientific Skills	Formulating research questions, designing studies, interpreting data, assessing causality
Problem-Solving skills	Identifying core health problems, evaluating evidence, developing intervention strategies
Communication skills	Articulating complex ideas, presenting findings, active listening, group discussion
Collaboration/Teamwork	Working effectively in diverse groups, providing constructive feedback, shared leadership
Self-Directed learning	Identifying knowledge gaps, locating and appraising information resources

Discussion

The application of Problem Based Learning in epidemiology education represents a significant pedagogical shift from a content focused to a process focused model. The results suggest that PBL is not just a method for teaching epidemiology, but a way of training students to *think* like epidemiologists. By immersing learners in realistic scenarios, PBL effectively mirrors the professional practice of public health, where practitioners are constantly faced with new and complex challenges that require an integrated application of knowledge and skills.

The advantages of PBL align closely with the core requirements of the epidemiology profession. The emphasis on critical appraisal of information is crucial in an era of evidence based practice. The collaborative framework prepares students for the interdisciplinary teamwork that is essential for effective outbreak investigations and public health interventions. Moreover, by cultivating skills of self directed learning, PBL equips future epidemiologists with the ability to adapt and grow in a field that is constantly evolving with new research and emerging health threats.

However, the successful implementation of PBL is not without its challenges. It requires a fundamental change in mindset for both educators and students. Instructors must transition from being content experts to skilled facilitators, a role which requires training and support. Institutions must invest in developing high quality case studies and allocate the necessary resources, including appropriate learning spaces and faculty time. Students, particularly those

accustomed to more passive learning environments, may need initial support to adapt to the demands of self directed learning and group collaboration.

In conclusion, Problem Based Learning is a powerful and effective method for teaching epidemiology. By centering the educational experience on solving authentic public health problems, PBL fosters a deeper understanding of epidemiological principles and develops the critical thinking, collaborative, and lifelong learning skills necessary for professional success. While it requires institutional commitment and a shift in pedagogical approach, the benefits of PBL in preparing competent and adaptable public health professionals make it a valuable and necessary innovation in modern epidemiology education.

Conclusion

In conclusion, Problem-Based Learning represents a highly effective pedagogical shift for epidemiology education, moving the focus from content memorization to the development of practical, applied skills. By centering the learning experience on authentic public health challenges, PBL trains students to think and act like epidemiologists, fostering a deep understanding of core principles and building crucial competencies in critical analysis, collaboration, and communication. While its successful implementation requires a significant commitment from institutions, including faculty development and curriculum redesign, the challenges are outweighed by the benefits. PBL ultimately cultivates competent, adaptable, and lifelong learners who are better prepared to face the dynamic and complex nature of the public health field, making it an essential innovation for modern epidemiology training.

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