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on university teaching and learning

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Problem-Based Learning

"How can I get my students to think critically, to analyze, to make the link between theory and practice, to apply their knowledge of basic concepts and principles in diverse situations? How can I get them interested in learning about this subject? How do I motivate them to go beyond learning the facts and to achieve a deeper understanding of the subject?"

If you are like most faculty, you regularly consider questions like these. Dalhousie University's Faculty of Medicine has adopted an approach to teaching which promises some answers. In 1992 , in a radical departure from the traditional university mainstay of the lecture method, Medicine implemented a problem-based-learning curriculum: the Case Oriented Problem Stimulated (COPS) program. In this issue of *FOCUS*, Dr. David Kaufman, Associate Professor, Division of Medical Education, describes this innovative approach.[1] Dr. Kaufman and his colleagues are frequently called upon at Dalhousie and elsewhere to facilitate workshops on problem-based learning.

What is Problem-Based Learning?

Problem-based learning (PBL) is an instructional method in which students learn by seeking solutions to real-world problems. While there are variations, the basic elements of the PBL process remain the same: a problem is presented as it would be in reality; working alone, students identify and study what more they need to know in order to find a solution; the skills and knowledge acquired through individualized study are applied to the problem, evaluated, and reinforced through group discussions; students' abilities to reason and apply knowledge are challenged; and learning is integrated into the students' existing knowledge and skills.

Problem-based learning methods may vary within certain dimensions of practice: *Primary purpose.* PBL can be useful in a number of disciplines and for a variety of primary purposes, such as stimulating the learning of content and/or the reasoning process in a particular discipline; developing problem-solving skills in a particular domain; and developing an appreciation and understanding of the multiple perspectives possible in "real-life" situations. Other skills also may be enhanced, such as cooperative learning, communication and interpersonal relations, self-directed learning, and self/peer assessment.

Educational setting. PBL can be used in small-group tutorials with a faculty tutor (the most common setting and the one used in the Faculty of Medicine); cooperative learning groups (no teacher present); case method teaching (large group discussions); case-based lectures; problem-based labs (not just a "programmed" step-by-step lab assignment); and independent study (e.g., directed study).

Case format. Case scenarios (or problems) can vary significantly in length and detail provided. While print-based cases are the easiest and least expensive to prepare, in medicine there has been increasing development of case simulations presented through the use of video and computer technology and of real and simulated patients.

Student support. There is great variability in the support provided to students in PBL situations. These variables relate to the subject matter expertise of the tutor (expert versus non-expert); the degree of structure in discussing and working through the case; the degree to which students are directed in the identification and pursuit of objectives and/or learning issues; and, whether students are provided with all the necessary resources or must develop the information retrieval skills required of self-directed learners.

Student evaluation. Students are generally evaluated at two stages: during the tutorial process and at the end of the course or program. Students' tutorial progress is usually rated by the faculty member, but self assessment and peer assessment may also play a role. Students may be evaluated in terms of their knowledge acquisition and their reasoning, cooperative learning, and interpersonal skills. A range of evaluation methods is employed: from written and oral examinations to case study analysis. In some programs, evaluation focuses on tests of recall or knowledge, while others emphasize the testing of higher level cognitive skills, such as the application and integration of knowledge.

The Rationale for Problem-Based Learning

In the PBL process, students engage in activities and interactions associated with a range of positive learning outcomes for students who

- use knowledge they already possess to understand and structure new information
- are more able to transfer knowledge learned within a practical context to other applications
- learn the multidisciplinary nature of knowledge, since "real-life" problems do not fall within a single discipline
- learn to integrate theoretical and applied knowledge
- develop responsibility for their own learning, as well as for assisting other members of their group in their learning
- have the opportunity to examine the information from different perspectives, thereby increasing understanding and retention
- learn to assess the limits of their knowledge, preparing them to engage in the lifelong, self-directed learning they will need in order to maintain the currency of their knowledge and skills
- learn to use problem-solving skills necessary to deal with changing and complex situations where routine algorithms or pattern recognition are no longer adequate
- develop skills in working in teams comprised of different types of individuals
- learn to communicate clearly to diverse audiences

The Teacher's Role in Problem-Based Learning

PBL represents a significant departure from the traditional lecture-based approach and radically transforms the role of the teacher who may serve as case writer, resource ex-

PROBLEM-BASED LEARNING
&
SEVEN PRINCIPLES FOR GOOD PRACTICE IN UNDERGRADUATE EDUCATION

Developed by a task force of higher education experts, the highly regarded "Seven Principles for Good Practice in Undergraduate Education" are a useful measure to assess the fundamental elements of problem-based learning.

1. *Good Practice Encourages Student-Faculty Contact*

Frequent student-faculty contact in and out of classes is the most important factor in student motivation and involvement. Faculty concern helps students get through rough times and keep on working. Knowing a few faculty members well enhances students' intellectual commitment and encourages them to think about their own values and future plans.

2. *Good Practice Encourages Cooperation Among Students*

Learning is enhanced when it is more like a team effort than a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated. Working with others often increases involvement in learning. Sharing one's own ideas and responding to others' reactions improves thinking and deepens understanding.

3. *Good Practice Encourages Active Learning*

Learning is not a spectator sport. Students do not learn much just sitting in classes listening to teachers, memorizing pre-packaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn part of themselves.

4. *Good Practice Gives Prompt Feedback*

Knowing what you know and don't know focuses learning. Students need appropriate feedback on performance to benefit from courses. In getting started, students need help in assessing existing knowledge and competence. In classes, students need frequent opportunities to perform and receive suggestions for improvement. At various points during college, and at the end, students need chances to reflect on what they have learned, what they still need to know, and how to assess themselves.

5. *Good Practice Emphasizes Time on Task*

Time plus energy equals learning. There is no substitute for time on task. Learning to use one's time well is critical for students and professionals alike. Students need help in learning effective time management. Allocating realistic amounts of time means effective learning for students and effective teaching for faculty. How an institution defines time expectations for students, faculty, administrators, and other professional staff can establish the basis for high performance for all.

6. *Good Practice Communicates High Expectations*

Expect more and you will get it. High expectations are important for everyone—for the poorly prepared, for those willing to exert themselves, and for the bright and well motivated. Expecting students to perform well becomes a self-fulfilling prophecy when teachers and institutions hold high expectations for themselves and make extra efforts.

7. *Good Practice Respects Diverse Talents and Ways of Learning*

There are many roads to learning. People bring different talents and styles of learning to college. Brilliant students in the seminar room may be all thumbs in the lab or art studio. Students rich in hands-on experience may not do so well with theory. Students need the opportunity to show their talents and learn in ways that work for them. Then they can be pushed to learn in new ways that do not come so easily.

The Johnson Foundation, 1989
Institutional Inventory: The Seven Principles for Good Practice in Undergraduate Education.

pert, lecturer, lab monitor, exam writer and/or marker, course coordinator, and committee member. However, the most frequent and demanding way to participate in PBL involves serving as a tutor for a group of students. The tutor's role changes over time as students acquire the necessary skills and knowledge. The three phases of the tutor's role are:

Modeling. In the initial phase, the tutor models the thinking process for students by demonstrating to them the questions that should be asked to deal with the problem, ensuring that students consider each step in their reasoning, and ensuring that learning issues are generated and recorded.

Coaching. In the second phase, the tutor intervenes less frequently, stepping in when students miss an important step or appear to be floundering.

Fading. Ultimately, the tutor withdraws progressively (acting primarily as a "safety net") as students become more skilled and more responsible for their own learning.

Conclusion

As we well know in the Faculty of Medicine, implementing a problem-based learning curriculum is difficult, time-consuming, and, ultimately, immensely rewarding for students and faculty. As the first of our COPS students near the end of their undergraduate studies, we are delighted with our progress. Under the able leadership of our Associate Dean, Dr. Karen Mann, with the solid support of our Dean, Dr. John Reudy, and thanks to the hard work and long hours of our faculty, our COPS Curriculum recently received an unconditional seven-year accreditation and glowing report from an external review team.

However, our work with other faculties at Dalhousie and elsewhere has taught us that each situation is unique and requires its own particular model of problem-based learning. The model will surely evolve with experience, and, therefore, it is essential that appropriate structures be established to guide the planning, design, delivery, and evaluation of the course or program. Most importantly, open lines of communication between students and faculty need to be maintained so that changes can be made in a timely and ongoing fashion. (You won't get it exactly right the first time; guaranteed!)

Professional schools have been the major sites of problem-based learning initiatives, but the method can be used in any number of disciplines and courses in many different ways. Whether it is used throughout the course or in a single class, you and your students will benefit from the experience.

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[1] Thank you to Anker Publishing Co., Inc. for permission to adapt this article from Dr. Kaufman's (1995), "Preparing Faculty as Tutors in Problem-Based Learning," in W. Alan Wright & Associates, *Teaching Improvement Practices: Successful Strategies for Higher Education*.

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