

Problem-based learning: its application to medical rehabilitation research

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Abstract

This report describes a modified PBL approach to a community and medical rehabilitation research course for students from the Pacific Basin Medical Officers Training Program (PBMOTP) in Pohnpei, Federated States of Micronesia. The course was cooperatively taught by faculty from PBMOTP and the Pacific Basin Rehabilitation Research and Training Center (PBRRTC), sister programs of the John A. Burns School of Medicine at the University of Hawaii, Honolulu, Hawaii until 1996.

In an intensive two part research development course, students learned to identify research issues, define research questions, do literature reviews, develop proposals, collate and analyse data and to interpret and present their research findings. The course used a PBL approach and taught students to do these tasks and to develop research projects in direct response to needs in their communities.

Introduction

The Pacific Basin Medical Officers Training Program (PBMOTP) was a five year physician training program developed specifically to address the acute shortage of indigenous physicians and the health needs of U.S.- associated regions in

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the Pacific^{1,2}. These regions are as follows: the Federated States of Micronesia (Chuuk, Kosrae, Pohnpei, and Yap), the Republics of Belau and the Marshall Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands. PBMOTP was a community-oriented medical education program^{1,2,3} which was strongly committed to PBL.

The Pacific Basin Rehabilitation Research and Training Center (PBRRTC) was a regional center, established to improve services to people with handicaps through relevant research and training. Additionally, PBRRTC assisted in the coordination of rehabilitation services provided by agencies and other entities in the U.S.-associated Pacific. The two programs served essentially the same region and both were directed towards addressing the needs of the people in these communities (PBRRTC's service area also included Guam and the State of Hawaii).

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The staff from PBMOTP were physicians with background in clinical and community medicine with some research experience. The staff from PBRRTC were cross-trained in qualitative and quantitative research methods and a variety of disciplines; one staff member was a nurse and a medical anthropologist with a strong qualitative orientation and the other is a biostatistician with a public health background.

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Goals

The course described here combined the research and training efforts of PBRRTC with the goal of promoting rehabilitation awareness and improved services through research that was initiated, designed, and conducted by Pacific people: in this case, medical students. PBMOTP's goal for the course was consistent with the aim of community-oriented

medical education³. The course was designed to produce community-oriented doctors who were willing and able to serve their communities by dealing effectively with the health problems and needs of the community concerned^{1,2}. As part of the PBMOTP community medicine curriculum, each student was expected (as part of a group) to develop and conduct a community-oriented research project which, in turn, would increase their knowledge of their respective communities and to respond appropriately to community need. While the short term goals of the course were to increase community, rehabilitation, and research awareness among the students, the long term goal was not necessarily to develop researchers, although future involvement in research is commonly associated with the introduction of research involvement during medical school⁴. Over the long term, these students should be better able to critically review research relevant to their clinical and public health practice. As health leaders in their community, they would be in a position to evaluate and participate in or direct future research in their communities.

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Teaching methods and strategies

The instructional approach was noteworthy in a couple of ways. First, course content placed emphasis on rehabilitation-related research and rehabilitation as an integral part of community primary health care. Second, the research course, like the general PBMOTP curriculum, was community-based, and thus represented a unique opportunity for applied community-based or participatory action research^{5,6}.

The course stressed disability and rehabilitation related research. It was often difficult for people from communities with significant primary and acute health care needs to see the importance of these issues for their communities. It is suggested that disability prevention and rehabilitation programs had the same goals of primary health care through their effect on health and well-being. Additionally, these programs helped keep people out of acute care. In these communities, disability and rehabilitation related programs were a part of primary care rather than tertiary care.

This course utilized principles of participatory action research in a unique way. Often research training is provided through the involvement of members of the community in research projects directed by “outside experts”. However, a process of providing fundamental research expertise to members of the community so that they can address their needs, encourages true community-based research⁵. The “outside experts,” become technical advisers who support

the research effort of the community not directors of the research. In this case, the research questions came from the students and were based on their knowledge of their community and their understanding of their community’s needs. This is one of the reasons the PBL approach was emphasized. However, some modifications were proposed.

A “modified” form of PBL was used for two primary reasons: (a) PBL involves the activation of prior knowledge⁷ and, (b) it is a slow process and therefore, time consuming⁸. PBMOTP students had a strong background in PBL and small group learning was consistent with traditional Pacific learning styles. However, the majority had little research background to draw upon. In addition, the students’ class and clinical schedule and the schedules of the trainers from PBRRTC presented a time constraint.

One of the PBMOTP faculty suggested that there were two PBL approaches: student-directed and instructor-directed. Because

of the limitations of time and background noted above, a more instructor-directed PBL approach was employed than is usual in a PBL format. Facilitation at the foundation level has been endorsed⁹. This approach allows instructors to clear up misconceptions before they became firmly established. This can happen when students have insufficient guidance from tutors before they have sufficient domain knowledge. Instructional strategies such as interactive lectures, experiential exercises, critiques of written work, and, on rare occasions, standard lectures are used to complement the problem-based approach¹⁰.

Curriculum format

The four week course was divided into two two-week segments offered several months apart. The first two-week segment introduced the basic components of research design and proposal writing. It was presented to Year Three students (Group 1) in September of 1991 and Year Two students (Group 2) in February 1992. The second two-week segment built on the first but emphasized analysis and presentation of data. This segment was presented to Group 1 in February 1992.

For the first segment, there were three hours of formal class time per day for nine days. For the second segment, students meet with faculty in small groups three times a week for approximately one hour each session, and the entire group met three times for two hours. For both groups, faculty were available in the evenings for individual and small group consultations.

First segment

Generally, for each formal session, one and a half hours were devoted to interactive lectures. The rest of the class time involved either experiential or PBL exercises. For example, for one session the students were divided into two groups. One group went to the Medical Records Department of Pohnpei State Hospital to extract data on injuries from hospital records. The second group went to the hospital and interviewed staff and patients using a questionnaire on attitudes towards people with disabilities. Both data collection instruments intentionally included potential problems. Following the exercise, the data and interview groups met separately to discuss the experience and prepare oral reports to present to their counterparts. On another occasion, the students were divided into small groups to explore project management issues. Each group worked with the same scenario but had a different set of potential problems. The groups then presented their evaluation of the problems and the potential solutions to the entire class. The presentations were followed by open discussion.

The preparation of research questions and the development of the research proposals can be better described as student directed PBL. For example, at the end of the first class, students met in small groups and explored ideas for their individual research projects, getting feedback from their group. Further development of questions and proposals followed a standard problem based model of learning. Sometimes students worked alone but, often they worked in small groups. The development of the proposal mirrors the seven steps of PBL⁷. These steps are as follows:

1. clarify terms and concepts
2. define the problem
3. analyze the problem
4. draw a systematic inventory of explanations inferred from step 3
5. formulate learning (research) objectives
6. collect additional information outside of the group
7. synthesize and test the newly acquired information.

This last step was accomplished, to some degree, through periodic formal and informal, oral and written presentations of the research proposal to the students and faculty.

Second segment

The second segment was primarily student directed PBL occasionally facilitated by the faculty. For example, during the second segment, faculty acted as technical experts for determining appropriate methods of analysis, but students initiated the query. The course was originally designed to have students analyze and prepare their own data for oral and written presentation. Unfortunately, the students were not able to complete data collection before the PBRRTC faculty returned for the second phase. As an alternative, the students were offered other databases from which to work. Several databases came from research projects conducted by PBRRTC staff and one came from the FSM Department of Health Services. In order to use these databases, students developed research questions/proposals which could be addressed with the available databases, analyzed the data, and prepared written and oral reports. Part of the assignment was to develop research questions which would address issues relevant to Micronesian communities.

Curriculum content

The course began with an introduction to research that tried to show the relevance of research for clinicians, whether or not they ever intended to be involved in additional research activities. For example, the first interactive exercise developed a clinical/research analogy (Table 1)¹¹. This showed the students that they engage in research everyday in their clinical practice. At this point, and throughout the course, students are shown how an understanding of research process and activities allow the clinician to critically evaluate medical literature. This point is especially important for students who engage in student directed PBL. Training in critical analysis may be important for correcting the problems of erroneous reasoning more common in the context of self-directed learning such as that associated with PBL¹⁰.

Table 1. Clinical / Research analogy

Clinical	Research
Chief complaint	The problem
Signs and symptoms/Lab tests	Data
Differential diagnosis	Hypotheses
Treatment	Experimental intervention
Response to treatment	Results
Notes in chart	Documentation
Diagnosis	Conclusion
Patient summary/Grand Rounds	Presentation of research

Other course tasks included: definitions of key terms, identifying research topics, defining research questions, investigating research questions through literature review, writing papers and proposals, proposal and literature critique, research design, data collection methods and skills, database development, database management, analysis techniques, data interpretation, presentation of data (oral, written, visual), use of research results, and research project management. All of these topics were introduced in the first segment, but detailed investigations of data analysis, and interpretation and presentations were offered only in the second phase.

As a whole, the course introduces all aspects of the research process. This includes the conception of the research question to proposal writing and data collection, management and analysis to the presentation of results. The course emphasizes the use of both qualitative and quantitative approaches to research design. The complementary nature of these approaches was re-enforced.

The course also emphasized community-oriented applied research. The research should have direct and immediate benefits for community residents and research participants¹², cultural relevance and sensitivity, and rehabilitation and disability-related issues. Examples and issues explored in the sessions drew on faculty and student knowledge of Pacific Island community health issues and the cultures of these communities. Once students began to identify their research interests, the issues were used in class. This was especially true during problem-based discussions. Thus class discussions often helped students explore issues pertinent to their own research.

This community orientation was apparent in the research topics developed by the students. The students were well aware of the upward trends in a variety of potentially debilitating illnesses such as diabetes, tuberculosis, stroke, cancer, and injuries, so many of their research projects focus on the care, prevention, and rehabilitation needs presented by these (and other) problems.

Ethical issues were considered throughout the course. This is especially important because of the community orientation of the program and the emphasis on community participation and cultural sensitivity. A volume of the American Journal of Physical Medicine and Rehabilitation (Vol. 70, No. 1 Supp.) devoted to physiatric research was the primary text for the course¹³. This text was supplemented with a variety of handouts and a set of research resource materials provided by PBRRTC.

Evaluation

The full effectiveness of this course probably cannot be measured until after the students have been in practice for a few years. However, initial evaluations suggest it has been a success. All of the students in both groups submitted impressive drafts of research proposals at the end of the first two-week segment. Although all the proposals needed some refinement, especially in the area of methodology and analysis of data (two areas only introduced in the first segment), the proposals contained well formulated, relevant research questions and research justifications. In the second segment, students were able to apply the principles learned during the first segment to a new research problem. At the end of two weeks, these students had a written draft of a research paper and had made an oral presentation of the process and initial findings. They were also able to apply that information to Micronesian communities.

Subsequent presentations of the course must incorporate changes recommended by the students and faculty. For

example, after the first presentation, writing sessions were moved to the first week and expanded the content. (It should be noted that English is a second language for most of these medical students.) Much of this material was also presented during the first session of the second segment and will be prepared for publication.

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Both students (formally on the course evaluation) and the PBMOTP faculty (informally) have graded the course as good or excellent and have requested continuation of the course with the recommendation that it be offered to the other students. The most common complaint is that the course is too short and the first segment should be lengthened to four weeks. Many student projects have been published in referred journals.

Conclusion

This research design course for students at PBMOTP incorporated several important dimensions. The first segment introduced the basic components of research design and proposal writing using a variety of teaching methods, including PBL. The second segment built on the first but emphasizes analysis and presentation of data with a primarily PBL approach. By the end of the course, students demonstrated an understanding of all the primary components of research and had developed and executed the proposed project. It was a short practical course which provided research training which could be incorporated into a medical school curriculum. It served as a model for a modified form

of PBL and demonstrated how this approach could be used in research training.

While there are many approaches to research training and several models for PBL, the strength of this course was its emphasis on community-based, participatory-action research. This course provides the researched, in this case indigenous medical students, with the knowledge and skills necessary to develop and conduct community-based research, rather than provide research training by simply including members of the community in a research project. Research topics came from members of the community and were clearly based on community perceptions of need. It should be noted that many of the projects involved other community members, thus additional people would also be exposed to the methods and process of research training.

All of the research projects designed by the students were applied research. Research justifications indicated that all students intended to use, or have their results used, in practical intervention programs. Students also learned how, and when, to use the technical expertise of "outside experts" In this course, the faculty take on the role of advisors and facilitators rather than principal investigators. This student-oriented learning process developed at the PBMOTP has also been since implemented in other training programs in the Pacific Rim^{14,15,16}.

Addendum

Much of the material and processes developed for this course have been used in other contexts. For example, Fitzgerald, working with another colleague with special expertise in quantitative research replicated the first segment of the course in a 20 hour subject with Fourth Year occupational therapy students at The University of Sydney in 1993 as a way to consolidate material presented in earlier research subjects. In 1993, an abbreviated version of the first segment was used in an afternoon workshop for staff of the Commonwealth Rehabilitation Service (CRS) in Sydney, Australia¹⁷. In that workshop staff identified how they could apply the research process to address needs and concerns of staff. As a result of this workshop, a research group was developed within the service and one of the projects has been expanded into a thesis for an occupational therapy masters degree.

The course and much of the material developed with PBMOTP serves as the base for a required Masters degree level subject, Research in Occupational Therapy Clinical Practice, in the graduate program at The University of Syd-

ney's School of Occupational Therapy. In this subject students develop, conduct, and present written and verbal reports on a group research project exploring research issues in occupational therapy practice. The work in this subject contributes a greater understanding of the relevance of research to practice, and to the development and implementation of the students' required coursework or research thesis. This material is currently being developed as a distance education subject.

The dilemma rich scenarios developed for the PBMOTP project management session were modified slightly for a University of Sydney, Centre for Teaching and Learning Workshop on problem solving in research in multicultural contexts¹⁸. The participants in this session were researchers with varying levels of expertise from different departments. As with the PBMOTP students, the session encouraged discussion of a range of ethical, moral, and cultural issues in research practice. The session was evaluated highly by all participants. A poster comparing the PBMOTP and The University of Sydney sessions and the advantages of using dilemma rich scenarios in research training was presented at a problem based learning conference in Newcastle, Australia in 1995¹⁹.

The four question organising guide (What? So what? Then what? Now what?) for research projects first developed for the PBMOTP course has been modified slightly and included in a guide for the use of focus groups in health research recently produced by the Transcultural Mental Health Centre in Sydney, Australia^{20,21,22}.

The additional applications of the principles, materials, and processes developed for the PBMOTP research design course suggest they have wide utility and can be adapted for

a range of students and situations. They also suggest that all or portions of the course can be incorporated into established programs and curricula in a meaningful and useful way^{21,22,24,25}.

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“ Don't despise empiric truth. Lots of things work in practice for which the laboratory has never found proof. ”

M. H. Fisher

In: 'Fisherisms' H. Fabing and R. Mar