Problem-Based Learning in Canadian Undergraduate and Continuing Medical Education

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Abstract

This article provides an overview of problem-based learning (PBL) in Canadian undergraduate medical education and continuing medical education (CME) programs. The CME field in Canada is described, and the major professional associations that require physicians to take annual courses and programs are noted. A brief history of PBL in undergraduate medical education is presented, along with definitions of PBL and a discussion of the strengths and weaknesses of the approach. Problem-based learning in CME has been adapted, in some cases, to suit its special circumstances; this is demonstrated by examples of how the CME

Résumé

L'auteur de cet article offre un survol sur l'apprentissage par problèmes (APP) dans les programmes d'études médicales ainsi qu'en éducation permanente médicale (ÉPM). Jubien décrit le domaine de l'éducation permanente médicale au Canada, et note les associations professionnelles majeures exigeant que les médecins suivent annuellement des cours et des programmes. Aussi y présente-t-elle un bref historique de l'apprentissage par problèmes en études médicales, des définitions de l'APP, ainsi qu'une discussion sur les forces et les faiblesses de cette approche. On a adapté, dans quelques cas, l'apprentissage par problèmes en éducation permanente

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departments of three universities have implemented PBL. Finally, the future of research in this field is reviewed.

médicale afin que cet approche convienne mieux à ses circonstances spéciales ; quelques exemples de l'apprentissage par problèmes démontrent comment le département d'éducation permanente médicale de trois universités ont mis sur pied l'APP. Finalement, Jubien étudie l'avenir de la recherche dans ce domaine.

Introduction

Many people consider problem-based learning (PBL) to be a superior learning strategy to lectures because learners are more actively engaged with the information and encounter it within the relevant context. Pioneered in North American medical schools in the 1960s, PBL has since been used in many disciplines, including such health-related disciplines as nursing, physiotherapy, and optometry (Zeitz, 1999).

This article examines how PBL has been implemented in undergraduate medical education and modified for use in in-person and distance continuing medical education (CME) programs. To make this study manageable, its scope was limited to the CME needs of physicians, one of the largest groups of health professionals who take CME courses.

The discussion begins with an examination of the CME field in Canada and the demand among physicians for CME courses. Some definitions of PBL are then considered and the strengths and weaknesses of this approach for meeting the demand for CME are outlined. To illustrate how the PBL approach has been adapted to suit continuing medical education, three distance CME programs are described, including the ways in which the PBL approach was implemented in each of them. The article concludes with recommendations for further research in this area.

Continuing Medical Education in Canada

In Canada, the continuing medical education (CME) field is large and complex and involves multiple levels of government, a variety of professional associations, and a wide range of CME providers. Since health care is a joint responsibility of the federal and provincial governments, there are physicians' associations at both levels of government. Membership in some of

these organizations is not only mandatory but also requires physicians to complete annual CME courses. There are also many associations that physicians may join voluntarily; some of the largest are the Canadian Medical Association (60,000 members), the Royal College of Physicians and Surgeons of Canada (38,000 members), and the College of Family Physicians of Canada (15,000 members). All three of these organizations require their members to take CME courses and programs each year, and their membership figures indicate the enormous demand for CME among Canadian physicians.

Canadian physicians who want or need to take CME courses have the choice of three primary providers: university continuing medical offices; medical professional organizations; and national specialty societies. Most Canadian medical schools offer CME courses and conferences. They also produce many of the available distance programs, most of which are accredited by professional bodies such as the Canadian Medical Association, the College of Family Physicians of Canada, and the Royal College of Physicians and Surgeons of Canada (Curran, Kirby, & Fleet, 2003). Select professional organizations, such as the College of Family Physicians of Canada, also offer their own CME programs.

The Problem-based Learning Approach in Medical Education

Implementation in Medical Schools

Problem-based learning (PBL) was pioneered in North American undergraduate medical schools in the 1960s and 1970s by innovative administrators and researchers who were seeking ways to improve medical school education. They felt that the existing curriculum, in which students studied only the basic sciences during their first two years, was ineffective because students could not link the factual information acquired in those first two years to their clinical work in their third and fourth years. Many educators believed that PBL would be more effective because it would teach basic science information in a practical context.

McMaster University in Hamilton, Ontario, was the first undergraduate medical school to incorporate PBL methods into its curriculum. This approach was one of many innovations adopted when McMaster's medical school was founded in 1965; an admissions system that was not limited to grades and a non-traditional grading system were also implemented (Blake, Norman, & Smith, 1999 [as in Refs]). From this pilot program, interest in PBL methods grew and the approach was gradually implemented in other medical schools in Canada, as well as schools in the United States, Europe, and Australia.

The medical schools that adopted PBL did so in one of two ways: as an alternative track or throughout their entire program. The University of Limburg at Maastricht, Netherlands, embraced a wholly PBL curriculum in 1974, and the University of New Mexico offered a concurrent PBL track in 1979 (David & Patel, 1995). Since then, others, including Georgia's Mercer University School of Medicine in the United States, the University Medical School of Manchester, England, and the New South Wales Medical School in Australia, have adopted PBL methods in some or all of their courses (Donner & Bickley, 1999 [as in Refs]). Perhaps one of the strongest endorsements of PBL came in 1985 when Harvard University's medical school designated it as the standard method of instruction for all undergraduate students.

Descriptions and Definitions

Selecting a single definition of PBL is difficult because of the many differing and contradictory definitions that are available. The situation is complicated by the fact that there seem to be more descriptions available than definitions. For instance, Howard Barrows (1986) suggested that PBL was not a specific educational method but rather could have many meanings, depending on the design of the educational method and the skills of the teacher. Meanwhile, Boud and Feletti (1997) suggested that PBL is indeed an educational method when they wrote that problem-based courses ". . . move students towards the acquisition of knowledge and skills through a staged sequence of problems presented in context, together with associated learning materials and support from teachers" (p. 2). Vernon and Blake (1999) provided one of the clearest descriptions of PBL: ". . . PBL is more than a simple teaching method. It is better described as a complex mixture of a general teaching philosophy, learning objectives and goals, and faculty attitudes and values . . ." (p. 166).

Characteristics

As the previous samples of descriptions indicate, there is no single, comprehensive definition or description of PBL that adequately covers all the different kinds of education referred to as PBL. Therefore, a list of common characteristics that apply to the PBL method employed by both undergraduate and continuing education programs is useful. One of the most important is that learners study problems that reflect real-life situations they would encounter in their professional work. Other important characteristics of PBL are that learners identify the new information they require in order to understand the problems, that they study with their peers in small groups, and that they have the support of facilitators. Students may study individually or in groups to fill in knowledge gaps, but they reconvene later with the large group and the facilitator to share their findings, integrate their new

knowledge with existing information, and formulate a comprehensive explanation of the initial problem (David & Patel, 1995).

Effectiveness

Much of the current information about the effectiveness of this learning approach comes from undergraduate medical education studies. Two of the most interesting findings from the literature concern how students structure and retain new knowledge. David, Dolmans, Patel, and van der Vleuten (1998) believed that students using PBL are more successful at integrating their knowledge of basic science concepts into clinical problems and retain this knowledge better than students in conventional curricula. By activating prior knowledge in their discussions, learners can begin to construct explanatory models, which in turn facilitate the processing of new information. Dolman and Schmidt (1999) [as in Refs] concluded that students can retain new information better if they have opportunities to elaborate on it during group discussions. Known as "contextual learning," this term is often used in discussions of PBL. Key features of contextual learning are that it stimulates learners' prior knowledge, encourages them to create explanatory models for relevant problems, and provides opportunities for group discussions.

Interestingly, the insights about the effectiveness of PBL in undergraduate medical education are similar to the findings of many studies of continuing medical education. In a study of 14 CME programs, Davis et al. (1999) found that interactive interventions that encourage participants' engagement and provide opportunities to practice their skills improved physicians' professional practice, as well as health-care outcomes. In their study, the interactive interventions consisted of case discussions, role-playing, and hands-on practice sessions. It is thus reasonable to conclude that PBL is also an interactive intervention because it meets the criteria set by these researchers (i.e., providing physicians with opportunities to interact and practice their skills).

The same study provided another insight into why PBL is effective—Davis et al. argued that PBL designs that have breaks between sessions allow participants the opportunity to learn-work-learn. Under these circumstances, students can implement what they learned in one session and then discuss their experiences in a later session with their peers.

Criticisms

When considering criticisms of PBL, the context of the studies upon which those criticisms are based must be examined to see if they were conducted in undergraduate or continuing medical education settings. Context is critical because some of the findings from undergraduate medical education are not relevant for CME. For instance, the criticism that PBL students do not do

as well on basic science tests as students in conventional programs does not apply to CME programs (Albanese & Mitchell, 1993). Furthermore, the shortcomings of this approach in CME may not apply to undergraduate medical education, although this is less likely since PBL is more common in undergraduate education than in CME programs.

Perhaps the most common criticisms of PBL are the extra time and the extra expense required to create such courses (Smits, Verbeek, & de Buisonje, 2002 [as in Refs]; Albanese & Mitchell, 1993). These criticisms are more complicated than would first appear and require a closer look. Besides considering whether the study involves undergraduate education or CME, it is essential to determine whether it was an in-person or a distance course because these factors, not PBL per se, may be responsible for some of the extra cost. For instance, a highly specialized, problem-based distance CME course designed to be taken by only a small group of students would likely cost more per student to create than an in-person undergraduate medical course meant for successive years of first-year medical students. Some of the additional costs of distance education are the extra time spent by faculty preparing and teaching the course, the cost of hiring instructional designers, and the expense of setting up and maintaining print, Web, broadcasting, and recording facilities (Moore & Kearsley, 2005). The task of determining which variable or combination of variables, among many, is responsible for the extra time and expense can be challenging.

Most of the current information about the cost of PBL comes from studies of undergraduate and postgraduate medical education. For instance, Smits et al. (2002) found that creating a problem-based, postgraduate medical training program costs 15% more than a lecture-based program, while Albanese and Mitchell (1993) concluded that for 100 or fewer students, the time spent preparing and delivering lectures was equal to or greater than the time spent tutoring PBL groups and that students in PBL programs covered materials only 82% as fast as students in conventional, lecture-based courses. Yet, although these findings are interesting, it is difficult to compare them or to draw conclusions from them because the researchers considered the issue of costs from different points of view. Smits et al. focused on the total cost of creating a problem-based course, and Albanese and Mitchell broke the cost into categories, such as faculty and support-staff time, instructional efficiency (how long students took to cover content), instructional media (textbooks and non-print media), and physical supports (rooms and buildings).

What these studies clearly show, however, is that many variables must be considered when trying to determine the costs of creating problem-based courses. More research is needed to understand the costs of implementing PBL in undergraduate and CME programs and how these figures compare to other course designs. Two other criticisms of PBL in undergraduate

medical education relate to the difficulty of creating suitable problems and the importance of having effective facilitators. These factors are also pertinent to CME.

Problems that are both relevant and meaningful are essential in continuing medical education if students are to effectively link new information with existing information through problem-based learning. Coles (1997) asserted that the PBL method failed to support the development of meaningful contextual learning, contending that it was ". . . an unnecessary complication to the educational scene" (p. 323). He cited three reasons why contextual learning often does not take place using PBL: the problems do not always provide an appropriate context for the learning; there is an expectation that students acquire the information for themselves, when it might be more appropriate to provide it to them; and the problem-solving activities do not necessarily provide opportunities for elaboration. Coles's criticisms highlighted the importance and interdependence of the problems, new information, and group discussions, and he demonstrated how these factors must relate, support, and reinforce each other for PBL to be effective.

Other researchers have also recognized the importance of having relevant problems. Some have even suggested that the process of creating problems is itself a worthy educational activity. Ryan and Marlow (2004) described a professional meeting of physicians in Ontario where small groups met and created PBL-type problems; they suggested that this "Build-a-Case" method was useful because it prompted physicians to think about the types of cases they encountered in their own practices and to build cases that reflected their experiences rather than those of experts. Ryan and Marlow also suggested that this strategy could be used to create PBL-type problems that are unique and unfamiliar, which would help to alleviate the challenge of creating problems that reflect current medical information. It has been estimated that medical information doubles every 19 years and that medical knowledge increases fourfold during a physician's lifetime (Godin et al., 1999). Thus, the "Build-a-Case" strategy is a feasible method of addressing the challenge created by this information explosion.

Another major criticism of PBL is the difficulty of facilitating small-group discussions. The primary responsibility of facilitators in lecture-based CME programs is to provide content to learners. In PBL, however, their responsibilities increase; they must find ways to encourage and to monitor group discussions so that students achieve the learning objectives (Premi, 1988 [as in Refs]). Connolly and Williams (1992) noted that when facilitators fell back on the lecture method during in-person PBL sessions, students' evaluation of the experience declined. This observation highlights the difficulty that some instructors have in effectively facilitating PBL courses. One solution is to offer them facilitator training, an approach that has been tried but may

not always be feasible. For example, facilitators who are working with unfamiliar technologies (as is the case in many distance programs) may require both technology and facilitator training and there may not be time for both. Another difficulty is related to motivation. It seems plausible that instructors who *volunteer* to facilitate PBL sessions are more interested in attending facilitator-training workshops than those who are *required* to participate.

Using Problem-based Learning in Continuing Medical Education

Determining how often PBL has been used in CME courses in Canada is difficult because there is no comprehensive study on this topic. However, studies done in the United States are useful for understanding the topic in a neighbouring North American context. In a study of 121 American medical schools, researchers learned that PBL was rarely used in the majority of the CME programs (Davis, Bukstein, Luskin, Kailin, & Goodenow, 2004). And, although there is evidence of Canadian and American universities using this method in their face-to-face CME courses, there are fewer examples of it in distance programs (Connolly & Williams [as in Refs], 1992; Davis, Kvern, Donen, Andrews, & Nixon, 2000; Rosenblatt, 2004; White et al., 2004). PBL may be considered by some administrators to be too new, too risky, or too expensive to implement in distance courses. The universities that have used PBL in distance courses were either early pioneers of PBL in undergraduate medical education or already familiar with the technologies used to deliver distance CME programs (Allen, Sargeant, Mann, Fleming, & Premi, 2003; Chan, Leclair, & Kaczorowski, 1999; Davis et al., 2004).

Modifying Problem-based Learning for Use in CME

CME programs that have used problem-based learning have done so by modifying the undergraduate medical model of PBL. The most common changes were identifying the learning goals and assembling new medical information before the course started and having a more-directive facilitator. These modifications were likely made to enable PBL to work in CME courses, many of which are brief and are delivered to physicians in their workplace. Under these circumstances, learners do not have enough time to either research new medical information or identify the course learning goals. In fact, physicians would want to know the learning goals in advance to help them evaluate the course and decide whether to register for it. In response to these constraints, course designers identify the learning objectives before the sessions and either prepare a summary of new medical information for the facilitator to present or rely on a content expert to give up-to-date informational mini lectures during the sessions (Connolly & Williams, 1992).

The process of granting CME credits is another possible cause of these modifications. Professional associations such as the Canadian Medical Association, the College of Family Physicians of Canada, and the Royal College of Physicians and Surgeons of Canada grant one credit for each hour of CME coursework that is completed. Since university continuing education offices want to attract registrants to their programs, they design courses that can be completed within measurable time limits. If students were required to do independent research outside of class time, it would be difficult to estimate the time required to complete courses. A much simpler solution is to have facilitators or content experts present emerging medical information during the sessions.

Three Examples

In order to shed more light on PBL and its implementation in CME programs, three examples are discussed: two from Canada and one from the United States. All three are distance programs created by universities that were already familiar either with PBL or with the technologies used to deliver distance-education courses.

McMaster University

One of the earliest experiments in the use of problem-based learning in continuing medical education took place at McMaster University in Hamilton, Ontario. A small-group program was developed in which eight physicians met for a total of 12 two-hour sessions to discuss a wide range of problems (Premi, 1988); feedback from the physicians was favourable and led, in part, to the formation of the Problem-Based Small Group Learning (PBSGL) project in 1992. The project was initiated under the joint sponsorship of McMaster University and the Ontario College of Family Physicians (a chapter of the Canadian College of Family Physicians). The university developed the project's learning materials, which included learning objectives, critical reviews, case histories, and discussion questions; helped physicians organize into small learning groups; and provided training for the volunteer physicians who agreed to facilitate the bimonthly meetings (Premi et al., 1994).

After the launch of these successful in-person projects, McMaster decided to extend the PBSGL program and create a distance program. The goal was to increase the program's availability not only to physicians living in rural areas who could not find the minimum number of study-group participants but also to groups unable to find physicians willing to be learning facilitators. In its first version, which was on the topic of geriatric psychiatry, program information and communication among participants and facilitators were distributed over the Internet (Chan et al., 1999). Interested participants were required to have Internet access and an email account and be proficient

enough with a Web browser to conduct an online literature search. Of the 32 physicians who initially expressed an interest in the program, 23 participated in it. Each physician had to complete a pre- and post-intervention multiple-choice questionnaire, and each was randomly assigned to either a control or a study group. The 12 participants who were assigned to the control group were given the addresses of relevant websites to review for information about geriatric psychiatry. Meanwhile, the 11 participants in the study group had online discussions that were supported by a facilitator and two specialists in geriatric psychiatry, as well as access to a course website that contained information about geriatric psychiatry and problem-based learning and links to other Web resources. The facilitator and the study-group members sent a total of 35 messages during the study's two-month period; 24 of these messages were posted by the participants. In their summary of the project, researchers identified a number of advantages of the distance PBL format used by the study group, including the ability to combine participant- and faculty-identified learning needs in an unobtrusive manner (in contrast to face-to-face interactions in which an expert's presence can dominate the learning process) and the flexibility that allowed facilitators to answer emails at their convenience, rather than at a fixed time, and to research new topics that emerged from the threaded discussions (Chan et al., 1999).

Yet, although this study demonstrated how an in-person PBL program was modified for distance delivery, it failed to detail the challenges that were encountered. For example, the issue of how CME credits were negotiated with the College of Family Physicians of Canada is intriguing, but unfortunately only passing reference was made to it: "Because the idea [of organizing problem-based small group learning] was relatively new, it took much longer than expected to convince the National Committee of the College of Family Physicians of Canada to support this project" (Chan et al., 1999, p. 58). Publishing what finally convinced the National Committee to award CME credits would have allowed other program administrators to more easily negotiate these credits for their programs.

Dalhousie University

Another example of a distance program that used PBL comes from Dalhousie University in Halifax, Nova Scotia. Researchers there modified existing PBSGL learning materials and delivered them via video conferences to physicians who were living in small communities where there were not enough participants for in-person meetings. Video conferencing was chosen because the infrastructure was already in place as part of the Nova Scotia Telehealth Network and had been used for Dalhousie CME programs since 1997. In total, 10 physicians from three sites participated in the teleconferences, and a facilitator in another location guided the discussions. Participants earned

credits from the College of Family Physicians of Canada for their participation (Allen et al., 2003).

Because the focus of the report on this project (Allen et al., 2003) was the feasibility and cost-effectiveness of video conferencing rather than PBL, it is difficult to know what challenges the researchers encountered when using PBL. Overall, however, the learners and the facilitator "agreed" or "strongly agreed" that the problems were relevant to their work, that there were adequate opportunities for group discussions, and that the information produced in those discussions was useful to their practice.

Washington University

Problem-based learning has also been implemented in distance CME courses in the United States. One of the most intriguing American examples is an audio teleconference program from Washington University in St. Louis, Missouri. The learning objectives were twofold: to increase physicians' understanding of asthma guidelines and to increase their prescription of anti-inflammatory controller medications. In total, 20 primary-care physicians attended three teleconferences (Davis et al., 2004). Problems were prepared ahead of time and presented by a facilitator who was trained in PBL techniques.

The researchers measured the effectiveness of the program by analyzing the prescribing patterns of the participating physicians six months before and after the program and then comparing these figures to the prescription records of physicians who did not attend the course but worked in the same offices as those who had (Davis et al., 2004). They found a significant increase in the prescriptions of anti-inflammatory controller medications among the physicians who took part in the course and no statistically significant change in the prescribing habits of the non-participants. One of the most interesting outcomes of this study was the conclusion that participants retained the information better and made more changes in their prescriptive patterns because of the small-group, interactive format. The researchers concluded that the small-group format encouraged physicians to think about the scenarios and discuss them with their peers and they proposed that PBL be used more often in CME programs because of its positive impact on physicians' learning.

Recommendations for Research in Problem-based Learning

Opportunities to study PBL will likely increase as this learning strategy is implemented in more undergraduate and continuing education programs. Three areas are in need of further research.

First, the question of expense should be studied more rigorously so that educators better understand whether problem-based learning or distance education is responsible for the extra costs when PBL is combined with distance delivery.

Second, it would be useful to know whether the age of physicians significantly limits the acceptance of PBL in continuing medical education. Zeitz (1999) found that the participants who were most unsatisfied with PBL were aged 50 years and older. Researchers may find that age is not an issue or perhaps diminishes in importance as more physicians are exposed to PBL in their undergraduate medical education, but it is essential to have a better understanding of the age issue.

Third, it would be valuable to research the feasibility of using PBL to teach physicians how to incorporate the latest clinical-practice guidelines into their work. Although guidelines exist for nearly all major diseases and new guidelines are produced on an ongoing basis, the accompanying CME programs that could facilitate the transfer of this information into physicians' work do not generally include these guidelines. In Quebec, the course designers of an interactive, problem-based course to help physicians integrate clinical-practice guidelines for congestive heart failure into their work suggested this was a more effective means of transmitting the information than publishing it in academic journals (Borduas, Carrier, Drouin, Deslauriers, & Tremblay, 1998 [as in Refs]). As the number of North Americans living with chronic diseases such as diabetes and heart disease increases, learning more about PBL and whether it is an effective method of transferring the most current medical guidelines into physicians' work with the public may take on new importance.

Conclusion

Since the early experimentation in problem-based learning at McMaster University's medical school over 40 years ago, interest in and the use of PBL has grown. Despite PBL's contradictory range of definitions and descriptions in the literature, many educators have implemented what they refer to as PBL in their teaching of undergraduate and continuing medical education. This approach allows students to study real-life problems in small groups with the support of facilitators. The approach has been modified for use in CME; some of the most significant changes are course creators researching new information and identifying learning goals before the sessions begin and more-directive facilitators. PBL has also been implemented in more face-to-face than distance CME programs. Those universities that have used it in distance programs were already experienced with PBL methods or with the technologies used in distance-education programs. Clearly, there are many opinions about the strengths and drawbacks of problem-based learning and further study is needed to fully understand both perspectives.

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Biography

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