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Problem-Oriented Approaches in the Context of Health Care Education: Perspectives and Lessons

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Problem-Oriented Approaches in the Context of Health Care Education: Perspectives and Lessons

Weiqun Courtney Kang, Elizabeth Jordan, and Marion Porath

Abstract

The current study aims to explore and articulate some of the key issues in problem-oriented learning (POL), in the context of health care education. Semi-structured interviews were conducted with faculties representing four different health care disciplines around common issues identified in a prior survey study. Thematic analysis of the interview data revealed that POL practice among health care educators includes both problem-based learning (PBL) in the strict sense, and a much broader integration of PBL components into discipline-specific curricula. In both cases, expertise was recognized as an important requirement for an effective tutor, although the range of necessary expertise was context-dependent. Tutor guidance and feedback, as well as sufficient autonomy for students, are crucial to maximize learning in POL. In conclusion, POL was shown to have broadened the instructional technique defined by PBL. Although addressing the same underlying principles, POL may represent a more flexible and inclusive approach to achieve the benefits claimed by PBL.

Keywords: Problem-oriented learning, problem-based learning, education of health professionals, expertise, responsibility

Introduction

Howard Barrows (Barrows & Tamblyn, 1980) introduced the Problem-Based Learning model into medical education 30 years ago. This multidisciplinary approach to critical thinking has since expanded into other professional fields. PBL now represents a major, complex, and widespread change within higher education, especially in professional education (Savery, 2006). This increasing recognition and wide application of PBL lies in its theory-based instructional strategy, which emphasizes that learning should be a constructive, self-directed, collaborative, and contextual process (Dolmans, 2003).

The principles of constructivism emphasize that learning is an active process in which students construct or reconstruct their knowledge networks (Ertmer & Newby, 1993).

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Competence is fostered not primarily by delivering knowledge, but by actively involving learners in the teaching process. This involvement stimulates activation and elaboration of prior knowledge networks in order to help students achieve deeper and richer understanding and better use of their knowledge (Harris & Alexander, 1998). Self-directed learning implies that learners play an active role in planning, monitoring, and evaluating the learning process (Ertmer & Newby, 1996). This approach leads to lifelong learners who are able to acquire new knowledge and skills more rapidly than those trained in the traditional lecturing system (Dolmans, 2005). Transition from self-direction to collaboration requires learners to be stimulated to interact with each other. As compared to a simple division of tasks, collaborative interaction requires a common goal, shared understanding of a problem, and shared responsibilities to make participants interdependent (Van der Linden, Erkens, Schmidt, & Renshaw, 2000). This type of interaction may positively influence learning (Dillenbourg, Baker, Blaye, & O'Malley, 1996). Learning should also be a contextual process, meaning that learners are exposed to a professionally relevant context while confronted with cases or problems from multiple perspectives. Such a learning context facilitates transfer of knowledge to future professional roles (Ertmer & Newby, 1993).

These guiding principles have the potential to prepare students effectively for future learning through the following seven core characteristics (Barrows, 1996; Dochy, Segers, Van den Bossche & Gijbels, 2003):

1. Student-centered learning
2. Small group learning
3. The tutor as a facilitator or guide
4. Authentic problems as the first step in learning
5. Problems that are representative of important and commonly occurring professional situations
6. Use of authentic problems as a vehicle to teach required knowledge and skills
7. Acquisition of new knowledge through self-directed learning

As PBL expands beyond health and medical education, each professional field embeds its own content within the PBL framework. While adhering to the essentials of PBL, which include focusing on the application of course content to real-world problems while supporting team-based and self-directed learning (Savery, 2006), each field adopts specific elements associated with the profession into its own problems or projects (Jonassen & Hung, 2008). Indeed, it has been acknowledged that there is no monolithic approach to problem-based learning. Rather, the applications may vary in a number of ways, from the problem format to the role of the instructor (Barrows, 2000). For example, within engineering where the problem is often a project, Lehman, Christensen, Du, and Thrane (2008) noted:

Engineers are today expected to master a combination of disparate capabilities—not only technical competencies concerning problem solving and the production and innovation of technology, but also interdisciplinary skills of cooperation, communication, project management and life-long learning abilities in diverse social, cultural and globalised settings. (p. 284)

Not only does the disciplinary expansion of PBL produce instructional variations, but it also introduces a vocabulary shift across disciplines, resulting in a broader definition of the instructional technique, defined here as problem-oriented learning. A campus-wide survey was conducted to investigate the extent to which POL, as an approach to learning, existed and to explore the range of POL approaches that were being used across different faculties within a large, research-intensive university. The ultimate goal of this study was to increase our understanding of the current perceptions and conduct of POL at the university level, in order to help promote effective approaches across disciplines and provide tailored support for further development.

POL was used as a global term for PBL instructional strategies in the current study, in order to capture all users of PBL principles:

Problem-oriented approaches to teaching and learning focus on the application of course content to real-world problems and issues. They encompass traditional problem-based learning as well as approaches like team-based learning, self-directed learning, case studies, project-based learning, design-oriented learning, and problem-based service learning.

POL is supported at this university by a cross-faculty teaching center on the campus. The center aims to promote collaboration among individuals and groups of PBL and POL practitioners across the university through organizing meetings and seminars and providing relevant resources. It does not provide specific training in PBL or POL. This is the responsibility of individual faculties. The center facilitated distribution of the survey to instructors who had participated in activities at the center.

The Internet-based survey consisted of 10 open-ended questions regarding the courses taught, the strengths of POL techniques in subject-specific contexts, and limitations or challenges identified by instructors and tutors in implementing POL within a specific faculty or department. The organization of the questions allowed respondents to omit segments that didn't pertain to their situations. For example, if the instructor didn't have tutors for the course, he or she was directed to another question. This format allowed participants the flexibility necessary to respond in ways that represented their teaching situations in ecologically valid ways. Ten complete responses were received from faculties of engineering, dentistry, medicine, nursing, and science. The health care disciplines were particularly well represented (Jordan & Porath, 2008). Despite the

low response rate, the breadth and depth of information given in the responses made analysis and follow-up worthwhile.

Analysis of the survey responses revealed both the expected diversity of approaches in different disciplines and a set of common themes. These included: 1) Whether tutors should be content experts, 2) Whether tutors should provide answers or guidance, and 3) Who takes responsibility for learning during the POL process?

We believed that these issues reflected those which most commonly concerned instructors across campus. They also comprised some of the central questions related to POL practice. Thus, a follow-up interview study was conducted with respondents of the survey in order to explore in further depth how individual faculty members from various disciplines perceived these issues during their practice. We focused on faculty in the health care disciplines who demonstrated a particular interest in regularly implementing POL in their curricula.

Method

Responses to the survey questions were reviewed in detail to identify discipline-specific context and tutor-specific practices. Open-ended questions were then constructed for each potential interviewee according to his or her survey responses, in the three topic areas of interest identified from the survey responses. For example, under the topic “whether tutors should be content experts,” the starting question for an experienced tutor was, “How do you feel your expertise helps you in preparation, guidance and evaluation during POL?” For a tutor who did not have as much expertise, the question became, “You mentioned that you are not entirely a content expert, but from a related field. In what ways do you feel that this is beneficial, and in what ways can it make your work with PBL/POL more difficult?” The interview questions were tailored to each participant. This provided the advantage of allowing participants the opportunity to clarify their comments in the original survey and to further address some of their main concerns. A complete list of the questions drafted for each respondent can be found in the appendix.

After the approval of the proposed study from the University Ethics Board, respondents who indicated an interest in being interviewed were contacted. The four participants were from four different health care disciplines. Margery¹ had introduced various forms of case study to her class for more than 20 years. Steven had initiated a three-hour weekly small group tutorial four years ago, which had become increasingly popular among his students. Paula had brought patient care problems and a clinical situations approach to her teaching for several years. Isabella was in her third year of tutoring for a PBL curriculum. An hour-long interview was conducted with each participant. Responses to interview questions made it clear that these educators spent additional time reflecting upon their practice and were still in an active process of optimizing their approaches.

Interviews were tape-recorded and transcribed verbatim. A thematic analysis of interview data was undertaken. In initial coding, common themes were identified. These themes were then refined, taking the specific context of each discipline into consideration.

Findings

As a preface to the findings, the two major forms of POL that were observed in this study are described.

Models of POL in health care education

As discussed above, a number of principal characteristics are shared by different formats of POL, for the same purpose of increasing student centeredness. The current interview study revealed that POL practice takes at least two major forms within the health care disciplines. This perhaps is related to historical reasons or the pedagogical preferences of individual schools or departments.

One format leans toward the case-, problem- or project-component model, in which real world issues are brought into the classroom. The aim is to allow students to apply knowledge and techniques already acquired to a real problem or case in the subject areas they have already learned about (Helle, Tynjälä, & Olkinuora, 2006). The objectives also include developing problem-solving abilities and the capacity for independent work. According to Paula and Margery, this is the model primarily adopted by two schools of health care education in the University. Paula further explained:

We do not really use PBL in its true form. Because we are [a] practice profession and students are engaging with patient care problems all the time, [there is the need to] talk about problems, cases or case-scenarios, clinical situations we have been in [and] those become the focus for [our students to] figure out [during their study]. [So] I do not particularly call them PBL. I would say problem-oriented learning or case-based learning is the way I describe it.

The other form is the case orientation model, which refers to a curriculum entirely devoted to the problem-based learning format. The cases that students complete form the basis of their education, while instructional teaching is provided to supplement the requirements of the case topics. In contrast to the prior model, what is essential here is that students' prior knowledge of the problem is insufficient for them to properly understand the phenomena in question. The students then decide upon learning goals, after which they study the problems on their own (Boud & Feletti, 1999). This approach shapes the template of the curriculum, the goal of which is to promote self-directed, interdisciplinary learning.

The small group tutorial conducted by Steven, however, includes characteristics of both models. These case-based tutorials address the learning process more than the outcome. Steven described himself as a tour guide who would guide students so that they could see what they want to see. Meanwhile, the tutorial is conducted only once a week. Instead of being the center of the curriculum, it serves more as an effective component fitting well into the entire professional training program.

Although sharing a problem- or case scenario-based format, the first model emphasizes knowledge integration, application, and transformation through provisions of case opportunities along with other teaching methods. In Margery's course, students "work with speech-language pathologists to collect and analyze the data from children in the community, and develop therapeutic plans with coaching from the instructor. [Through] application of knowledge and techniques they learned from class in this problem-solving process, students are expected to demonstrate final products or outcomes in the form of a report or a treatment plan."

The same provision of case opportunities applies to Paula's course, where the ultimate goal of incorporating POL components into the courses is to "allow students to apply their knowledge in real contexts, to link content knowledge to the situation and to think through the problems they are going to encounter in their future practice. [This] very explicit purpose of POL [allows them to] leave knowledge acquisition to other courses."

In contrast, the second model (or PBL approach in the strict sense), which is conducted in the undergraduate medical and dental curriculum, does not necessarily culminate in an end product. The focus here is on the learning process, facilitated by a tutor, to enable students to navigate ways of learning. In other words, students' activities during this problem-solving process are directed to studying, with the ultimate goal being to foster their development as independent, lifelong learners. Isabella compared the information-loaded lecturing format of teaching to restaurant food: students receive well-organized and structured knowledge that is already prepared. In contrast, the PBL process is like teaching students how to prepare food themselves, starting with shopping for ingredients. Tutors are like guides, telling them the types of stores they should go to and the recipes or parameters for a good dish. Yet the tutors are not responsible for how tasty the final dish will be. The different features of the two models may help us understand the following perceptions held by instructors and tutors from different programs.

Whether tutors should be content experts

Tutors' competencies are recognized as one of the important factors in a successful PBL program (Van Berkel & Dolmans, 2006). PBL tutors play a role that is different from the role of a teacher in the conventional teaching format. It is a tutor's task to stimulate active, self-directed, contextual, and collaborative learning and display interpersonal behavior that is conducive to students' learning (Van Berkel & Dolmans).

Earlier studies showed that tutors can be grouped into those who rely more on the use of expert knowledge, and those who rely more on their abilities to stimulate the learning process in the tutorial group (De Grave, Dolmans, & van der Vleuten, 1999). De Grave and colleagues also demonstrated that a tutor who stresses the learning process was perceived as more effective than a tutor who stresses content (expert tutor). Based on results from Das, Mpofu, Hasan, and Stewart (2002), students' and faculty's perceptions of the importance of tutor skills for guiding information management were different. The students expected more support from tutors, whereas the tutors tried to emphasize self-learning in the PBL curriculum. It therefore remains debatable as to whether a tutor should be knowledgeable about the content area under study, or whether it is more important for a tutor to be able to effectively facilitate groups using certain techniques (Lohfeld, Neville, & Norman, 2005).

The debate also involves a practical concern, given the difficulties of recruiting and retaining suitable educators for PBL or POL approaches (Maudsley, 2003). For example, two of the programs represented in this study needed more than 60 PBL tutors at any given time for their year-one and year-two PBL curricula. It is unlikely that such a need could be met with content experts alone. Participants in this study reported that, based on the belief that facilitation skills are more crucial in conducting effective PBL, several researchers in related fields were recruited to work as PBL tutors. To supplement these tutors' relative lack of content-specific knowledge, they were provided with a number of pre-drafted guiding questions along with each case. Tutors then used these questions to explore specific areas related to the case and learning objectives, and to stimulate discussion in student groups. It is thus interesting to know whether these guiding questions helped noncontent experts to function as effective tutors. According to Isabella, "Guiding questions [in the Tutor's Guide Book] are good. But sometimes if you do not have sufficient knowledge, you do not know what they are talking about and whether they are only touching the surface or just memorizing [without real understanding]." An experienced tutor of PBL, Isabella continued:

Every time if I have good information about the subject, I feel very confident and powerful, because I can ask more questions to probe them and to challenge them better. [Furthermore,] I feel empowered if I know more about the topic. It helps me to prevent students from wasting their time and make sure they cover everything they are supposed to know. [Therefore, I] will be a better tutor and more helpful to them (students), if I know more about the subject. [In conclusion] as a tutor, I would like to be the expert of the subject.

For those disciplines that do not adopt an entire PBL curriculum but rather incorporate case- or team-based approaches in each course, expertise of instructors apparently

becomes more crucial for the success of their conduct of POL. For example, Margery has a strong belief in the necessity for instructors to have the expertise, partly because she views POL as serving the purposes of both the application of knowledge and a process to facilitate students' learning. She believes that the more experience an instructor has, the more he or she knows if students' ideas and solutions fit the problem or not, and is able to give students feedback. Margery's pedagogical model is that it is important to learn from people with experience. She values "human life feedback," articulating:

You can go to a book, which is not life. The book does not talk to you. Engaging with someone who does it for 25-35 years listening, thinking and debating in this area, I feel PBL misses on that particular thing. That is what I feel PBL does not do. [For example,] I am not a mechanic. [So] I would not feel comfortable walking into a car maintenance class without being a content expert.

Meanwhile, Margery stated, "[I] do not mean I control it or I tell them everything. I [just] felt my expertise is valid and valuable in the classroom." She agreed "directed learning (facilitating skills) combined with expertise would be a powerful, powerful program." Echoing this perspective, Paula stated:

It is sufficient [for nonexpert tutors] if it was a very rich and well-developed guide for the tutor. It is possible to walk learners through the problem-based approach. But it might not be ideal. Without some content knowledge, I think it is more challenging to steer students, to provide guidance for them, or help them if they get frustrated with the process or they are stuck with how to address some part of the problem structure. With the expertise, you can have the freedom to let them go far enough off [track], even before they need some help to come back. If I did not have content knowledge, I might not be able to do that as effectively.

To further address the benefit an expert brings to POL, Margery added, "learners of PBL do not have to know it all. The facilitator needs to be able to guide them to know what they need to know, by asking the questions she needs to ask."

According to Steven, a practitioner and an educator, "content expert" is not a rigid but rather a relative term; PBL tutors do not need to be specialists in particular clinical areas.

The facilitators do not have to know how to work with young kids or an injured hand. [Instead,] what that person needs is the problem solving skills—how to analyze questions, and to find the best way to answer the [clinical] question. The clinical reasoning skill should be the same [across] different streams in medicine.

Steven therefore feels that it is necessary for tutors to be professional therapists with basic clinical knowledge who also have problem solving skills and clinical reasoning skills. The combination of the two, he stated, would allow them to facilitate students' learning and to guide them by asking the right questions.

Whether tutors should provide answers

It might be obvious that participants' answers to this question varied depending on the specific teaching goals or approaches they took. As Margery put it, a facilitator does not have to tell everything but should be there to provide feedback. This overarching principle is seemingly appropriate to meet students' learning needs in different settings.

Margery further identified two distinct types of situations that require different approaches. The first one is about an analytical or technical procedure that leads to an incorrect outcome because students have not understood the underlying principle. This can also include cases involving clear right and wrong dimensions or analytical knowledge as the domain of inquiry. Experts need to provide timely feedback in these cases. Margery's justifications were that she has considerable experience, whereas students have little.

So I can look at what they produce, and say, "You have missed the point here. Here is how it works." I cannot let them take away the wrong answers. It would be unethical not to tell them that these answers are wrong. Sometimes feedback is for patients' safety, that is when it is crucial for the expertise to come in.

This view is echoed by Paula, who further emphasized that the bottom line is to help students understand the professional standard of safe, ethical and effective patient care. That is why she will ask "what if" questions on the fly, to help students extend their thinking in, and link theory to, real clinical situations. As a POL instructor in a clinical setting, she also monitored her students all day to judge their performance and to provide individualized feedback.

According to Margery, the second situation is around interpretations or discussions, which are very open-ended. This might be more frequent in the case-oriented POL model where tutors are not supposed to give information or answers but encourage students to research and discuss themselves. Steven expressed his appreciation of creating a learning community through the PBL process:

I believe that is the beauty of small group tutorial or PBL. We do not need to give all the answers but let the students find answers themselves. And even if they make a mistake, they find out among themselves—what kind of mistake they make and how can you resolve that kind of problem by learning from each other. [For example], if the treatment is full rest, that is the finding from the

particular literature. And that is a wrong finding. The other seven students will be finding answers that are very different, that you need to do these exercises, that kind of mobilization, or take that kind of medication. It will be very different from this particular student's finding. So when you pull all seven other students' findings together, then you realize that that is not right.

The importance of allowing students to make occasional mistakes during their learning in front of a group reflects Steven's own honesty as a practitioner. He acknowledged:

Sometimes I may make a wrong decision. And that is fine. Other team members will remind me, "No, you are wrong." That might not feel well. But that is the reality that in our real clinical setting, we do not have the so-called mentor, or a professor, to tell you that this is right, this is wrong.

It seems crucial to Steven that PBL brings the reality of future practice into the classroom. Group dynamics are important in creating a learning environment where students can have opportunities to learn from each others' successes and mistakes.

Who takes responsibility for learning during the POL process?

Responsibility can mean a number of duties or self-perceived priorities for instructors, depending on their goal for the specific POL process. If the instructor designs the course, his or her responsibility starts from drafting structured cases and guiding questions to increase students' critical thinking. He or she may also introduce a variety of teaching methods, including group learning, lectures, and homework exercises. This variety of approaches helps to address students' different learning needs and styles.

Instead of providing answers to students, participants all agreed that the provision of guidance is one of their more important responsibilities. They realize that students are new to the profession and often do not know what they need in the near future. As teachers or professionals practicing in the field for many years, they feel responsible to tell their students the best way to get there, emphasizing the critical points in the process. In particular, they adopt the role of guiding students to find the knowledge themselves. One approach to guidance, as Steven explained, is to give students very clear objectives but leave exact learning goals up to them. Another approach suggested by Steven is to provide students with guidance on what to look for. For example, he stated:

You will give them good textbooks. Tell them that those articles are over there, and there is a journal that will help you here. [Or say] "Do your own search using these few key words." "Go to the library, look this book up." [Or,] "Go to the Internet, look for this information from this web site." Or, "Use these words as the key word and go to the data base and find out from the journals." And, "Go

to Google and find out information. Go to certain clinics or talk to certain clinicians." [That is] how we can guide them to find information by themselves.

Providing timely and specific feedback is another key responsibility recognized by all interviewees. For students who practice in real clinical settings, individual feedback about their performances can be obtained at the end of every clinical day from their instructors. Students utilize and reflect on this timely feedback to know what they should be doing next time, or what more to include. Interviewees shared a focus on the learning process rather than the outcome most of the time, when providing feedback to their students is critical. For example, they paid special attention to interactions among students, focusing on their problem-solving processes, the logic of their arguments or interpretations, and their efforts to ask good questions and to do so effectively. To Isabella, feedback is also very helpful in maintaining the efficiency of the learning process by keeping students on track and focusing them on learning objectives. Isabella believed that providing this type of feedback becomes one priority for tutors, when their students do not have much time and yet have to cover a lot of material.

Interviewees saw themselves playing a big role in the development of students' professionalism, which is one of the major goals of health care education programs. They want to enable their students to become qualified professionals and to be life-long learners. To this end, they feel the need to provide individualized feedback dealing with specific issues such as participation, preparation, and the appropriate amount of research. A responsible tutor tends to use different means to provide timely feedback to students, through group-level feedback or e-mails to individuals whenever he or she sees something important, including being respectful, supportive or caring for others' needs. To help some students to overcome shyness and speak up, Isabella would tell them that PBL is a good opportunity for everybody to overcome their weaknesses, because the environment is safe and supportive. In order to motivate them, she even went the extra mile to tell students her own experiences and lessons learned.

As a PBL tutor, helping students might be more indirect, sometimes subtle, without providing the answer or information directly. Asking good questions and helping students to know the elements of a good approach to problem solving might make a big difference to them in the end. Tutors can also remind students of the value of PBL, and help them realize that the research they do will be useful to make them work as independent professionals. As Steven summarized, "PBL is such a way to create a learning community among learners—to learn from each other and to benefit." To achieve this goal, instructors, in general, agree that it is crucial for students to prepare by researching patients' conditions and medications, and synthesizing all pieces of information to know what's going on with their patients.

POL-based curriculum provides students more autonomy by allowing students to identify what they want to learn, how they are going to learn, and how members of the group will contribute to learning. Steven's belief behind this provision of autonomy is:

If I insist this (learning goal) in the tutorial, if that is not what they want to learn or [are] interested [in], they will not be putting in their 100 percent interest and effort in it. [Instead], we believe that learners are all adults. They will learn things that will be appealing to them, not appealing to us.

This entrusting of responsibility upon students also gives their instructors the confidence that if students are given choices, they will eventually learn what they need to. However, it seems that even students in professional training can be irresponsible. The instructors or tutors were concerned that such students might end up making unnecessary mistakes in their future practice. One solution is to bring rigor to the task, to tell students if an answer is right or wrong. This may get the attention of students who seek an easy path to learning. Alternatively, according to Margery, "It is probably better to have a traditional educational system, which forces you (students) to do the right thing by exams and tests. . . . This kind of 'discipline enforced upon' students might be effective." She acknowledged that groups vary in their need for this structure. Some can get the most out of group experiences and learning activities, whereas other groups complain about the workload. Margery concluded that a variety of activities would be helpful to address the diversity of learning needs and styles.

Discussion

The current interview study portrays the diversity in approaches to conducting PBL or POL and provides insight into teachers' perspectives in different health care education programs. Being health professionals themselves, interviewees shared several commonalities. They understand the requirements of professions that deal with people's lives on a daily basis. Thus they see the rigorous and comprehensive delivery of professional knowledge to be crucial to guarantee technical or analytical correctness. Meanwhile, they share a passion in engaging students in the learning process. They found that it is not enough to just talk to students; rather something is needed to anchor people's ideas. They consciously foster integration and application of knowledge, and promote lifelong independent learning. To this end, they bring real world situations to the class and actively transform them into a whole variety of interactive learning approaches reflected in the curriculum. Direct contact with patients or exposure to clinical scenarios are provided to students beginning with their first year in the program. Clinical considerations, including even basic knowledge, can be addressed in a more relevant context, so that students learn to analyze and handle practical scenarios early on. In addition, these educators make special efforts to cultivate

a positive group dynamic and encourage peer learning, features that mirror their own professional practice. This early exposure motivates students' learning by steering their activities toward what truly matters in their future careers.

Taken together, it is evident that interviewees constantly encourage their students toward constructive, self-directed, collaborative, and contextual learning. They consciously apply these PBL or POL principles in teaching, which leads students to go beyond their textbooks and to transfer knowledge into problem-solving abilities and effective clinical reasoning through practice in relevant, and often real, contexts. Our findings also illustrated that POL, with its greater flexibility, may be a more advantageous approach in dealing with potentially different learning styles among students than PBL in its stricter sense.

In agreement with Dolmans et. al. (2002), all interviewees in this study stated that the combination of facilitation skills and appropriate levels of expertise (in content knowledge or clinical reasoning) would lead to the most powerful POL approach. This conclusion is based on their common recognition that facilitation skills and expertise complement and support each other in the complex learning environment of POL. Both components were perceived by the participants as crucial for an effective and rich learning experience, although the importance of the two can be situation-specific and dependent on contextual circumstances, such as the quality of the problems, the structure of the unit, and links with students' prior knowledge (Schmidt, 1994). For example, the value of rich expertise was repeatedly addressed by interviewees in providing valid feedback on technical issues so that students can grasp key concepts and skills of the profession more effectively. Given the difficulties of recruiting suitable educators to serve as PBL or POL tutors and potential resource limitations, staff development strategies must be addressed to ensure an adequate level of content knowledge among tutors. Meanwhile, individual tutors should not be satisfied by walking the student through the guiding questions provided by the tutor guidebook. Rather, tutors with relatively less expert knowledge should be encouraged to acquire sufficient information through self-learning. As Isabella experienced, this equipping exercise will provide tutors with stronger ability and increased confidence to guide and probe students in desirable directions and depth.

Potential limitations of our study deserve comment. They include those inherent to interview studies. Both self-selection and the small number of participants may introduce bias to the data and the analysis. However, participants of the current study are all highly experienced educators representing four different health care disciplines, and also demonstrated passion toward teaching and care for students' learning. It was clear during the interviews that these educators constantly spent additional time to reflect upon their practice and were still in the active process of optimizing their approaches. They were in a good position to share their experiences and opinions. Their insights and suggestions will be valuable and beneficial to the healthy growth of the POL community, which allows more students to benefit from diverse teaching and learning approaches.

All four interviews taken at a single university might influence the generalizability of the findings. Nonetheless, what seemed more important to us in this case study was that we were able to construct a more complete picture of health care education via combining perspectives from four subdisciplines. This illustrates more comprehensively the diverse applications of PBL concepts under the broader umbrella of POL.

In summary, the current study helps us to understand more clearly how the principles of PBL can be influenced by a variety of practical factors when it is implemented across a spectrum of disciplines. Our examples demonstrate the feasibility and possible approaches of expanding the guiding principles of PBL. By increasing flexibility and diversity, POL practice gets more inclusive which can lead to increased effectiveness, as well as innovative means, to improve teaching and learning in a broad context.

Appendix

Problem-oriented learning (POL) interview questions for the four interviewees

The purpose of these questions is to further probe the three major topic areas of our interest, which are also specific to each interviewee based on his or her answers to our previous survey questions.

Interviewee 1

1. Should tutors be content experts or not?
 - a. Why do you feel a general grasp of PBL techniques, that is, asking probing questions/ guiding questions, plus a tutor-guide book (that provides both guiding questions and appropriate answers), are not sufficient for a POL tutor?
2. Should tutors give answers/teach or not?

You emphasize the importance of guiding students using your own expertise. However, one major purpose of POL is to foster students' own problem-solving skills (PSS), which needs them to both identify questions and search for answers/solutions.

 - a. In this case, how do you decide when to guide/provide answers, and when to allow students to search in their own ways?
 - b. How do you balance the two to allow students to improve their own PSS, and make good use of the instructor/tutor's expertise?
 - c. What is the ultimate goal of your POL?
3. Whose responsibility is it during the POL learning process, the tutor's or the students'?
 - a. What do you think are the responsibilities of a POL/PBL tutor/organizer?
 - i. Preparation:
 1. Strategic planning:

- a. Specific goals for POL?
 - b. How to incorporate POL into the overall curriculum?
- 2. Drafting good cases to better convey learning objectives/goals, and to improve the effectiveness of PBL?
 - ii. Provide introduction session to explain the format and the purpose of POL, how it might be different from other forms of teaching, and your specific expectation?
 - iii. Provide coaching: what exact content is included – to what extent is coaching needed? Why is coaching necessary?
 - iv. Provide ongoing support, in and outside class
- b. Do you feel it is important for students in your class to fully understand advantages of PBL? Does that help them realize and accept an increased responsibility from their side during this process?
- c. How do you adopt different learning styles of students? (i.e., those who are not used to this type of learning and feel uncomfortable/unwilling/overwhelmed by the increasing responsibility?)
 - i. By breaking POL into various components (i.e., funlab, literature review, team presentation, WebCT discussion, tool assessment)?
 - ii. Using evaluation? How do you use multiple grading systems to promote the goals you set for the course?
- d. Do you feel PBL brings extra curriculum load to students?
 - i. How you adjust overall curriculum load?
 - ii. Do you fit PBL into the overall curriculum, in conjunction and coherence with other ongoing teaching activities?

Interviewee 2

- 1. Should tutors be content experts or not?
 - a. You are apparently an absolute content expert. How do you feel that expertise helps you in preparation, probing, guiding and evaluation of POL?
 - b. Do you think non-content experts can work as tutors of the type of POL you are doing? According to your experience, what might be some of the advantages/disadvantages of using non-content experts as tutors?
- 2. Should tutors give answers /teach or not?
 - a. Your POL is mostly case-based, which needs students to brainstorm issues or problems followed by solutions/action plans. During this process, in which cases do you find guidance and answers are helpful for learning?
 - b. Which seems the more effective approach to you – providing guidance whenever students tend to go “off track,” or allowing them time to further explore (along

- the “wrong” direction) and to figure out that they have gone down the wrong path with evidence they found themselves – would this option better serve the purpose of increasing their real problem-solving skills?
- c. What is the ultimate goal of your POL – a more effective vehicle to learn the knowledge (in the form of learning objectives), or helping students to learn practical skills such as teamwork, searching for relevant information, and problem solving?
 - d. Do you think it would be possible to balance the teaching of knowledge and of practical skills in your POL? If so, how do you balance the two? If not, do you tend to address skills like problem-solving using POL approach, but address knowledge using lectures?
3. Whose responsibility is it during the POL learning process, the tutor’s or the students’?
- a. How do you conduct your POL?
 - b. What do you think are the responsibilities of a POL/PBL tutor/organizer?
 - i. Drafting good cases to better convey learning objectives/goals, and to improve the effectiveness of PBL?
 - ii. Provide introduction session: explain the format (how it might be different from other forms of teaching) and the purpose of PBL?
 - iii. Provide coaching: Why is coaching necessary? What exact content is included? To what extent is coaching needed?
 - iv. Provide ongoing support, in and outside class?
 - c. Can all students realize and accept an increased responsibility from their side in a POL process?
 - d. How do you motivate these students to engage into this interactive type of teaching/learning process?
 - e. Do you feel PBL brings extra curriculum load to students?

Interviewee 3

1. Should tutors be content experts or not?
 - a. You told us that you are a content expert – in which way are you an expert (practitioner working specifically with community, or family doctor)?
 - b. How do you feel that your expertise has helped you in conducting PBL sessions, that is, in planning, probing, guiding, or addressing certain issues you think are important?
 - c. Do you find any negative effect of being a content expert during your PBL conduct?
2. Should tutors give answers/teach, or not?
 - a. During your tutorial, you used many open ended questions to discover unknown concepts. Did you sometimes also provide students with answers?
 - b. And in what case do you do so, and when do you not? How do you balance the

- two given that students had no prior knowledge and there was a shortage of time?
 - c. How do you feel giving answers or not would affect students' learning?
 - d. Do you feel one of the strengths of PBL/POL is self-directed study? If so, would providing answers help with it?
3. Whose responsibility is it during the POL learning process, the tutor's or the students'?
- a. You mentioned that you tended to provide answers due to the lack of prior knowledge and time constraints. Then what do you think would be students' responsibility in this process (generating learning issues and conducting research on them)?
 - b. Where do you think the right balance between students' vs. tutors' responsibility would be?
 - c. From a health professional's perspective, what useful (professional) skills do you think need to be addressed during the PBL process?

Interviewee 4

1. Should tutors be content experts or not?
- a. How do you feel that your expertise has helped you in conducting PBL sessions, that is, in planning, probing, guiding, addressing certain issues you think are important?
 - b. Have you found any negative effect of being a content expert during your POL (i.e., do you tend to provide answers)?
2. Should tutors give answers/teach or not?
- a. You mentioned that during your tutorials you tended to use many open-ended questions. Do you also provide answers? In which cases do you do so, and when do you not?
 - b. How do you feel that this would affect students' learning?
 - c. Do you feel one of the major strengths of POL is self-directed study? If so, do you feel providing answers would help with it?
 - d. What is your purpose of incorporating a POL component into the curriculum, that is, to promote independent learning or to promote acquisition of knowledge?
3. Whose responsibility is it during the POL learning process, the tutor's or the students'?
- a. How do you conduct your POL?
 - b. What do you think are the responsibilities of a POL/PBL tutor/organizer?
 - i. Drafting good cases to better convey learning objectives/goals, and to improve the effectiveness of PBL?
 - ii. Provide introduction session: explain the format and the purpose of POL, how it might be different from other forms of teaching, and your expectations?
 - iii. Provide coaching: Why is coaching necessary? What exact content is

- included? To what extent is coaching needed?
- iv. How do you provide ongoing guidance/support, in and outside class?
 - c. Can all students realize and accept an increased responsibility from their side in a POL process?
 - d. If some of them cannot, how do you motivate these students to engage in this interactive type of teaching/learning process?
 - e. Do you feel PBL brings extra curriculum load to students?

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1. Pseudonyms are used for study participants.

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