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The use of problem-based learning in graduate programs of higher education

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THE USE OF PROBLEM-BASED LEARNING

IN GRADUATE PROGRAMS

OF HIGHER EDUCATION

by

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ABSTRACT

**The Use of Problem-Based Learning
In Graduate Programs of
Higher Education**

by

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This study was intended to discover what Problem-Based Learning (PBL) looks like in graduate departments of higher education according to faculty who use PBL methodology in their curriculum and graduate students who experience PBL in their courses. This study also attempted to further understand the advantages, disadvantages, and challenges of PBL as perceived by both faculty and graduate students.

After a comprehensive review of literature, two surveys were constructed, one for faculty and one for graduate students. The questions for both surveys were composed based on the information gleaned from the review of literature. The American Association of Higher Education (AAHE) was selected as the population to be surveyed because it was an accessible population that could easily be controlled and many of the 189 members offered graduate programs in Higher Education.

Once the population was determined, surveys were sent to both faculty and graduate students who agreed to participate. A qualitative comparative analysis was also conducted with three cooperating professors.

The data revealed many similarities between faculty and graduate student responses in relation to research studies previously conducted on the use of PBL. Both faculty and graduate students favorably agree that PBL provides critical thinking, as well as offers opportunities to use real-world problems and therefore, hones readiness for on-the-job experiences. The results of the data did show, however, that there is a discrepancy as to what type of PBL faculty use in the classroom and what type of PBL students perceive they are receiving.

There is a need for continued research on the use of PBL and further quantitative studies on how it affects the student learner. PBL has limitations, which were discussed in the study. The researcher concluded that PBL is another type of teaching methodology that can be used in the classroom to embellish constructivist learning and provides opportunities for adults to use their previous knowledge and skills. PBL, however, is not the panacea for student learning although it can provide an alternative path of education.

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CHAPTER 1

INTRODUCTION

As our society has rapidly changed from an industrial bureaucratic age to an ever-changing informative, technological and accountability age, there has been an emphasis towards establishing learning communities within organizations. The importance of learning communities for organizations has changed over time. One particular aspect of this has been the changing ideas about the nature of organizations and management. For example, in classic bureaucratic organizations learning is strongly linked to professionalization (Jarvis, Holford and Collin, 1999, p. 125). Swieringa and Wiedrsma (1992, p. 140) argue that the concept of the learning organization may be a response to the outdatedness of the bureaucratic form of organization, where hierarchical stratification separates thinking, deciding, doing and reflecting.

Jarvis et al. state that in the "scientific view" of organizations usually associated with Taylorism from the early twentieth century (see Morgan, 1997), the emphasis was likely to be on the acquisition of technical skills for task efficiency. A different and often conflicting emphasis emerged through the human relations movement and, subsequently, with the work of authors such as Abraham Maslow and Douglas McGregor. This helped to spark interest in the learning and personal development of individuals in organizations. This emphasis grew in the 1960s and 1970s through the emerging field of organizational

development, and concurrent interest in the quality of working life. (p. 126)

In very broad terms, according to metaphors identified by Gareth Morgan (1997), there has been a broad shift from seeing organizations as machines towards seeing organizations as organic systems or even brains. Learning is seen less as an input intended to make the machine more efficient. After all, if an organization is like a brain or an organism, learning is very much one of its inherent components. Reg Revens (1982), known for his work on action learning wrote, "For an organization to survive, its rate of learning must be equal to or greater than the rate of change in its external environment" (quoted in Garrett, 1987, p. 54).

Learning has always had a role in organizations. What has changed is the nature of that role, and the extent to which learning is viewed as a core component of organizations (Jarvis, et al., p. 126). Authors such as Charles Handy (e.g., 1989) have told us we cannot rely on the same ideas that served us in the past. Stata (1994) says he, " would argue that the rate of which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries" (p. 356).

Jarvis et al. questioned how do we, however, enable our future employment force to meet these requirements? They contend that there has been a recurring theme in debates about education over the years. How should schools prepare children for the "world of work" ? Do they do so effectively? But the fact that schools as well as colleges, professional institutes and universities are designed to educate or train for work

– among other things – has tended to obscure another truth. People do not just learn in order to work. They learn at work. (p. 111)

Boud and Feletti (1991) write that work-related learning has two rather distinct aspects. For some writers, the key issue is how we can make learning in classrooms properly reflect the real world of work. The most important trend in this area is problem-based learning (PBL. They define this as "constructing and teaching courses using problems as the stimulus and focus for student activity" (p. 14), Jarvis et al., write that PBL does not simply bring problem solving into a traditional curriculum based on disciplines. It builds a curriculum around key problems in professional practice. (p. 117). Boud and Feletti explain that problem based courses start with problems rather than with the exposition of disciplinary knowledge. They 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. 14).

Advocates of strong versions of PBL argued that it should not be thought of as a method, but as an entire approach to learning. Engel (1991, p. 29), outlines four key elements of a problem-based curriculum:

1. Learning is seen as cumulative. Subjects and topics are not studied in depth at one time. Instead, they are repeatedly introduced with increasing sophistication whenever they contribute to a process of decision making on a problem.

2. Learning is integrated. Subjects are not presented separately, but are available for investigation at the time they are seen to relate to a problem.

3. There is progression in learning. The various elements of the curriculum (such as the use and make-up of groups, the relationship of theory to practice) change as the students mature and progress.

4. Learning must be consistent. The aims of PBL should be supported in every aspect of the curriculum and its implementation. For example, students should be treated throughout as responsible adults, and summative assessment should therefore be used sparingly, and should test application of knowledge, not just recall.

Engel warns that such an approach makes demands on the organization of educational institutions and on curriculum planning. Within universities, colleges and schools, for instance, he writes that authority must shift away from disciplines toward inter-disciplinary or multi-disciplinary groupings of staff. But, he continues, curricula still needs to be designed, and students' educational progression monitored. Structures (committees, working groups, and the like) are necessary for this. However, Engel argues that these should not be formed on the basis of subject representation. Jarvis et al. state that a key element in the construction of problem-base progress routes is formulating generalizable competencies. These are based clearly on the kind of abilities and skills, which a professional practitioner will need on completion of the qualification. The professionals or students who devise solutions to the problems posed are, in an important sense, constructing new knowledge as they do so. (p. 118)

Piper Fogg reported that the Carnegie Corporation recently called for major reform for teacher education (The Chronicle of Higher Education, Sept. 19, 2002). They released a paper which suggested a major overhaul of teacher education and called for

teaching to be treated as a modern, clinical profession complete with two-year "residency" programs. The report, titled "Teaching as a Clinical Profession: A New Challenge for Education," called teacher quality the most important predictor of student performance and called on colleges to create long-term relationships with their teacher graduates, track teacher effectiveness through student data, and integrate the theory of teaching with practice.

The article continued to add that the initiative, called "Teachers for a New Era," and designed by Daniel Fallon, chair of Carnegie's Education Division, asked participating colleges to provide graduates with a clinical residency program, similar to a residency program in medicine. For two years, while their graduates are teaching in a school system, the colleges must provide teaching coaches and academic-content mentors to their graduates. The colleges would also try to identify successful teaching practices by collecting data on student performance in their classes. The colleges would then use that research to reform their own curriculum design and course work. The report acknowledged that the major barriers to putting in place such an initiative on a national basis include "time, money, politics, public opinion, and bureaucratic inertia".

Ellen Condliffe Lagemann, dean of the Harvard Graduate School of Education and an advisor to the Carnegie Corporation, was quoted at the end of the article saying there are several ways to begin removing some of those barriers. "We need to move education schools from the periphery of universities to the center," she said. "We have to get education schools closely tied to other universities. We need to strengthen the curriculum."

Today, according to Duch et al., our students must be prepared to function in a very different working world than existed ten years ago. The problems that these future professionals will be expected to solve will cross-disciplinary boundaries, and will demand innovate approaches and complex problem-solving skills. With few exceptions, college and university faculty embark upon the business of teaching with very little instruction or training in pedagogy. This didactic type of instruction reinforces in students a naïve view of learning in which the teacher is responsible for delivering content and the students are the passive receivers of knowledge. (p. 4)

What worked in the classroom a decade (or two or three) ago, Duch et al. state, will no longer suffice, for the simple reason that past approaches fail to develop the full battery of skills and abilities desired in a contemporary college graduate (p. 4). In June of 1994, a Wingspread Conference brought together state and federal policymakers, and leaders from corporate, philanthropic, higher education and accreditation communities to discuss the quality in undergraduate education. This conference was sponsored by the Education Commission of the States (ECS), the Johnson Foundation, the National Governor's Association, and the National Conference of State Legislatures. The Conference developed the following list of important characteristics of quality performance of college and university graduates (Wingspread, 1994):

1. High-level skills in communication, computation, technological literacy, and information retrieval to enable individuals to gain and apply new knowledge and skills as needed.

2. The ability to arrive at informed judgments – that is, to effectively define problems, gather and evaluate information related to those problems, and develop solutions.

3. The ability to function in a global community through the possession of a range of attitudes and dispositions including flexibility and adaptability, ease with diversity, motivation and persistence (for example, being a self-starter), ethical and civil behavior, creativity and resourcefulness, and the ability to work with others, especially in team settings.

4. Technical competence in a given field.

5. Demonstrated ability to deploy all of the previous characteristics to address specific problems in complex, real-world settings, in which the development of workable solutions is required.

More recently, the Carnegie Foundation's report, "Reinventing Undergraduate Education: A Blueprint for America's Research Universities (1998) stated that "traditional lectures and note-taking were created for a time when books were scarce and costly and lecturing to large numbers of students was an efficient means of transferring knowledge." Quoting John Dewey's (1938) observation that "true learning is based on discovery guided by mentoring rather than the transmission of knowledge," Boyer (1998) developed the Boyer report in which he urged universities to:

> facilitate inquiry in such contexts as the library, the laboratory, the computer, and the studio, with the exception that senior learners, that is, professors, will be students' companions and guides. The research university's ability to create such an integrated education will produce a particular kind of individual, one equipped with a spirit of inquiry and a zest for problem solving; one possessed of the skill in communication

that is the hallmark of clear thinking as well as the mastery of language; one informed by a rich and diverse experience. It is that kind of individual that will provide the scientific, technological, academic, political, and creative leadership for the next century. (p. 15)

Duch, et al. write that student-centered, inquiry-based instruction, particularly problem-based learning, falls right into line with this philosophy (p. 6).

According to Bereiter and Scardamalia (1992), PBL derives from the theory that learning is a process in which the learner actively constructs knowledge. Modern cognitive psychology suggests that learning results from a learner's actions and that instruction plays a role only to the extent that it enables and fosters constructive activities. Gijselaers (1996) adds that transmission of subject-matter through direct instruction (lecturing, for example) is, from this perspective, only of limited use. If instruction is to play any role in the learning process, teachers should focus on helping students acquire self-directed learning skills. (p. 13) PBL is regarded as an approach that meets this requirement (Schmidt, 1993). Problems serve as the stimulus for learning (Gijselaers, p. 13).

Thirteen years ago, Edwin M. Bridges and Philip Hallinger (1995) introduced PBL to educational administration through a master's degree program for prospective school principals at Stanford University School of Education. In the spring of 1995, the newly appointed dean of Stanford School of Education commissioned a comprehensive internal and external review of its academic programs. The Prospective Principals Program was the only program singled out for special accolades. All graduates who were interviewed mentioned the problem-based orientation of the program as a basis for its excellence. When asked to comment on the appropriateness of the emphasis of PBL in curriculum

(roughly 40 percent), students consistently answered, "Don't alter the emphasis. It is too intense to be increased and too valuable to be reduced." Bridges and Hallinger determined, therefore, that PBL suggests that it can address certain intractable problems encountered in the professional education of both future and practicing leaders. (p. 61)

Statement of the Problem

Despite the introduction of PBL as a teaching strategy in professional schools, notably medical schools, at universities, and its adaptation to PK-12 schools, it has only recently found its way into program in Higher Education.

In 2001, the graduate program in which I was enrolled was evaluated by an expert external reviewer. She suggested the program explore infusing its curriculum with PBL. At that time, the program had no baseline data to understand, plan, or implement PBL. Thus the concept for a dissertation study was born. After considerable reflection and numerous conversations, a dissertation plan was devised to address this void.

In Chapter Two of this study, current research on the implementation of PBL in medical curriculums is included because not much has been discovered in other areas. This information is intended to provide relevant and current research information on the use of PBL in educational curriculums as it was used in schools of medicine.

Purpose of the Study

This study was intended to gather background information on PBL, its image, its nature, its challenges, advantages, and disadvantages, and the ways in which it might be employed in a curriculum in Higher Education.

Research Questions

In order to address the problem, three research questions served as organizing guides:

1. What does PBL look like?
2. What do professors who profess to use PBL report as the advantages, disadvantages and challenges of PBL?
3. What do graduate students who have experienced PBL report as the advantages, disadvantages, and challenges of PBL?

Significance of the Study

The purpose of this study was intended to gather background information on PBL. This study was designed to explore the use of PBL in AAHE graduate programs of higher education and report the advantages, disadvantages, and challenges of its application. By offering such an analysis of PBL, it holds the potential to increase the appreciation and understanding of PBL and its potential use in classroom settings for Higher Education programs nationwide. A review of related literature on the justification of using PBL in various educational arenas is presented in Chapter Two.

Conceptual Framework

The primary model that provides the basis for the conceptual framework on which the present study rests is that of social constructivism.

Social Constructivism

Boud and Feletti (1997) write that the theoretical framework that best encapsulates the beliefs about knowledge and learning, which underlay the approach to reiterative PBL, is that of constructivism (p.126). As an educational theory Jerome Bruner, a constructivist, maintains that "learning is an active process in which learners construct

new ideas or concepts based upon their current/past knowledge" (Kearsley, 1996: Constructivist Theory). Cognitive structures are utilized (and in the process, changed) to provide personal meaning and organization to experiences. Constructivists acknowledge that we experience a "real" world, but argue that meaning is imposed by us, rather than existing in the world independently of us. This meaning is "rooted in, and indexed, by experience" (Duffy and Jonassen, 1991, p. 8) – that is, understanding is embedded in the experience of the individual (Brown et al, 1989; Honebein et al, 1993). Candy (1991) writes that by acknowledging the existence of a "real" world beyond the individual knower, constructivists avoid the charge of the metaphysical position of solipsism "or the claim that there is no reality outside the self, and that all human perception and experience exists only in the mind" (p. 263).

According to Belenky et al. (1986), all knowledge is constructed, and the knower is the intimate part of the known (p. 137). Belenky et al. continue to write that this is the essence of constructivist thought. Constructivists realize that questions and answers vary depending on historical and cultural context, and on the inquirer's frame of reference. Posing questions and problems become key methods of inquiry. Procedural knowers remain "subservient to disciplines and systems", but constructivists search for truths beyond and across systems. (p. 140) They "are not troubled by ambiguity and are enticed by complexity" (p. 139).

In his article, "The Value of Ideas: Problems Versus Possibilities in Learning," Richard Prawat (1993) puts forth the idea of restructuring education toward the goal of understanding the world in the holistic sense, as opposed to viewing the understanding of the world as a series of problems to be solved. The major idea seems to be that individual facts or bits of knowledge "blind" one to a more thorough understanding of

relationships and the world. He concedes that the specific problem-solving approach lends itself more or better to measurement because of the overt results of such study and, further, that the information-processing model tends to decrease the emphasis on more mechanical, technical, or rote skills with a positive emphasis given to teaching problem-solving strategies. Despite the benefits of the information-processing model over more simplistic behavioral ways of knowing, Prawat claims that the model cannot account for how new thoughts or organizations of concept are acquired. How can educators "cling to performance models" yet "incorporate insights from more recent cognitive constructivism and cultural anthropological theory"? (p. 10). To answer this question, Prawatt presents the notion that idea-based social constructivism, and the information-processing model, should guide the direction of education. Following the idea-based social constructivism as a guide would result in curricula that are organized around big ideas and not merely tied to teaching specific competencies. This is referred to as a learner-centered as opposed to a subject-centered approach.

Mezirow and associates (2000) write that constructive-developmental theory invites those with an interest in transformational learning to consider that a form of knowing always consists of a relationship or temporary equilibrium between the subject and the object in one's knowing. The subject-object relationship forms the cognate or core of an epistemology. That which is "object" we can look at, take responsibility for, reflect upon, exercise control over, integrate with some other way of knowing. That which is "subject" we are run by, identified with, fused with, at the effect of. We cannot be responsible for that to which we are subject. What is "object" in our knowing describes the thoughts and feelings we have; what is "subject" describes the thinking and feeling that has us. We "have" object; we "are" subject. Constructive developmental theory

looks at the process it calls development as the gradual process by which what was "subject" in our knowing becomes "object". When a way of knowing moves from a place we are "had by it" (captive of it) to a place where we "have it" and can be in relationship to it, the form of our knowing becomes more complex, and more expansive. (pp. 53-54) (Other models that were examined as possible conceptual frameworks were reviewed. A description of several of these are presented in Appendix A.)

Research Design

This exploratory study involved contacts with Departments of Educational Leadership at institutions belonging to the American Association of Higher Education (AAHE) and employed quantitative and qualitative methodologies that would address the research questions about PBL. The first research question of the study, "What Does PBL Look Like?" was a broad concept and therefore, the researcher intended that the review of literature would help answer this question along with the data gleaned from the faculty and graduate student surveys. The elements of the design of this study were as follows:

Participants – Each of the 189 institutional members of AAHE were contacted and a determination of which of them employed PBL in their graduate curriculums of higher education was made. This was done via an electronic communications search and/or a telephone search, speaking to the department chairpersons and/or graduate program coordinators. Specific faculty members who used PBL were identified and then contacted with a request to participate in the study. Forty-two faculty members agreed to participate. Three professors were also contacted who agreed to participate further in a qualitative study.

Instruments – Two survey instruments were designed to collect data directly from participating faculty and from graduate students who had taken PBL courses from the faculty. The survey instruments consisted of appropriately focused questions that could be answered using check marks. The faculty survey consisted of nineteen questions that would solicit responses that yielded data on their definition of PBL; what types of PBL components faculty actually used in their instruction; and descriptions of instructional strategies they employed and their perceptions of the strengths, weaknesses, and challenges of PBL. Both faculty and students were questioned as to their satisfaction with PBL versus traditional teaching. The survey was designed to take no longer than 15 to 20 minutes to complete in order to encourage a greater return rate. Faculty were given a separate envelope to place their survey in order to mail it back to the UNLV Cannon Center for Survey Research.

The second survey instrument was constructed specifically for graduate student participants. It was sent along with the faculty survey. A request for distribution by the faculty member to students who had taken PBL designed courses was included in a mail packet. Faculty were asked to give these surveys to their students in specific courses that addressed the topics of either leadership, organization, law or finance or other specialty courses in higher education. The content of these courses was held to be critical to the study because they have the most relevancy and impact on a student's success, as well as offering more enriching data concerning problem-based learning strategies in "real-life" situations. Faculty were given instructions on when and how to distribute these questionnaires to students and were also asked to collect the student surveys and place them in a separate envelope to mail them back to the UNLV Cannon Center for Survey Research.

This second questionnaire asked students particular questions concerning how they rated their satisfaction with PBL versus traditional instruction; how they rated the effectiveness of PBL versus traditional instruction; whether they perceived themselves to be well equipped with problem-solving strategies after participating in PBL programs; and what they cited as the strengths and weaknesses of PBL. This survey was expected to take no longer than 15 to 20 minutes to complete.

A qualitative questionnaire was formatted by the researcher which consisted of 15 questions that closely followed the format of the original surveys. These were then to be sent to the participating professors using e-mail, thus providing the opportunity for each professor to respond to each question in-depth. The answers could be sent back to the researcher using the same mode of electronic transmission.

<u>Collection of Data</u> - The UNLV Canon Center for Survey Research was utilized for assistance in the development of the survey instruments. A packet of materials was mailed to each faculty participant, containing materials as described above along with a letter fully explaining the intent of the survey, a question asking if they would like a copy of the research study once it is completed, and a return, postage-paid envelope. Surveys were coded only for the purpose of follow-up with participants not returning the completed instrument. A second mailing was made to non-respondents after three weeks.

<u>Analysis of Data</u> – Once data for the study were collected, the Cannon Center at UNLV processed the quantitative data only to produce some descriptive frequency distributions, accompanying tables and appropriate graphs.

Once the researcher received the qualitative interview returns, the data was then analyzed using a cross-case analysis methodology and results were analyzed based on the three research questions.

Limitations

Because various self-report instruments were used to collect data, this study was dependent upon the subjects reporting fully and accurately on the data requested. The following limitations should be noted:

1. Due to the fact that the number of AAHE programs using PBL was likely to be small in number because it was a relatively new approach, the ability to generalize the findings needed to be done cautiously.

2. The fact that PBL was still in its experimental and exploratory stages raised some threat to the internal validity of the study. A contaminating effect similar in nature to the Hawthorne Effect operated and was beyond the control of the researcher.

3. The nature of the research was descriptive, using a survey approach of faculty and students. The questionnaire was distributed to faculty who teach graduate courses using PBL in their curriculum, and another questionnaire was distributed to selected students who are taking courses utilizing PBL. Data analysis was limited to this pool of responses so any generalizations made must be done with caution.

4. The questions from both the faculty survey and the graduate student survey were constructed based on information gleaned from the review of literature.

Delimitations

The study was delimited in the following ways:

1. Only programs of preparation at universities in the United States that belong to the AAHE and who specifically declare they are using PBL to teach graduate courses in higher education were included in this study.

2. Data was collected only from faculty and graduate students pursuing advanced degrees in higher education administration or students services or another specialty in Higher Education during the 2002-2003 academic year.

Definition of Terms

Affordances - - "what the environment offers to the animal, what it provides or furnishes for good or ill" (J. J. Gibson, 1979, p. 127).

American Association of Higher Education - - a membership organization that serves its members, other individuals, communities and institutions in the higher education community, by building their capacity as learners and leaders and increasing their effectiveness in a complex, interconnected world. AAHE's members are 9,000+ faculty, administrators, and students from all sectors, disciplines, and positions, plus policy makers and leaders from foundations, government, accrediting agencies, the media, and business, addressing collectively the challenges higher education faces. (www.aahe.org)

Andragogy - - any intentional and professionally guided activity that aims at a change in adult persons (Knowles, 1990, p. 53).

Complexity Skills - - the advanced skills that go beyond key skills and subject skills in a qualification framework, such as the capacity to work in complex and ambiguous contexts and to solve and manage problems in ways that transcend conventional lines of thinking (Savin-Baden, 2000, p. 149).

Constructivist Theory - - in this theory, an emphasis is placed on the learner or the student rather than the teacher or the instructor. It is the learner who interacts with objects and events and thereby gains an understanding of the features held by such objects or events (http://hagar.up.ac.za/catts/learner/lindavr/lindapg1.htm).

Critical Contestability - - a position whereby students understand and acknowledge the transient nature of subject and discipline boundaries. They are able to transcend and interrogate these boundaries through a commitment to exploring the subtext of subjects and disciplines. (Savin-Baden, 2000, p. 149)

Dialogic Learning - - learning that occurs when insights and understandings emerge through dialogue in a learning environment. It is a form of learning where students draw on their own experience to explain the concepts and ideas with which they are presented, and then use that experience to make sense for themselves and also to further explore other issues. (Savin-Baden, 2000, p. 149)

Didactic Instruction - - intended for instruction; instructive; overinclined to teach or lecture others; teaching or intending to teach a moral lesson (Webster's College Dictionary, p. 369).

Epistemology - - the branch of philosophy that investigates critically the nature, grounds, limits, criteria, or validity of human knowledge and refers to precisely not what we know but our way of knowing (Mezirow et al, 2000, p. 52).

Faculty - - Assistant, Associate and Full Tenured Professors who are teaching master and doctorate level courses in higher education administration.

Graduate Students - - students who are pursuing either an Ed.D. or Ph.D. in a program of higher education.

Higher Education - - this definition pertains to colleges, public or private, and includes four-year liberal arts colleges, comprehensive and research universities and community colleges.

Hypothetico-Deductive Process - - the process of generating hypotheses, inquiring against these hypotheses, and using the data gathered to rule in and rule out hypotheses until an optimal decision can be reached (Kelson and Distlehorst, 2000, p. 176).

Key Skills - - skills such as working with others, problem-solving and improving personal learning and performance that it is expected students will require for the world of work (Savin-Baden, 2000, p. 149).

Learning Context - - the interplay of all the values, beliefs, relationships, frameworks and external structures that operate within a given learning environment (Savin-Baden, 2000, p. 150).

Learner Identity - - an identity formulated through the interaction of learner and learning. The notion of learner identity moves beyond, but encapsulates the notion of learning style, and encompasses positions that students take up in learning situations, whether consciously or unconsciously. (Saven-Baden, 2000, p. 149)

Performative Slide - - the increasing focus in higher education on what students are able to do, which has emerged from the desire to equip students for life and work..

Higher education is sliding towards encouraging students to perform rather than to necessarily critique and do. (Saven-Baden, 2000, p. 150)

Problem-based Learning - - this term, for the present study, is defined by Bridges with Hallinger (1992, pp.5-6) as having the following characteristics: 1) First, a problem is the starting point for learning; 2) Second, problems are best chosen where they conform to those existing in the workplace; 3) Third, the knowledge which students are expected to acquire during the program is organized around problems rather than disciplines; 4)

Fourth, students, individually and collectively, assume a major responsibility for their own instruction and learning; and 5) Fifth, emphasis is placed on learning in small groups rather than on lectures.

Reiterative PBL - - Barrows (1986) taxonomy provides a ranking of the likelihood with which a range of PBL methods will achieve each of the primary objectives of PBL: the structuring of knowledge within the context of the professional practice; development of effective reasoning and self-directed learning abilities; and increased motivation for learning. The rankings range from the least likely – the lecture-based case (in which "the teacher presents students with information and then a case or two, usually vignettes, to demonstrate the relevance of the information" (1986, p. 483) – to the most likely: "closed loop: or "reiterative" PBL (Boud and Feletti, 2001, p. 126).

Traditional Learning - - a type of learning whereby the student learns from lecture or recitation. Students learn by listening to a lecture, taking notes, and repeat what they have learned through criterion-referenced tests.

Transitional Learning - - learning that occurs as a result of critical reflection on shifts (transitions) that have taken place for the students personally (including viscerally), pedagogically, and/or interactionally (Savin-Baden, 2000, p. 150).

CHAPTER 2

REVIEW OF RELATED LITERATURE

During this review of literature, the author will attempt to provide a broad overview of the different perspectives of Problem-Based Learning (PBL). Some of the various topics that will be covered will include a historical overview of PBL, educational models that interconnect knowledge acquisition and problem solving, an anatomy of PBL, derivations and contexts of PBL, the significance of PBL, a theoretical framework for PBL, a deeper understanding concerning the effectiveness of PBL, the continuing controversy surrounding the use and effectiveness of PBL, and finally, what challenges are foreseen for the future use of PBL in institutions of higher education.

Historical Overview of PBL

One of the earliest statements that personifies the theoretical conceptualization of PBL is found in the writings of Joseph Payne (1883):

> If we observe the process, which we call instruction, we see two parties conjointly engaged – the learner and the teacher. The object of both is the same, but their relations to the work to be done are different. The essential part, the appropriation and assimilation of knowledge by the mind, can be performed by no one but the

learner from which it follows that he is in fact his own teacher, and that the learning is self teaching. The Teacher's part then in the process of instruction is that of a guide, director, or superintendent of the operations by which the pupil teaches himself.

Yet, according to Savin-Baden (2000), it is possible to trace the origins of the practice of what is now called PBL back to much earlier forms of learning that demanded the diverse kinds of problem-solving and problem management that emerged in problem-based curricula. For example, Socrates presented students with problems that through questioning enabled him to help them explore their assumptions, their values and the inadequacies of their proferred solutions. Aristotle, too, argued that in "every area" the philosopher, or in our case, the student, has to begin by setting down what he terms "the appearances". Thus, in working on a particular problem, say for example the problem of knowledge, the philosopher would begin by setting down the "appearances" of knowledge. What would be included under this heading would not just be our perceptual experiences but also our ordinary beliefs about knowledge. Having set this down the philosopher will look for any contradictions. If contradictions are found, sifting and sorting will occur until decisions are made about which beliefs are more central than others and these will be preserved, to return to ordinary discourse with increased understanding. This kind of increased understanding and examination of perspectives and frameworks is encouraged through problem-based learning because it offers students opportunities to examine their beliefs about knowledge in ways that lecture-based learning and narrow forms of problem-solving learning do not. (p. 3)

Savin-Baden writes that more recently the work of Dewey may be viewed as being in harmony with PBL and has influenced the way in which knowledge is perceived: not as something that is reliable and changeless but as something that is an activity, a process of finding out. Dewey's challenge to the world of science – that we are the very stuff and substance of the world and as such we must work from the middle of a situation in which our most reliable beliefs are at best imperfect or inadequate – is that we are not spectators, but agents of change. Dewey's perspective was thus a pragmatic stance towards knowledge. He argued that knowledge was bound up with activity and thus he opposed theories of knowledge that considered knowledge to be independent of its role in problem-solving enquiry. His views on this were played out in practice by his emphasis on learning by doing, which can be seen as essentially a problem-solving approach to learning. (p. 4)

The initial formed rationale for PBL stemmed from years of observing experts, according to Savin-Baden, engaged in clinical reasoning in the field of medicine and reported by Barrows and Tamblyn (1980) claiming that PBL was based on two assumptions. The first was that learning through problem situations was much more effective than memory-based learning for creating a usable body of knowledge. The second was that the medical skills that were most important for treating patients were problem-solving skills, rather than memorization. (p. 14)

Acting on these assumptions, according to Barrows (1996), the McMaster University Faculty of Health Science established a new medical school with an innovative educational approach to be used throughout its entire three-year curriculum, an approach

now known the world around as PBL. It graduated its first class in 1972. According to Boud and Feletti (1997, p. 3), some key features of the McMaster model are evident in an earlier curriculum reform by medical faculty at Case Western Reserve University in the late 1950s, which incorporated a wide range of instructional methods and strategies. Their multidisciplinary laboratory was perhaps the forerunner to the PBL tutorial (Bussigel et al, 1988). The Case Western Reserve model heralded an equally legitimate and perhaps more feasible approach for developing problem-based curricula at larger and more traditional medical schools. Harvard Medical School's "hybrid" model is a good example of the latter. It uses problem-based tutorials, lectures, conferences and clinical sessions to integrate teaching and learning around weekly themes (Tosteson et al, 1994).

In 1969, just as McMaster was getting under way, Spaulding (1969) described the motivation for creating an innovative approach: "Current dissatisfaction with medical education imposes on a new medical school a responsibility of experimenting with novel approaches" (p. 659). According to Spaulding, the McMaster group noted that students were disenchanted and bored with their medical education because they were saturated by the vast amounts of information they had to absorb, much of which was perceived to have little relevance to medical practice. They also noted that, by contrast, during residency, students were excited by working with patients and solving problems. (p. 28)

At about this same time, the College of Human Medicine at Michigan State University implemented a problem-solving course as a separate track in its preclinical curriculum, according to Jones, Bieber, Echt, Scheifley, and Ways (1984). In describing the innovative problem-based track at Michigan State, Jones et. al. (1984, pp. 181-182),

stated that during curriculum planning it was "accepted that education in the techniques of medical problem-solving should be a part of the College's preclerkship curriculum.".

According to Barrows (1996), the McMaster approach with cross-fertilization through other evidence of effectiveness, stimulated the creation of other medical schools in Maastricht (the Netherlands) and Newcastle (Australia) who also developed PBL curricula in the early 1970's. By the early 1980's, medical schools with conventional curricula began to develop alternative, parallel problem-based curricula for a subset of their students. One early leader in this trend was the Primary Care Curriculum at the University of New Mexico. Later on, other schools took on an even more arduous task of converting their entire curriculum to PBL. The leader was the University of Hawaii, followed by Harvard (which had first established an alternative track) and the University of Sherbrooke in Canada. (p. 3)

Both Barrows and Bennett (1972), wrote that Barrows' enunciation of the motivation for developing a specific PBL approach was congruent with both logic and research. The contention was that studies of the clinical reasoning of students and resident physicians in neurology suggested that the conventional methods of teaching probably inhibited, if not destroyed, any clinical reasoning ability. This, together with the observation that students had forgotten their freshman neuroanatomy by the time of their clinical neurology course as juniors, an observation reinforced by the studies of Levine and Forman (1973), led to Barrow's design of a method stressing development of clinical reasoning or problem-solving process for the neuroscience unit of the McMaster curriculum (Barrows, 1984).

A wider dissemination of PBL in the United States resulted from the "Report of the Panel on the General Professional Education of the Physician and College Preparation for Medicine" known as the "GPEP" report (Muller, 1984) sponsored by the Association of American Medical Colleges. This report made many recommendations for changes in medical education such as promoting independent learning and problem solving, reducing lecture hours, reducing scheduled time, and evaluating the ability to learn independently.

According to Barrows (1986), now countless medical schools in the United States have developed or are developing problem-based curricula in courses, alternative curricula, or as an entire curriculum revision. Many schools, particularly those with long traditions, want to create their own variation of PBL that reflects their rigor and excellence. This often includes blending PBL with elements of conventional teaching into a hybrid, as a compromise with faculty unconvinced about the value of PBL. All of these approaches to PBL represent such a wide variety of methods that now the term has far less precision than might be assumed.

Savin-Baden writes that although initiated in the field of medical studies, PBL has now spread. New debates about professional education have been influential in putting the PBL approach high on the agenda of other disciplines of higher education. For example, Eraut (1985) argued that higher education needed to develop a role beyond that of creating and transmitting knowledge, by enhancing the knowledge creation capacity of individual and professional communities. This would therefore require a greater exchange between higher education and the professions. One such way was seen to be

the inclusion of PBL within professional curricula (for example Sadlo, 1994; Cawley, 1997) and more recently the shift towards valuing and accrediting initiatives such as work-based learning. (p. 20 –21)

Thus, an investigation of the extent to which the use of PBL has progressed in preparation for programs in Higher Education Administration is timely and well justified at this time.

Educational Models That Interconnect Knowledge Acquisition and Problem Solving

According to Myers Kelson (2000), expertise in problem-solving in any domain does not exist in a knowledge vacuum. Problems demand knowledge for their resolution (Chase & Simon, 1973; Chi et al., 1982; Glaser, 1984; Lesgold et al., 1988). In addition, virtually any real-life problem that is in fact "problematic" is so because the individual encountering the problem recognizes a deficit in the full complement of knowledge and skills essential to its adequate resolution. Otherwise, the individuals would engage in algorithmic activity rather than in problem-solving activity. Even when ill-structured problems must be addressed without the benefit of external resources, the initial response of the expert problem solver is an awareness in deficit in knowledge, in skills, or in both afforded by the problem. In the absence of external resources, the deficit must be made up via reconstructive processes in which the disassembling and reassembling of prior knowledge, skill, and experience generate new contextually situated knowledge for the present experience (cf. Brown, Collins, & Duguid, 1989; Spiro et al., 1987). Conversely,

when the status of the problem allows for the utilization of external resources, the problem solver will engage in knowledge construction vis-à-vis these resources, be they textual, human, or both. Hence, problem solving, knowledge, and knowledge acquisition are inextricably linked. (p. 325)

Educational approaches that attempt to capture the connection between problem solving, knowledge, and knowledge acquisition generally do so from one of four perspectives, according to Myers Kelson. The first three are outlined as follows:

Problem Solving or Reasoning Can Best Be Taught in the Course of Knowledge Acquisition (e.g., The Socratic method; Inquiry approaches). One educational approach, which builds on the interconnectedness of knowledge acquisition and problem solving, and looks at knowledge acquisition as an appropriate form of problem solving. Inquiry approaches, after the tradition of Socrates, are within this model (cf. Collins & Stevens, 1982; diSessa, 1982; McDiarmid, 1996). In such an approach the teacher persistently confronts students with cases, with counter examples, with demands for predictions, and with other forms of Socratic dialogue, repeatedly challenging their thinking processes within a content domain. The acquisition of domain knowledge serves to promote the development of sound reasoning and problem solving.

Knowledge for Future Use Is Best Acquired in Problem-Solving Situations (e.g., Anchored Instruction). A number of approaches to, or recommendations for instruction have supported the use of problem-solving contexts for knowledge acquisition, theorizing that this will increase the probability that knowledge and skills acquired in these contexts will be more useable in others. These approaches specifically address what Whitehead

(1929) has termed "inert" knowledge, knowledge that can be recalled if it is specifically requested, but that is not spontaneously available for use in problem-solving situations (Bereiter & Scardamalia, 1989; Bransford et al., 1989, 1990; Palinscar & Brown, 1984; Spiro et al., 1987). Knowledge acquisition as enhanced by a problem context is exemplified by Anchored Instruction, an education approach described by the Cognition and Technology Group at Vanderbilt (1990). The goal of Anchored Instruction is that the students, motivated by the problem context, will experience the effects that new knowledge has on their perception and understanding of these contexts. Awareness of these effects will make the new knowledge more readily available for use in contexts encountered later on. Instruction in domain-specific knowledge is anchored in a macrocontext, or complex problem space.

Knowledge Takes a Part of Its Meaning From Its Application to Problem Situations (e.g., cognitive apprenticeship). Cognitive apprenticeship is the term given to an educational approach that emphasizes the enculturation of students into authentic practices in which domain knowledge is used to address authentic challenges. Collins, Brown and associates (Brown et al., 1989; Collins, Brown, & Newman, 1989), building on the work of Lave (Lave, 1977; 1988a, 1988b), observed that knowledge is situated in context, that it can never be completely separated from the context in which it is developed and used. Knowledge, therefore, takes a part of its meaning from its application to problem situations. They argued that learning, too, must be situated in contexts of practice in which students can actively come to understand the nuances of meaning imparted by the multiple purposes and contexts in which it can be used.

The notions of situated cognition and learning environments conducive to cognitive apprenticeship begin to merge problem solving and knowledge acquisition into the whole

to which we have been alluding. However, as with the other approaches described, cognitive apprenticeship starts with domain knowledge and situates it in practice. Nesting the culture of practice with domains such as reading, writing, and mathematics focuses on adapting domain knowledge to context. There remains a need to address the development of the capacity to attune to the inherently multidisciplinary and complex affordances contextualized in problems themselves. The fourth educational approach, Problem-Based Learning, attempts to achieve just that. (p. 326 – 327)

"Much of what humans learn is acquired through discourse and interactions with others." (National Research Council. 2001. *Knowing What Students Know: The Science and Design of Educational Assessment*, p. 5). According to Maki (2002), the traditional teaching model in higher education assumes learning results directly and primarily from instruction. However, developments in research on learning and knowing are challenging higher education to intentionally integrate the range of learning contexts within and outside of our institutions that also directly contribute to students' learning and development. In its current and emerging work, AAHE is exploring how individuals with various roles and responsibilities within and outside of the academy provide rich social interactions that contribute to the diverse ways in which humans learn. By focusing on these multiple learning contexts and more intentionally valuing them as integral to the process of teaching and learning, higher education increases the likelihood of student success.

Maki continues to write that in opposition to traditional theories of learning that viewed learning as a process of taking in discrete bits of information, research on learning and knowing is now focusing on the complexity of the learning process.

Among the contributors to learning are the social dimensions of learning. In fact, in its more recent work, *Knowing What Students Know: The Science and Design of Educational Assessment,* the National Research Council reports that in contemporary theories of learning and knowing, "Emphasis is also given to social dimensions of learning, including social and participatory practices that support knowing and understanding" (p. 102). That is, through discourse and interactions with others, "individuals build communities of practice, test their own theories, and build on the learning of others". For example, those who are still using a naïve strategy can learn by observing others who have figured out a more productive one (p. 88). Further, the Council reports, "Studies of the social context of learning show that in a responsive social setting, learners can adopt the criteria for competence they see in others and then use this information to judge and perfect the adequacy of their own performance" (p. 89).

Maki concludes with stating that strengthening and deepening these alternative contexts for learning is higher education's challenge. Research on learning and cognition, as well as recognition that humans learn differently, compel us to think more broadly and organically about how and when and under what kinds of educational opportunities students learn. Recognizing that our institutions offer a wide range of alternative and complementary educational opportunities is a first step. Creating opportunities to discuss exactly how learning inside the classroom can be intentionally extended outside the classroom is the next step. This step requires that faculty, staff, administrators, and local community leaders discuss how they can design experiences that extend classroom learning, as well as provide multiple ways of learning for diverse learners, to foster the values and desired outcomes of an institution. For example, faculty and community leaders working together to define a community-based problem might

determine how that problem is specifically designed to challenge students' understanding of economic principles within the realities of the community's socio-economic demographics. Students could record and explain their problem-solving strategies for faculty and community leaders who would both respond to the efficacy of those strategies. Faculty and student affairs might work together to define specific co-curricular social issues that challenge students' abilities to address "muddy" ethical problems. Together, faculty and students and student affairs staff could explore students' decision making process as a means of understanding the kinds of ethical principles that may or may not be at work in their problem solving.

Finally, according to Maki, focusing on the sum of our students' experiences enables individuals with different roles and responsibilities to contribute to students' learning. What a student may not fully understand in the classroom or through online instruction may become crystal clear when he or she works with students to solve a campus-based problem and observes how a peer applies an unclear concept or principle. As the National Research Council asserts:

> Studies of the social context of learning show that in a responsive social setting, learners can adopt the criteria for competence they see in others and then use this information to judge and perfect the adequacy of their own performance. Shared performance promotes a sense of goal orientation as learning becomes attuned to the constraints and resources of the environment. (p. 89)

Anatomy of PBL

To better conceptualize and thus understand the foundations of PBL, it is necessary to trace its roots in theories of learning and human growth and development. In this regard, it seems profitable to explore the concept of "affordances".

Myers Kelson writes that the Gibsons theorized that learning to perceive affordances in the environment played a significant role in a child's development. The term "affordances" is used in the sense first proprosed by perceptual psychologist James Gibson (J. J. Gibson, 1977b, 1979; E. J. Gibson, 1982, 1991). J. J. Gibson (1979) described affordances as "what the environment offers to the animal, what it provides or furnishes for good or ill" (p. 127). He illustrates the concept with the following example. If a surface is nearly horizontal as opposed to slanting, nearly flat, sufficiently extended relative to the size of the animal, and rigid relative to the weight of the animal, then the surface *affords* support. Although affordances in this original sense are physical properties, the properties that define the affordance have unity only relative to the animal (1979, p. 127). However, affordances are not invented or read into events by the perceiver. They reside in an objective sense in the environment. They are a function of features of the object, there to be perceived. A lever affords facilitation of moving something even in the case of a small child who is as yet ignorant of its utility. He or she simply does not perceive its affordance (E. J. Gibson, 1991).

According to Myers Kelson, here the concept of affordances is extended to problems. First, the term "problem" is used to refer to ill-structured problems (Spiro et al., 1987), those which by definition are problematic because they present less information than is needed to resolve them algorithmically, because there may be more than one viable approach to resolving them, because they often demand decisions in the absence of

certainty. Second, knowledge and skills refer to all kinds of knowledge: declarative, procedural and situational. (p. 321)

In extending the concept of affordances to problems, it will be argued that problems afford both resolutions and learning. A problem affords a particular set of resolutions and not others. Just as the object's affordance of support is a function of the knowledge and skill demands of the problem. The possible problem resolution (s) only come together as a meaningful unit, however, relative to the problem solver, in particular, relative to the extent to which the problem-solver is able to engage in dynamic interplay between the features of the problem itself and its knowledge and skill demands. This in turn, is a function of the problem solver's ability to perceive and respond to the problem's knowledge and skill demands (cf. Bransford, Franks, Vye, & Sherwood, 1989). The knowledge and skill demands, however, are not invented or read into the problem by the problem solver. They reside in the problem itself. Hence, different problem solvers may arrive at different resolutions, and these may be of varying quality. (p. 322)

Myers Kelson continues to write that some knowledge and skill demands of the problem may not represent competencies of the problem solver. When this is the case, the problem has the potential of *affording learning* for that problem solver. If problem solving proceeds in the absence of these competencies, some possible resolutions will not be perceived and other non-viable ones may not be discarded. If, on the other hand, the learner attunes to the problem's knowledge and skill demands, assesses his or her own competence with respect to these, and carries out strategic action to acquire the requisite competencies, and returns to the problem, armed with these newly acquired competencies, then the problem has afforded learning as well as problem solving. (p. 322)

Two substantive examples to substantiate these concepts are offered by Myers Kelson. First from medicine (the original domain of PBL), a medical problem in which a patient presents numbness and tingling in the hands and feet may suggest a set of hypotheses that might initially include peripheral blood clots, diabetic neuropathies, toxicity, and spinal injury. There are, no doubt, others. The actual problem itself, however, affords some (or none) of these resolutions and not others. Arriving at an (or the) optimal resolution is a function of the problem solver's ability to engage in dynamic interplay between the features of the actual problem, most of which initially may not be apparent, and the problem's knowledge and skill demands. For this problem, the latter might include neuroanatomical and neurophysiological mechanisms that can produce these sensations. It might include knowledge of peripheral vasculature and blood clots, of diabetic neuropathy, and of the source, of tertiary syphilis, of absorption and metabolism of Vitamin B12. It might include skills in eliciting specific neurological findings and assessing circulation. It would include much more. The problem solver does not impose these knowledge and skill demands. The problem makes the demand. The problem solver who approaches the problem with a deficit in the knowledge and skill demands of the problem will fail to perceive the full range of viable resolutions, will be unable to engage effectively in uncovering the relevant features of the problem, and will consequently be unable to rule in or rule out hypotheses appropriately. However, the problem solver who recognizes his own deficit with respect to the knowledge and skill demands, resolves the deficit and returns to the problem armed with additional knowledge and skill, not only stands in better stead to resolve the problem, but has acquired knowledge in the process. (pp. 322-323)

Can one, however, writes Myers Kelson, arrive at a resolution in the absence of extensive knowledge? Absolutely! However, beyond making a lucky guess, the quality of the resolution is a function of the extent to which the problem solver is able to work with the knowledge and skill demands of the problem to uncover the problem's salient features and to reason to a resolution. For example, the problem solver may be armed with only the rather superficial knowledge that "glove and stocking" numbness and tingling are commonly associated with diabetes. A quick diagnosis based on this pattern of clinical correlates may through happenstance correspond with a more thoughtful diagnosis based on deep reasoning. This single hypothesis may trigger a search for a salient problem feature: abnormal glucose indices. The problem solver could happen to hit pay dirt. However, this superficial knowledge alone will not be sufficient to arrive at a resolution should the patient's blood glucose indices be normal. (p. 322)

A non-medical example is offered by Myers Kelson that involves the challenge of creating a landscape design for a particular site. The problem – with its geographic, climatic, and access feature, budget, owner, preferences etc. – affords certain resolutions and not others. The problem also demands certain knowledge and skills – knowledge of horticulture, geology, hydrodynamics, skill at lay-out, to name a few. Arriving at an optimal resolution is a function of the problem-solver's ability to work creatively within the problem's knowledge and skill demands and the features of the problem itself. Is it possible to create a landscape design in the absence of knowledge that the problem demands? Most of us can attest to the fact that it certainly is! However, the quality of the design is directly related to the extent to which the problem solver is competent with respect to knowledge and skill demands of the problem and can use these competencies to address the problem's features. Similarly, the power of the problem to drive further

learning is a function of the extent to which the problem-solver is motivated to resolve identified knowledge and skill deficiencies in order to increase the likelihood of an optimal resolution of the problem. (p. 322)

Myers Kelson concludes by saying that following the Gibsons (J. J. Gibson, 1977a, 1977b; E. J. Gibson, 1982, 1991), she hypothesizes that learning to perceive and address problem affordances, both resolution affordances and learning affordances, plays a significant role in the development of expertise. (p. 323)

Derivations and Contexts of PBL

Before providing a direct review of definitions of PBL, it seems appropriate to touch on the related concepts of life long learning and the connections between problem solving, knowledge, and knowledge acquisition.

According to Myers Kelson, Bereiter and Scardamalia (1989) used the term "lifelong learner" to mean one who expects learning to be a part of life and establishes patterns that make this possible. Here, the basic definition will be expanded to include not only the expectation and development of patterns for learning but also the habituation of learning and problem solving as an orchestrated whole. Such an individual will be referred to as the "proactive lifelong learner." This is not merely the individual with an insatiable, freestanding curiosity about knowledge in general or topics in particular, a curiosity that would take a lifetime to satisfy, though this is certainly an admirable quality. Rather, the term is used to refer to the individual for whom any problem triggers a dual demand: the need to problem-solve and the need to know. (p. 320)

Myers Kelson writes that the development of expertise involves many variables (cf. Ericsson, 1996; Sternberg, 1996, 1998). The development of expertise is dependent on

learning from or within experience, not just on having experience. There is an old saw that says, "One can have 20 years' experience or the same year's experience 20 times. They are not the same." According to Myers Kelson, Bereiter and Scardamalia (1993) hypothesized the following process related to the development of expertise: Initially demanding tasks become automatic or proceduralized (Anderson, 1982), freeing up mental resources. The would-be expert is one who reinvests these freed-up resources in the activity itself. This reallocation may involve consciously refining the process by chunking elements into patterns – enabling proceduralization (Chi, Glaser, & Rees, 1982), or it may involve directing deeper or more creative attention to the problem's affordances. Either has the potential for moving the problem solver farther along the expertise continuum. Myers Kelson continues to write that Bereiter and Scardamalia (1993) suggested that the expertise comes not from merely solving many problems in a domain but from extending oneself beyond each of these problems, thus continually adapting to an environment that is constantly changing in ways that require still higher levels of expertise. The proactive lifelong learner is positioned to develop expertise. He or she has acquired an approach to problem solving that actively searches for problem affordances and invests cognitive resources so as to maximize these affordances both in the direction of the problem's optimal resolution and in adding to his or her general repertoire of knowledge and skills. Curriculum and assessment systems that model closely this interplay between knowledge acquisition and problem solving have the greatest chance of producing a learner practiced in the behaviors that will sustain learning across a lifetime. (p. 324)

Gijselaers (1996) writes that PBL derives from the theory that learning is a process in which the learner actively constructs knowledge (p.13). According to Gijselaers,

Barrows, one of the major contributors to the field, defined PBL as "the learning which results from the process of working toward the understanding of, or resolution of, a problem". The problem is encountered first in the learning process (Barrows and Tamblyn, 1980)." Barrows also describes PBL as an approach to education that moves away from situating domain knowledge in context; rather, it builds from the knowledge affordances of the problem context itself (Barrows, 1992; Barrows and Tamblyn, 1980). According to Myers Kelson, PBL does two things. It builds a curriculum from the complex affordances of a set of common and important problems of the profession. Second, it places the responsibility for attuning to and addressing these affordances on the student. Consequently, PBL offers a consistent model as students move along on the continuum from novice to developing expert, and it provides persistent practice in attuning, assessing, addressing and applying with respect to problem affordances. In PBL, students, as novices, are expected to approach problems as a developing expert. However, the more novice the student, the more he or she directs attention to addressing identified deficiencies in knowledge by attending to the learning affordances of the problem. As the student moves through the curriculum, and along the novice-expert continuum, the developing knowledge and skill base allows for freeing up of resources that may then be reallocated to refining the approach to the problem and adding depth and breadth to the knowledge base. The student gains knowledge and becomes a more proficient problem solver, all the while practicing the patterns that define the proactive lifelong learner. (pp. 327 – 328)

Barrows (1996) writes that in spite of the many variations of PBL that have evolved during its dissemination as a new method in medical education, a core model or basic

definition with which others can be compared is needed. The original method developed at McMaster works well as this model. Its characteristics are these:

Learning is Student-Centered. Under the guidance of a tutor, the students must take responsibility for their own learning, identifying what they need to know to better understand and manage the problem on which they are working and determining where they will get that information (books, journals, faculty, on-line information resources, and so forth). "Resource faculty" in many different subject areas are available to the students as consultants. This allows each student to personalize learning so as to concentrate on areas of limited knowledge or understanding, and to pursue areas of interest.

Learning Occurs in Small Student Groups. In most of the early PBL medical schools, groups were made up of five to eight or nine students. Characteristically, at the end of each curricular unit, the students are resorted randomly into new groups with a new tutor. This gives them practice in working intensely and effectively with a variety of different people.

Teachers Are Facilitators or Guides. At McMaster, the group facilitator was referred to as a "tutor". This role was often defined in negative terms. It was someone who did not give students a lecture or factual information, did not tell the students whether they were right of wrong in their thinking, and did not tell them what they ought to study or read. The role is better understood in terms of metacognitive communication. The tutor asks students the kinds of questions they should be asking themselves to better understand and manage the problem (Barrows, 1988). Eventually the students take on this role themselves, challenging each other. To inhibit the tutor from falling back on old teaching reflexes and giving the students direct information and guidance, McMaster

promoted the concept of the "non-expert" tutor. This meant that tutors should perform in curricular units where they were not content experts. It seems generally agreed now that the best tutors are those who are expert in the area of study, only they must also be expert in the difficult role of tutor.

Problems Form the Organizing Focus and Stimulus for Learning. In PBL for medicine, a patient problem or a community health problem is presented in some format, such as a written case, case vignette, standardized (also called *simulated*) patient, computer simulation, or videotape. It represents the challenge students will face in practice and provides the relevance and motivation for learning. In attempting to understand the problem, students realize what they will need to learn from the basic sciences. The problem thus gives them a focus for integrating information from many disciplines. The new information is also associated with cues patient problems present. All this facilitates later recall and application to future patient problems.

Problems Are a Vehicle for the Development of Clinical Problem-Solving Skills. For this to happen, the problem format has to present the patient problem in the same way that it occurs in the real world, with only the patient's presenting complaint or symptoms. The format should also permit the students to ask the patient questions, carry out physical examinations, and order laboratory tests; all in any sequence. The students should get the results of these inquires as they work their way through the problem. Such formats as the "P4" (Barrows and Tamblyn, 1977), the PBL Module (Distlehorst and Barrows, 1982), standardized patients (Barrows, 1987), and computer simulations can allow for free inquiry as in clinical practice.

New Information Is Acquired Through Self-Directed Learning. As a corollary to the characteristics already described (the student-centered curriculum and the teacher as

faciliator of learning), the students are expected to learn from the world's knowledge and accumulated expertise by virtue of their own study and research, just as real practitioners do. During this self-directed learning, students work together, discussing, comparing, reviewing, and debating what they have learned. (pp. 5 - 6)

The following exhibit contains an example of a first-year problem from the problem-based business program of the University of Limburg, Maastricht, the Netherlands, that is based on Barrows' definition of PBL. This problem is presented about three weeks after students have entered the business program. The problem is one in a series how organizations should be structured and how they should formulate their organizational strategy given certain market demands.

> For more than fifty years, the Lee Company of Merriam, Kansas, did a good steady business. In the 1960's and 1970's, Lee Riders were riding high as jeans became fashionable among women as well as men. Lee couldn't make jeans fast enough. Recently, however, ten plants were closed down. Furthermore, Lee's international sales decreased despite enormous demand in foreign countries. Nowadays, Chief Executive Officer Fred Rowan is struggling to reorient Lee to suit the changes in the external environment. In order to make a sound reorientation, what is the first thing Fred should do? (Gijselaers, 1996, p. 17)

Gijselaers continues to write that when using PBL, the first step students take is to make sure everybody understands all of the concepts and terms used in the problem. Students can raise questions about the concepts of organizational environment, dynamics of market behavior, and market share. Depending on their prior knowledge, students ask for more information about certain concepts in the Lee Company problem. This step serves as an important purpose in the learning process. Learning new information is

based on existing knowledge. The first step of clarifying concepts elicits and activates existing knowledge. The primary analysis of the problem serves to activate prior knowledge, allowing students to couple new information to existing knowledge. Consequently, as the tutor listens, he or she gets information about students' existing knowledge and their naïve beliefs about the mechanisms underlying the problem.

During the next step, Gijselaers writes, students define and analyze the problem. For example, in discussing the problem, students may question why in a stage of growing market demand, Lee Company is not able to sell jeans. At this point, students are confronted with conflicting information: there is a substantial market demand; in the past, Lee was more or less surfing on market demands because production could not keep pace with demand; and now market demand is still growing, but Lee is unprofitable. This problem increases their interest in knowing more about organizational behavior and market analysis, because the information in the problem conflicts with their naïve beliefs about market demand and opportunities to sell products, which say that if market demand is large, Lee Company should not have these problems.

At this stage, Gijselaers continues, a tutor who understands the role well will not tell students whether they are right or wrong in their thinking. The tutor resists giving the "right" solution. In the perspective of teaching metacognitive skills, a tutor asks questions that monitor the process of problem-solving action. This models the kind of questions that students should be asking to identify the nature of the problem and the kind of knowledge required to understand it. These questions also lead students from the concrete problem and toward conceptual knowledge. Another important tutor role is to teach students how they can take on the role of expert. That is, the tutor asks students to reflect upon their own problem-solving behavior, and emphasizes that acquiring

knowledge is a means, not an end. Knowledge is instrumental in the pursuit of competence in effectively managing problems.

As a result of discussing the problem, Gijselaers states, students study the relationships between the environment of an organization and organizational behavior. Possible learning issues are: How does the environment of the organizations influence organizational behavior? What kind of organizational strategies are most effective given certain market features? How do you conduct a marketing opportunity analysis to determine how a company can be restructured in response to market demands?

Gijselaer concludes by writing that the PBL process is completed when students report in a subsequent group session about what they have learned. At this stage, learning occurred because students were motivated by issues raised during the initial discussion of the problem. They wanted to understand the problem. When students report on what they have learned, the tutor provides feedback regarding whether the original learning issues have been resolved and whether students understand the issues behind the problem in sufficient depth. This particular case provides the context for learning new information and serves as a stepping-stone for students to acquire knowledge about the general problem domain. It also enables students to observe how knowledge from one problem may be transferred to new problem situations. (pp. 17-19)

Savin-Baden writes that Barrows (1986) has suggested that the combination of variables for PBL, when linked to the educational objectives, is endless. He concluded that the term, PBL, must be considered a genus from which there are many species and

subspecies. As such, all types of problem-based learning must be evaluated in terms of issues such as the type of scenarios, assessment methods, learners' autonomy and the way in which teaching and learning occurs. Barrows has thus proposed a taxonomy of PBL methods that explain different meanings and uses of problem-based learning. The taxonomy has highlighted the educational objectives that it is possible to address through problem-based learning and it has included the following combination of varieties in use:

1. Lecture-based cases – students are presented with information through lectures and then case material is used to demonstrate that information.

2. Case-based lectures – students are presented with case histories or vignettes before a lecture that then covers relevant material.

3. Case method – students are given a complete case study that must be researched and prepared for discussion in the next class.

4. Modified case-based – students are presented with some information and are asked to decide on the forms of action and decisions they may make. Following their conclusions, they are provided with more information about the case.

5. Problem-based – students meet with a client in some form of simulated format that allows for free inquiry to take place.

6. Closed-loop problem-based – this is an extension of the problem-based method, where students are asked to consider the resources they used in the process of problem-solving in order to evaluate how they may have reasoned through the problem more effectively. (p. 18)

Margetson (1991) suggested that PBL should be seen as more than just a different method of learning, but rather as a specific stance towards both knowledge and the position of the student in the learning process. PBL may be seen as "a conception of knowledge, understanding, and education profoundly different from the more usual conception underlying subject-based learning". (pp. 43 – 44)

Savin-Baden also writes that Walton and Matthews (1989) have argued that PBL is to be understood as a general educational strategy rather than merely a teaching approach, and have noted that there is no fixed agreement as to what does and what does not constitute problem-based learning. However, they have argued that for PBL to be present, three components must be able to be differentiated. The three broad areas of differentiation are as follows:

1. Essential characteristics of PBL that comprise curricula organization around problems rather than disciplines, an integrated curriculum and an emphasis on cognitive skills.
2. Conditions that facilitated PBL such as small groups, tutorial instruction and active learning.
3. Outcomes that were facilitated by PBL such as the development of skills and motivation, together with the development of the ability to be lifelong learners.

This particular interpretation of PBL offers modes of understanding this educational strategy that take account of the complex nature of learning. At the same time it is an interpretation that encapsulates the differing ways in which students learn in diverse professions across a variety of institutions. (pp. 19 - 20)

In summary, problem-based learning is a pedagogical strategy for posing significant, contextualized, real world situations, and providing resources, guidance and instruction to learners as they develop content knowledge and problem-solving skills (Mayo, Donnelly, Nash & Swartz, 1993). In problem-based learning, students collaborate to study the issues of a problem as they strive to create viable solutions. Unlike traditional instruction, which is often conducted in lecture format, teaching in problem based learning normally occurs within small discussion groups of students facilitated by a faculty tutor (Aspy, Aspy, & Quimby, 1993; Bridges & Hallinger, 1991).

Because the amount of direct instruction is reduced in problem-based learning, students assume greater responsibility for their own learning (Bridges & Hallinger, 1991). The instructor's role becomes one of subject matter expert, resource guide, and task group consultant. This arrangement promotes group processing of information rather than an imparting of information by faculty (Vernon & Blake, 1993). The instructor's role is to encourage student participation, provide appropriate information to keep students on track, avoid negative feedback, and assume the role of fellow learner (Aspy et al., 1993).

The Significance of PBL

Myers Kelson writes that since the mid 1980's, various educational organizations have been calling for educational reform among their constituents (e.g., General Professional Education of the Physician (GPEP) Report, 1984, a call for reform of medical education; National Commission on Excellence in Education, 1983, a call for reform of public school education; and the Secretary's Commission on Achieving

Necessary Skills (SCANS) Report, 1991, for insight into workplace demands of schools; Learning a Living: A Blueprint for High Performance, 1992; the Wingspread Conference, 1994; and The National Research Council, 1996). According to Myers Kelson, concern is expressed that students are engaged primarily in rote learning, which entails the acquisition of facts that have little staying power. Critics note that in schools, students are being asked to absorb greater and greater quantities of factual knowledge but are not being challenged to apply knowledge and skills to novel situations. They are being asked to complete assignments covering designated curricular objectives but are given far too little experience in problem solving or in critical thinking. These "passive" recipients of instruction show little initiative when encountering challenging situations. Their school experience leaves them with neither the propensity nor the skills for lifelong learning. These expressed concerns can be traced to the actual outcomes of curricula and assessment systems that have reduced expected outcomes to sets of educational activities and tests of factual knowledge. Thus, the call for reform demands a radical restructuring of both curriculum and assessment, one in which the actual outcome and the expected outcome are congruent. (p. 319)

Myers Kelson continues to write that standards currently being produced and distributed by national organizations in response to calls for reform almost universally include both a lifelong learning component and a problem-solving or critical thinking component (GPEP, 1984; SCANS, 1991). Employers across all spectra of the workplace are challenging educational institutions to turn out students who are ready to take on the challenges of a work environment through adaptive problem solving and continuing

learning (Feltovich & Barrows, 1997). True to form, however, there appears to be uniform agreement that while lifelong learning is an important goal of education it is addressed in a typical schoolwork manner. It is converted into assignments such as making note cards, doing computer searches, or writing reports. The outcome is predictable. Students, and very often teachers, see the completion of the assignment as the educational focus. Any skills acquired that might be useful in another context are acquired incidentally and are likely accessible, if at all, only when someone gives a similar assignment. What is needed is not simply a call for reform, but a way to operationalize lifelong learning as both a pedagogical method and as an outcome. (p. 320)

The proactive lifelong learner, the objective for our educational endeavor, is more than a combination of problem-solver and independent learner, however, according to Myers Kelson. The outcome sought is an individual who, on encountering a challenging situation, as an integral part of problem solving, identifies issues about which he or she needs to know more, skills he or she needs to have, ambiguous knowledge that needs further elucidation, and concepts that he or she needs to rethink. Furthermore, these responses should be automatic assuming they were developed within a system of valued and rewarded practice (cf. Bereiter & Scardamalia, 1989). This "need to know" must be afforded by the problem itself, not initiated from some source external to the problem (cf. Bransford, Sherwood, Vye, & Rieser, 1986; E. J. Gibson, 1982; J. J. Gibson, 1977a, 1977b), concludes Myers Kelson. (p. 320)

Similarly, this automatically triggered, need to know, sets in motion a preliminary plan for addressing that need, a plan that interdigitates with the problem-solving process – the plan itself is situated in the problem according to Myers Kelson. For this reason, recognizing the need to know is not met with foreboding but with enthusiasm. The proactive lifelong learner has a repertoire of sources and skills that immediately begin to come together to form an initial, flexible frame of a plan for acquiring the needed knowledge, skills or both. (p. 320-321)

According to Savin-Baden (2000), the largest area of growth in the use of PBL is in the area of professional education. This can be seen in the diversity of literature and texts that offer guidance to those in professional education wanting to implement PBL. It is also increasingly being seen in professional education as a means of managing the growing and widening knowledge base of individual professions, since curricula can no longer expand to cope with such demands. As a result students in professional education are increasingly being equipped to "manage knowledge" rather than being expected to have assimilated it all before qualification. Thus it can be seen that experimentation around the use of problem-based learning has been shaped by new questions being raised about professional in the context of unprecedented world expansion in higher education in the 1960's and again during the 1980's and late 1990's. (p. 21)

Savin-Baden continues justifying the use of PBL by writing that there are other trends, which influence its use in the higher education curriculum. PBL offers opportunities for students to learn in teams, develop presentation skills, learn negotiation abilities and develop research skills and many other abilities. Such skills and abilities are

highly valued by a variety of public and private sector clients. PBL is clearly recognized as offering students a means of acquiring such skills and abilities in the context of curricula where it then becomes unnecessary to bolt on extra sessions to enable students to acquire market related skills. The value here is in the centralization of activities in problem-based learning curricula, which can prompt students to engage not only with skills for life and work, but also to develop an ability to critique, instead of fragmenting the nurturing of particular activities through skills training sessions. (p. 22)

Interprofessional education is growing in the United Kingdom, according to Savin-Baden, and PBL is increasingly being viewed as a vehicle to promote and implement it. There has been a shift away from forms of shared learning where students of different professionals groups, as it were, "share" the same learning experience by receiving lectures and seminars on subjects of common ground. Instead there is an increasing desire for forms of learning to occur in which students engage with each other through debate, group work and PBL, in which they are educated with and through each other. Such forms of learning, defined here as interprofessional education, seek to enable students to develop sound understandings of different professional perspectives, to understand the similarities and differences between them, and to encourage an exploration of discipline and subject boundaries. Students are also helped to experience the different ways in which professions utilize the same knowledge in different ways. (p. 23)

There has been a decline of over thirty percent in the public funding that the United Kingdom universities have received per student since 1980 (Williams and Fry, 1994), and

the reductions continue, Savin-Baden states. Because of the shift from an elite to a mass system there has been an increased participation in higher education compared with former years, with the result that university resources are increasingly overstretched. Large student numbers, decreasing resources and overextended staff is beginning to characterize the state of higher education worldwide. For some, PBL is seen as a means of teaching a large group of more diverse students than in former years, by using less face-to-face contact. For example, if the students are learning in groups without a member of the staff to facilitate the process, then the staff can be available to undertake research and other activities that may help the survival of their department. A more cynical perspective is to suggest that new and more interesting ways of learning than lecture-based learning, such as PBL, are likely to attract students because they provide "infotainment"; a liberal mix of information and entertainment (Ritzer, 1996). Ritzer has also suggested that:

> In addition to the demands of increasingly consumerist parents and students, the pressure on colleges and universities to change is being fueled by economic factors, especially the relative decline in the funding of higher education. With outside funding being reduced, the university responds, among other ways, by cutting costs and by attempting to attract and keep more new (and paying) "customers". The new means of consumption are attractive models because they not only excel at attracting customers, but also at reducing costs. (p. 188)

According to Savin-Baden, this kind of infotainment will be particularly evident in curricula that include the added attraction of information technology and distance

learning components. Students will see kinds of learning such as this as efficient, independent, low cost and fun. Thus, universities who utilize problem-based learning "infotainment-style" will expect to attract more students whilst at the same time reducing costs. She suggests that at an organizational level PBL may be adopted to solve practical curricula difficulties as merging departments of the same discipline when two institutions unite. Alternatively, PBL may be utilized when large subject areas, such as health sciences, move into the university sector. Such schools have invariably been regional satellites with different curricula and pedagogical emphases. In instances such as this, problem-based learning has been adopted as a means of managing diverse curricula agenda. (pp. 24-25)

Bernstein (1992) has argued that through their experiences as students, individuals within higher education are in the process of identity formation. He has suggested that this process may be seen as the construction of pedagogic identities, which will change according to different relationships that occur between society, higher education and knowledge. Pedagogic identities are defined as those that "arise out of contemporary culture and technological change that emerge from dislocations, moral, cultural, economic and are perceived as the means of regulating and effecting change" (p. 3).

Thus, according to Savin-Baden, pedagogic identities are characterized by the emphases of the time. For example, in the traditional disciplines of the 1960's, students were inducted into the particular pedagogical customs of those disciplines, whereas pedagogic identities of the 1990's were characterized by a common set of market-related, transferable skills. The difference between the two identities is that, while pedagogic

identities are seen to be those that arise out of contemporary culture and technological change, learner identities emerge from the process through which students seek to transcend subjects, disciplines and the structures embedded in higher education. Thus, in developing learner identities, some students are enabled to shift beyond frameworks that are imposed by culture, validated through political agenda or supplied by academics. They are facilitated in developing for themselves, possibly through an approach such as PBL, the formulation of a learner identity that emerges from challenging the frameworks, rather than having those systems and frameworks imposed upon them. (p. 32)

In relating this process of self discovery to the burst of innovations in technology, according to Savin-Baden, it has been argued:

> The technology is changing rapidly but underlying constructivist models of learning are not part of the revolution. Learners still need to do things, to have a sense of audience for, and feedback on, what they are doing, to feel personal progress, to be provoked and guided in their learning and to celebrate their own capabilities whilst acknowledging those of others. (Heppell and Ramondt, 1998, p.26)

For the most part, Savin-Baden writes, PBL would seem to offer many students the opportunity of (re) discovering their learner identity by learning to "make sense" for themselves. The result is that PBL can go some way in helping students to understand their situations and frameworks and thus present opportunities for personal and pedagogical shifts to take place in their lives. (p. 34)

According to Dolmans and Schmidt (2000), in PBL, students are actively involved in their own learning. Preliminary discussion in the small group will help students mobilize whatever knowledge is already available. Based on this prior knowledge, learners actively construct explanatory models, which in turn facilitate the processing and comprehension of new information. In addition, the new information is better understood because students are stimulated to elaborate on it. Elaboration in the tutorial group takes place through discussion and through answering questions. These activities help students construct rich cognitive models of the problems presented to them (Schmidt, 1993) because both conditions, activation of prior knowledge and elaboration, facilitate students' learning. Illustrative evidence for these claims comes from two experiments conducted by Schmidt, De Volder, De Grave, Moust and Patel (1989) and by Schmidt (1984). In these experiments, participants were asked to discuss a problem and elaborate on possible explanations. Subsequently, these participants were required to study a problem-relevant text. The participants who had discussed the problem recalled much more information from the text than the control group. These data suggest that problem-based analysis is indeed an effective knowledge activation and knowledge elaboration procedure facilitating comprehension of and access to relevant new information. (Dolmans & Schmidt, 2000, p. 252)

Dolmans and Schmidt continue to write that research has also shown that educational strategies in which learning is seen as a passive process of transmitting information into memory, usually characterized by a high level of external regulation by instruction, encourage students merely to memorize information. (p. 252) On the contrary, according

to Vermunt (1989), educational strategies in which learning is seen as an active constructive process, usually characterized by a high level of internal regulation by students, encourage students to relate and structure information. It is the learner's actions that accomplish constructive activities. Educational programs should be developed in which students are encouraged to become architects of their own learning (Bereiter & Scardamalia, 1989).

According to Schmidt and Moust, further research was conducted to examine to what extent PBL affected cognitive processing. In 1984, Schmidt conducted a study focusing on students' activation of prior knowledge. He presented small groups of students attending higher professional training with the following problem: "A red blood cell is put in pure water under a microscope. The cell swells and eventually bursts. Another blood cell is added to an aqueous salt solution. It shrinks. Explain these phenomena." A few years prior to this study, during their high school years, the students involved had all been acquainted with the subject of osmosis, which is the underlying explanatory mechanism for the phenomena described in the problem. Half of the students discussed the red blood cell problem, while the other half discussed a problem about factors affecting an airplane taking off. Both groups then read a text on osmosis and diffusion. At a subsequent "free-recall test" the group that had discussed the blood cell problem remembered almost twice as much information about osmosis as the other group. This demonstrates that problem analysis in a small group indeed has a strong activating effect on prior knowledge. (pp. 29 -30)

Schmidt and Moust note that in another study Schmidt, De Volder, De Grave, Moust, and Patel (1989) presented the red blood cell problem to novices, 14-year old high school students, who had never studied the subject concerned. Therefore, the theory that these students developed about the mechanisms and processes that could be responsible for the phenomena described in the problem was expected to have a commonsense character. In an attempt to account for the swelling of the blood cell, one group assumed, for instance, that the membrane probably had valves that would let water in but would prevent it from escaping again. Another group explained the shrinking of the cell by assuming that salt has hygroscopic characteristics. According to them, the salt "soaked up" fluids from the cell in the way that it would a wine-stained tablecloth. Subsequent to the discussion, a six-page text about osmosis was distributed, both to groups that had tackled the blood cell problem and to a control group that had discussed a neutral topic. The group that had discussed the blood cell problem prior to reading the text remembered significantly more about the text than the group that had studied an unrelated topic. These findings indicate that activation of prior knowledge through problem analysis in a small group definitely facilitates understanding and remembering new information, even if that prior knowledge is only to a small extent relevant to understanding the problem – and sometimes incorrect. What is interesting, however, is that students who studied the topic of osmosis a few weeks before the experiment was conducted (called the "experts" by the authors) did not profit as much by the experimental treatment as compared to the novices, indicating that problem analysis is most helpful if students have only limited knowledge of the subject. (p. 30)

In regards to discovering the contribution of group discussion to the effect of PBL according to Schmidt and Moust, we must first of all understand that individual prior knowledge activation can be performed in several ways; for example, by giving students questions or by asking them to write down everything they remember about a topic. Does group discussion contribute more? De Grave, Schmidt, Belien, Moust, De Volder, and Kerkhofs (1984) have compared effects of problem analysis in a small group with individual problem analysis and direct prompting of knowledge about osmosis. They discovered that small-group analysis had a larger positive effect on remembering a text than individual problem analysis. Simply prompting already available knowledge had the smallest relative effect. The investigators concluded that the confrontation with a relevant problem and small-group discussion of that problem each have an independent facilitating effect on prior knowledge relative to direct prompting of prior knowledge. Group discussion, had, in particular, a considerable effect, suggesting that elaboration on prior knowledge and learning from each other, even before new information is acquired, are potent means to facilitate understanding of problem-relevant information. (pp. 30-31)

Researching further, Schmidt and Moust reported another study that was conducted focusing on cognitive processing while involved in problem discussion. Research by Moust, Schmidt, De Volder, Belien, and De Grave (1986) demonstrated that the quantity of one's contribution to the discussion and its quality were unrelated to achievement. This led the researchers to the conclusion that subjects not or less participating in the discussion elaborate as much as those who do participate without verbalizing their elaborations to the same extent as the latter. The more silent students were involved in

what they called "covert elaboration." In other words, these students are elaborating without sharing their conclusions with their fellow students. (p.32)

In an exploratory study, according to Schmidt and Moust, Geerligs (1995) investigated to what extent students participating in tutorial groups were really task-focused; for example, were actually involved in the thinking about the problem at hand. He followed five tutorial groups during ten subsequent sessions in the first and second year of the health sciences curriculum (at Maastricht University in the Netherlands). Geerligs used the technique of thought sampling for his study. At irregular intervals a beeper was activated and the tutor asked the students to write down their thoughts just before the beeper was heard. The results showed that 74% of students' thoughts were task-related, whether content-related (55%), procedure-related (11%) or reflective thoughts (8%). Task-irrelevant thoughts accounted for 16%, whereas 10% of students' thoughts were classified as miscellaneous or as reflecting an absence of thought. This research suggests that students in problem-oriented environment are, most of the time, actively involved in the processing of problem-relevant information. The Moust and colleagues (1986) study suggests that, contrary to popular belief, more silent students do not appear to be less task-oriented. (p. 32)

There is also evidence for constructive processes in small-group tutorials report Schmidt and Moust. In a recent study, De Grave, Boshuizen, and Schmidt (1996) investigated the ongoing cognitive and metacognitive processes during the phase of problem analysis by analyzing the verbal communication among group members and their thinking processes. Thinking processes were tapped by means of a stimulated

recall procedure. Directly after a tutorial session, each participant individually reviewed a videotape of the session and was requested to stop the tape whenever he or she would recall particular thoughts that came up during discussion. The investigators analyzed the verbatim transcripts or "verbal protocols" of the interaction in the tutorial group, and the "recall protocols" of individuals to study to what extent the ongoing processes could be described as theory construction, and whether there was evidence of conceptual change in small-group tutorials. The authors discovered that the verbal protocols were dominated by attempts at theory building, causal reasoning, and hypothesis testing. Considerable time was also spent on what the authors described as data exploration (finding out what the significance is of the various cues in the problem) and problem definition. Less attention was given to procedures and metareasoning. By contrast, the recall protocols reflected metareasoning. Students evaluated the appropriateness of their prior knowledge, reflected on the learning process, and reflected on strategies of thinking. It seems that, while thinking, students prepare their utterances and assess to what extent they are relevant to the task at hand. They also pay thought to the process of collaboration, although this category hardly shows up in the actual verbal interaction. This indicates that students are sensitive to the way the group collaborates and take their own contributions in this respect into account. Theory construction and evaluation are also prevalent in the stimulated recall protocols. Interestingly, the investigators found "bursts" of theory construction, alternated by data exploration. It seems that ideas are proposed in a cyclical fashion that continues during the whole session. Even in the last three minutes of the twenty-minute meeting, new ideas were proposed. In addition, the

patterns of verbal interaction and individual thought were rather similar, thoughts being both a response to what is said and a precursor. Finally, the authors presented evidence for conceptual change as a result of initial problem discussion. Students evaluate what is proposed by other students and are influenced by the arguments exchanged, leading to conceptual change. This is a somewhat surprising finding, because it was expected that conceptual changes would result largely from reading the literature. (pp. 34-35)

Schmidt and Moust question if PBL enhances a student's long-term retention of information. An assumption of constructivist learning is that education becomes more personally meaningful. If this is so, then knowledge acquired should be retained over longer periods. To test this assumption, Tans, Schmidt, Schade-Hoogeeven, and Gijselaers (1986) compared achievement of physiotherapy students randomly allocated to either a problem-based or to a lecture-based version of a course in muscle physiology. Students in the problem-based course performed significantly poorer on an immediate multiple-choice test. However, a free-recall test of core knowledge taken after six months showed the reverse effect: students under the problem-based condition recalled up to five times more concepts than the control group. This finding, along with the findings of Martensen, Eriksson, and Ingelman-Sundberg (1985), and Eisenstaedt, Barry, and Glanz (1990), suggests that PBL induces students to retain knowledge much longer than under conventional teaching conditions. Results from these studies seem to indicate that initial learning may be poorer, possibly because students under this condition learn less initially, but process the information more extensively. (p. 34)

Schmidt and Moust investigated the extent in which PBL affected intrinsic motivation. In a series of studies done by De Volder & his colleagues (De Volder, Schmidt, De

Grave and Moust, 1989; De Volder, Schmidt, Moust & De Grave, 1986), attempts have been made to see to what extent group discussion about a problem would increase intrinsic interest in problem-related subject matter. Groups were presented with either the blood cell problem or with a problem describing a plane taking off from Amsterdam airport. Immediately after the discussion, the students were asked to indicate to what extent they were interested in receiving information about osmosis. After having studied a text on the subject, they were asked whether they would like to read more about the subject and whether they were interested in additional information sent to them by the investigators. Before, as well as after having studied the text, the groups that had tackled the blood cell problem displayed significantly greater intrinsic motivation than the group that had studied the airplane problem. Schmidt (1983a) found that this higher intrinsic motivation also demonstrated itself in the fact that significantly more students participating in the blood cell discussion had signed up to attend a lecture about osmosis than those who had not participated in that discussion. Program evaluations carried out routinely in Maastricht University curricula, suggest that students consider PBL highly motivating, a fact that is also demonstrated in consumer studies of higher education carried out nationally in the Netherlands. In these studies, Maastricht University curricula are mostly nominated number one in their category, primarily because of PBL. (pp. 34-35)

A Framework for PBL

Engel (1997) writes that where problem-based learning has been adopted as the mainstay of the curriculum, its application is expected to fulfill two quite distinct purposes. One aim is to use problem-based learning as a method that will assist students

towards achieving a specific set of objectives, that is to become capable in a set of competences (see below) that will be important to them throughout their professional life, irrespective of the precise branch of the practice in which they come to practice:

1. Adapting to and participating in change.
2. Dealing with problems, making reasoned decisions in unfamiliar situations.
3. Reasoning critically and creatively.
4. Adopting a more universal or holistic approach.
5. Practicing empathy, appreciating the other person's point of view.
6. Collaborating productively in groups or teams.
7. Identifying own strengths and weaknesses and undertaking appropriate remediation, eg through continuing, self-directed learning. (pp. 18 – 19)

Engel continues to write that Barrows (1986) has analyzed the various educational practices that use the appellation "problem-based learning". Only one method of problem-based learning can be expected to contribute optimally to the achievement of the generalizable competencies cited above. This is also the only problem-based approach that will consistently support effective adult learning. The following steps present a condensed illustration of the "pure" form of problem-based learning (Barrows and Tamblyn, 1980) and may serve to support Barrow's contention.

1. Active learning through posing own questions and seeking the respective answers.
2. Integrated learning, learning in a variety of subjects or disciplines concurrently through learning in the context in which the learning is to be applied in real-life situations.

3. Cumulative learning to achieve growing familiarity through a sequence of learning experiences that are relevant to the student's goals, experiences that become progressively less straightforward but more complex, as well as less non-threatening but progressively more challenging.

4. Learning for understanding, rather than for recall of isolated facts, through appropriate opportunities to reflect on their educational experiences and through frequent feedback, linked with opportunities to practice the application of what has been learned. (p. 19)

Therefore, according to Engel, there are also important and essential components of a problem-based curriculum, which are:

1. Cumulative learning:

No subject or topic should be studied in finite depth at any one time, rather it should be reintroduced repeatedly and with increasing sophistication whenever it contributes legitimately to reasoned decision making in a problematic situation.

2. Integrated learning:

Subjects should not be presented separately but rather be available for study as they relate to a problem.

3. Progression in learning:

As the students mature so the various aspects of the curriculum (eg. working in groups, relationship between theory and practice) must change and progress.

4. Consistency in learning:

The aims of PBL must be seen to be supported in every facet of the curriculum and in the way it is implemented (e.g. students must be treated throughout as responsible adults). It

should never be perceived as merely the sugar on a bitter pill; summative assessment should be used sparingly and should test for application, not merely recall of knowledge (Feletti et al, 1983); adequate human and material resources must be available to support individual, self-directed study. (p. 23)

According to Watson and Groh (2000), when the Institute for Transforming Undergraduate Education (ITUE) was formed at the University of Deleware to promote reform of undergraduate education through faculty development and course design, the adoption of PBL into their program framed the discussion of general education reform to ensure that every student will be able to do the following:

1. Attain effective skills in oral and written communication, quantitative reasoning, and the use of information technology.
2. Learn to think critically to solve problems.
3. Be able to work and learn both independently and collaboratively.
4. Engage questions of ethics and recognize responsibilities to self, community, and society at large.
5. Understand the diverse ways of thinking that underlie the search for knowledge in the arts, humanities, sciences and social sciences.
6. Develop the intellectual curiosity, confidence, and engagement that will lead to lifelong learning.
7. Develop the ability to integrate academic knowledge with experiences that extend the boundaries of the classroom.
8. Expand understanding and appreciation of human creativity and diverse forms of aesthetic and intellectual expression.

9. Understand the foundations of U.S. society, including the significance of its cultural diversity.

10. Develop an international perspective in order to live and work effectively in global society. (Engle, pp. 20-21)

According to Engle, there are consequences in using PBL. First, a central education committee will need to ensure that the overall curriculum, with its progression through the years of the course and its philosophy, is implemented through sub-committees that are not staffed on the basis of subject representation (Clarke, 1984). Second, each system needs to develop a "discipline map" that provides a hierarchical overview of the principles and concepts which the subject experts expect students to learn. When this concept has been justified in terms of curriculum objectives, to the satisfaction of the education committee, it can be transformed into a "road map" that shows when the principles and concepts are studied, repeatedly, in relation to the agreed progression of problems. Third, an overall curricular structure must be devised that allows students to progress towards mastery in each of the generalizable competences. Fourth, the academic staff need time to become informed about the need for change, the nature of the change and its consequences. (pp. 23-24)

Listed below is the table developed by Barrows and Tamblyn further illustrating the process to follow when using the "pure" form of PBL (Engel, pp. 20 –21).

Table 2.1 Condensed Illustration of the "Pure" Form of PBL

The first problem-based groups session

The process	The goals	The outcomes
The tutor starts the session with the presentation of a problem that a new graduate might be faced with. He or she may show a short video tape, play a brief audio recording or distribute a written account.	The students are stimulated to attempt to tackle a realistic problem in the field in which they wish to become competent.	Learning in the context in which it is to be applied is remembered longer and can be retrieved more easily for application in the context in which it is to be used. Relevance to the goals of the learner provides an incentive to learning.
The students are expected to organize their thoughts about the problem and to attempt to identify the broad nature of the problem and the factors or aspects involved in the problem.	The students practice observation and succinct presentation of what has been observed. The students are challenged to begin by applying their existing knowledge and experience.	Learning is cumulative, leading to increasing familiarity. Stimulation of existing knowledge facilitates anchoring of the new knowledge.
After a period of brainstorming in relation to underlying causes, mechanisms and solutions the students are encouraged to examine each of their suggestions more critically.	The students are given constant practice in a logical, analytical, and scientific approach to unfamiliar situations.	This facilitates the progressive development of a mental process for the storage, retrieval and application of knowledge.
Throughout the discussion the students will quite naturally pose questions on aspects that they do not understand or need to know more about. These questions will also be recorded by the scribe.	The students are consistently encouraged to identify what they do not yet understand or know and to regard this as a challenge to further learning (not as a disgrace).	Adults find it easier to learn if they can ask their own questions and seek answers to their own questions.
Before the end of the session, the tutor will help the students to concentrate on questions that are particularly important at this stage of their studies. The students decide which of these questions they will all want to follow up and which questions they will leave to individuals who will subsequently teach their fellow students.	Students are helped to recognize that nothing is ever learned completely, and that learning in a variety of subjects/topics is concurrent in order to be applied in an interrelated fashion. Also that when a great deal has to be learned, the task needs to be shared with other students.	Integration of learning assists integrated application. Cooperation is fostered instead of competition with colleagues.

The second session

The process	The goals	The outcomes
The tutor starts the session by encouraging the students to reflect on what they have learned towards answering the questions that are still on the flipchart or board. They will start by exploring each others' answers to the questions which all the students had decided to follow up. The next step is to invite individual students to pass on to their peers the insights they have gained from their study of questions which they alone had agreed to tackle.	The students practice exchanging information on the usefulness of various sources of information. They practice sharing new learning by presenting it to their peers and by questioning each other.	They learn how to obtain information from various sources, including consultation of experts. They learn how to convey information and how to question others critically but without causing offense. Active use of what has been learned and feedback on how well new learning has been assimilated help to embed new information in long-term memory. Students learn how to compare their performance with that of their peers and to identify their own strengths and weaknesses.
New knowledge and understanding is applied to the original problem. The students consider whether their earlier conjectures or hypotheses can be reordered or refined, and what further information about the problem will assist in its further exploration. Throughout both sessions the tutor can provide further data about the problem when the students have advanced cogent reasons for access to such information. A definitive resolution of the problem may not be necessary, particularly early in the course.	The students practice the application of new knowledge to the original or similar problem.	They practice transfer of knowledge through application in a realistic context.
Perhaps, once every two weeks, at the very end of a second session, the tutor will call "time out" and stimulate the group to reflect on how their studies are progressing, what they have learned, how their learning fits together, how they, as individuals, are progressing and how they have functioned as a group.	Students are encouraged to reflect on what they have learned, how they have learned and how they have contributed to the group's work.	Reflection on recent experiences is an effective method of learning; wisdom through reflection.

According to Savin-Baden, Boud (1985) suggested that PBL differs according to the nature of the field and the particular goals of the program. He noted that developments in PBL have drawn on a number of ideas in addition to problem-centeredness, the most important of which he sees as student-centeredness. Boud subsequently outlined eight other characteristics of many problem-based learning courses:

1. An acknowledgement of the base of experience of the learners.
2. An emphasis on students taking responsibility for their own learning.
3. A crossing of boundaries between disciplines.
4. An intertwining of theory and practice.
5. A focus on the process of knowledge acquisition rather than the products of such processes.
6. A change in staff role from that of instructor to facilitator.
7. A change in focus from staff assessment of outcomes of learning to student self- and peer assessment.
8. A focus on communication and interpersonal skills so that students understand that in order to relate their knowledge, they require skills to communicate with others, skills which go beyond their area of technical expertise.

Savin-Baden continues writing that what is required are forms of PBL that not only offer students opportunities for crucial contestability but also simultaneously offer them real choices about what and how to learn. Critical contestability is a position whereby students understand and acknowledge the transient nature of a subject and discipline boundaries. They are able to transcend and interrogate these boundaries through a

commitment to exploring the subtext of subjects and disciplines. Knowledge is thus contingent and contextual and as students interrogate the boundaries, the boundaries move continually in relation to one another. This will mean that a move is required beyond mere dialogue about the relationship between conflicting experiences and ideological images. Curricula are required that offer opportunities in learning that may enable students to realize how they construct their learner stances in relation to learner identity, learning context, peers, staff, and past, present and future learning. This demands an understanding of the kinds of problem-based learning that embrace the notion of critical contestability and that bridge or fill the gaps between competing agenda. PBL for critical contestability will offer students opportunities to embrace, challenge, or transcend the theories and practice put before them. Yet what might be the mean by which students can be enabled and supported in the development of a learner identity that reflects the notion of critical contestability? In order to address this question the kinds of problem-based learning curricula on offer need to be examined, some of which go some ways towards the ideal of critical contestability and others which offer little beyond instrumental reasoning. The following series of models (see Table 2.2) are offered as a means of understanding ways in which learners are enabled and disabled in the process of constructing knowledge for themselves, depending on the form of PBL with which they are faced. (pp. 123-125)

Table 2.2 Models of Problem-Based Learning

Categories	Model 1 *PBL for Epistemological Competence*	Model II *PBL for Professional Action*	Model III *PBL for Interdisciplinary Understanding*	Model IV *PBL for Transdisciplinary Learning*	Model V *PBL for Critical Contestability*
Knowledge	Propositional.	Practical and perform-ative.	Propositional, performative and practical.	The examining and testing out of given knowledge and frameworks.	Contingent, contextual and constructed.
Learning	The use and management of a prepositional body of knowledge to solve or manage a problem.	The outcome-focused acquisition of knowledge and skills for the work place.	The synthesis of knowledge with skills across discipline boundaries.	Critical thought and decentering oneself from disciplines in order to understand them.	A flexible entity that involves interrogation of framework.
Problem scenario	Limited – solutions already known and are designed to promote cognitive understanding.	Focused on real-life situation that requires an effective practical solution.	Acquiring knowledge to be able to do, therefore centered around knowledge with action.	Characterized by resolving and managing dilemmas.	Multidimensional, offering students options for alternative ways of knowing and being.
Students	Receivers of knowledge who acquire and understand prepositional knowledge through problem-solving.	Pragmatists inducted into professional cultures who can undertake practical action.	Integrators across boundaries.	Independent thinkers who take up a critical stance towards learning.	Explorers of underlying structures and belief systems.
Facilitator	A guide to obtaining the solution and to understanding the correct prepositional knowledge.	A demonstrator of skills and a guide to "best practice".	A coordinator of knowledge and skill acquisition across boundaries of both.	An orchestrator of opportunities for learning (in its widest sense).	A commentator, a challenger and decoder of cultures, disciplines and traditions.
Assessment	The testing of a body of knowledge to ensure students have developed epistemological competence.	Testing of skills/competencies for work - place supported by body of knowledge	The examination of skills and knowledge in a context that may have been learned out of context.	Opportunity to demonstrate integrated understanding of skills and personal/propositional knowledge across disciplines	Open-ended and flexible.

Model I, according to Savin-Baden, is characterized by a view of knowledge that is essentially propositional, with students being expected to be competent in applying knowledge in the context of solving, and possibly managing, problems. Those wedded to a concept of knowledge of this sort would be unlikely to debunk the myths connected with this view of knowledge since in Model I what counts as valid knowledge is defined in advance and all other viewpoints are largely ruled out. Students are expected, therefore, to know how to use propositional knowledge to solve given problems. Thus, knowledge is seen as being certain and the solutions of the problems are already known to the staff and known to be specific by the students. Problem-based learning is therefore used as a means of helping students to learn content. As such, problems situations are seen as the means by which students become competent in knowledge management and in covering the required content in the curriculum. In practice, problem-based learning will largely be based within a particular discipline area, such as economics or engineering, and the problem scenarios will be based on key concepts about which students are expected to know. Model I has many of the components of problem-based learning. What is different about Model I is that problem-based learning is also being used to enable students to develop problem-solving abilities, to become competent in applying their knowledge to solve problems, and, in parallel with professional practice, to test students' understanding of what has been taught. (pp. 125-126)

Savin-Baden writes that Model II of problem-based learning has, as its overarching concept, the notion of "know how". Action is seen here as the defining principle of the curriculum whereby learning is both around what it will enable students to do, and

around mechanisms that are perceived to enable students to become competent to practice. Through this process of problem-based learning, students learn how to problem-solve and to become competent in applying this ability to other kinds of problem scenarios and situations within given frameworks. So, the students develop critical thinking skills for the work place, interpreted somewhat narrowly as the ability to use problem-solving abilities in relation to propositional knowledge as a means of becoming competent in the work place and being able to turn on these skills at any given point. (p. 128)

This kind of model, Savin-Baden remarks, is seen and has to a large extent emerged from, those curricula that have strong links with public and private industry and which are largely influenced by the world of work such as business studies, social work, and occupational therapy. The limit of this model is its tendency to focus on skills acquisition in the context of the university with the somewhat mistaken assumption that these can necessarily be transferred to the world of work (Bridges, 1993; Harvard et al., 1998). What will be needed in this kind of problem-based learning are concepts of skills and know-how firmly rooted in the notion of skills *with* cognitive content and professional judgment. (p. 129)

In Model III of problem-based learning, Savin-Baden explains, there is a shift away from a demand for mere know-how and propositional knowledge. Instead, problem-based learning becomes a vehicle to bridge the gap between the know-how and know-that and between the different forms of disciplinary knowledge in the curriculum. In practice what occurs is an attempt by staff to develop in their students a form of understanding

that is interdisciplinary, both across forms of propositional knowledge and in the sense of using meta-skills across the boundaries of the world of work and the academic context. (p. 130)

In Model III the student works, learns, and develops herself *within* subjects and disciplines, Savin-Baden states. She (the student) understands that disciplines taught as discrete entities do overlap, but that she must make the necessary connections for herself. The connections she makes are in the relationships *between* the disciplines. Learning is therefore seen here as knowing and understanding knowledge from the disciplines, and also recognizing the relationship between them, so making sense for herself both personally and pedagogically. This kind of problem-based learning unites disciplines with skills (of all sorts), such that the student is able to see, from her stance as a future professional, the relationship between her personal stance and the propositional knowledge of the disciplines. She is enable to develop not only an epistemological position but also a practice-related perspective that integrates knowing-that with knowing-how. (p. 131)

In Model IV, Savin-Baden writes, problem-based learning operates in a way that enables the students to recognize that disciplinary boundaries exist but that they are also somewhat illusory, that they have been erected. The student might transcend boundaries but he is not likely to challenge the frameworks into which disciplinary knowledge is placed. According to Popper (1970), all thought (and presumably action and experience), takes place within some kind of framework, although we are not forever confined to this framework. Barnett (1994) has argued that Popper avoided the issue that the practical

rules of a particular framework forbid an examination of that framework. To do so would run counter to the very nature of the framework, because by deconstructing one framework that is the basis of the discipline, other related frameworks thereby become problematic as all the other connecting boundaries become problematic. In Model IV, the frameworks are not reframed (as in Model V) since to do that would risk jettisoning those frameworks. Instead, what occurs in practice is that knowledge and skills are "kept in their place" and that students have an overview of the frameworks, which does not risk disturbing them. (p. 131)

Students in this model, Savin-Baden explains, tend to adopt such stances as pedagogical autonomy, a position of learning that they perceive will offer them the greatest degree of autonomy. For these students learning does not have to fit entirely within the remit of that defined by authorities, and thus students are independent in making decisions about how they can learn. Learning here, therefore, involves utilizing critical thought to decenter one's self from disciplines in order to transcend them. Here, decentering (Habermas, 1990) is not seen in the Habermasian sense of a *radical* transcendence of one's prior beliefs, personal needs and social norms, but in terms of a reflection on, and an openness towards, the stances of others and, therefore, necessarily an evaluation of one's own. It is also about integrating what one knows tacitly with what else is on offer and as a result integrating and transcending boundaries simultaneously. Students are therefore encouraged to integrate their learning into their deepest level of understanding and consequently to integrate theory and practice across disciplinary boundaries, knowing that the boundaries are somewhat arbitrary. (p. 132)

In this model of problem-based learning, according to Savin-Baden, students are encouraged to adopt a critical position towards knowledge, themselves and their peers, and to use the problem-based learning group as a place in which to examine and test out personal and pedagogical frameworks. Students here will tend to develop a highly autonomous position as individuals within a group, and as a group. They will elect to use the group to resolve dilemmas and to discover meaning in their lives, to the extent that the facilitator becomes an orchestrator of opportunities. The danger with this model, however, is that the facilitators see students as such autonomous learners that they opt out of facilitating the group that is moving towards a position of criticality. This reduces facilitation to a skills-based task that focuses purely on process and ignores the quality of what students can actually produce and feed back to the group. Thus, instead of the students integrating knowledge and skills across the boundaries, by, as it were, filling the gaps between disciplines for themselves, as in Model III, here they take the position of being critical thinkers; autonomous learners who use discipline boundaries to make sense of multiple ways of knowing. (p. 132)

Finally, in Model V, Savin-Baden writes that this form of problem-based learning is one that seeks to provide for the students a kind of higher education, which offers, within the curriculum, multiple models of action, knowledge, reasoning, and reflection, along with opportunities for students to challenge, evaluate and interrogate them. Students will therefore examine the underlying structures and belief systems implicit within a discipline or profession itself, in order to not only understand the disciplinary boundary but also its credence. They will transcend and interrogate disciplinary boundaries

through a commitment to exploring the subtext of those disciplines. Thus, students are encouraged to challenge borders, create new borders, live and work in the border country and, at the same time, begin to know how to live in that country (Giroux, 1992). Knowledge here is seen as being constructed by the students, who begin to see themselves as creators of knowledge, and who become able to build on and integrate previously learned knowledge and skills with material that is currently being learned. Students are encouraged to evaluate critically both personal knowledge and propositional knowledge on their own terms; thus the student embraces knowledge and also queries it. (p. 133)

Therefore, according to Savin-Baden, in the context of their peer group, students are encouraged to make knowledge claims that are put before the group for examination by others in order to facilitate shifts not just towards critical contestability but also ideally towards the acquisition of a critical spirit (Barnett, 1997), through which students can evaluate themselves, the world and knowledge in relation to one another. Individuals will use dialogue and argument as an organizing principle in life so that through dialogue they will challenge assumptions, make decisions and rethink goals. Students will use group process to challenge identity and all that is implicit within that identity. Thus, students are expected to develop qualities of moral and intellectual, as well as emotional, independence. In addition, they are required to set their own goals and delineate their process for learning. With the problem-base program they are offered opportunities to examine themselves as reflexive projects and to discover and to develop their own voices, so experiencing a continual state of personal and pedagogical renewal. (p. 133)

As future practitioners, Savin-Baden remarks, it is intended that students would be enabled to become questioning and critical practitioners; practitioners who would not only evaluate themselves and their peers effectively, but would also be able to analyze the shortcomings of policy and practice. Students involved in this form of problem-based learning would tend to adopt reflective pedagogy. They will see learning and epistemology as flexible entities, perceive that there are also valid ways of seeing things besides their own perspective, and accept that all kinds of knowing can help them to know the world and themselves more effectively. (p. 133)

Problem-based learning of this sort enables students to develop a critical position from which to interpret the practice of others, to (re) develop their own critical perspectives and thence to critique them, according to Savin-Baden. Here, students' personal, pedagogical and interactional stances are acknowledged and valued (as well as challenged) within the curriculum, with disjunction being seen as a central principle. What this means is that disjunction will be seen as an essential concept in the curriculum through which students are encouraged to learn to manage uncertainty for themselves and as a means of being and becoming reflexive projects. (p. 134)

The difficulties with this model largely stem from issues of power and control in the learning context, Savin-Baden explains. Staff's sense of self is likely to feel at risk or threatened in their role in the group and in relation to their conceptions of learning and knowledge, since they will be under increasing scrutiny from the students. It might be that the enactment of this model is only actually possible in the context of postgraduate

programs, where students are offered more freedom to learn in the context of their own agenda than in undergraduate or pre-registration (professional) curricula. (p. 134)

According to Bereiter and Scardamalia (2000), there are two forms of PBL identified as uppercase PBL and lowercase pbl. Although there are variations, and although it has been applied in other disciplines, practitioners of PBL acknowledge its medical school origins and tend to adhere to the structure and procedures systematized by Barrows (1986). Lowercase pbl refers to an indefinite range of educational approaches that give problems a central place in learning activity. Mathematics and physics have traditionally done this, but most other disciplines have not. A problem-based literature course, for instance, would be a novelty even today. However, case-based education, as practiced in law schools and in business schools, would count as lowercase pbl, insofar as the cases are treated as problems to be solved, much like the cases that typically figure in medical PBL. (p. 185)

Lest everything be counted as pbl, however, write Bereiter and Scardamalia, it is worthwhile to distinguish between exercises and problems. Elementary school mathematics, for instance, is full of exercises that are often glorified as problems. This, however, is a far cry from the kind of mathematics education that Lampert (1990) has pioneered, where the problems with which students wrestle are problems of method and justification, or the kinds of mathematical problems presented in the Jasper Woodbury adventures (Cognition and Technology Group at Vanderbilt, 1997), which are complex, realistic problems much more like medical cases than like typical schoolbook word problems. Uppercase PBL entails more than a focus on problems, however. It also

entails a collaborative group process. Collaborative group work, certainly a pedagogical novelty in the early days of PBL, has caught on much more widely and is now found to be associated with many forms of lowercase pbl as well. (pp. 185-86)

Their own work, which provides the vantage point from which they write this commentary, is lowercase rather than uppercase pbl. The label they attach to it is "collaborative knowledge building" (Scardamalia & Bereiter, 1994; Scardamalia, Bereiter, & Lamon, 1994). Although their work has been mainly with elementary and middle school students and with graduate students in education, there are notable similarities to PBL as practiced in medical schools:

1. Everything starts with and keeps returning to a problem.
2. Dialog is central to the problem-solving process.
3. An important part of work on a problem is identifying what needs to be found out in order to advance.
4. Small groups work collaboratively on solving the problem.
5. Information search and other tasks are distributed among group members instead of having everyone do the same things.
6. The focus is on achieving a cognitive outcome rather than on producing an artifact or a presentation, thus distinguishing if from much of what is called "project-based learning" (Marx, Blumenfeld, Krajcik, & Soloway, 1997).

However, there are also notable differences:

1. The problems are usually at the level of principles, rather than cases; for instance, "How does heat affect matter?" rather than "Why doesn't the ball go through the ring?"

2. The focus is on understanding rather than on reaching a conclusion or achieving a particular result.

3. Problems themselves are expected to undergo transformation in the course of inquiry, as they do in science. Thus, it is not expected that problems will be solved but that the state of collective knowledge will be advanced.

4. The teacher functions as coinvestigator – moreso than seems to be typical of tutors in PBL.

5. Much of the collaborative problem-solving work is computer mediated and asynchronous in addition to being conducted face-to-face. It uses technology generically known as Computer Supported Intentional Learning Environments, or CSILE (Scardamalia & Bereiter, 1994), the most current version of which is Knowledge Forum.

6. The software environment supports and structures interactions in ways that would be the responsibility of the tutor in PBL. (Bereiter and Scardamalia, 2000, pp.186-187)

Dathe, O'Brien, Loacker, and Matlock (2001, p. 283), proposed a reconceptualized framework for developing problem-solving ability with the educational program that they have had in place at Alverno College since 1973. At that time PBL was not their aim and they sought to provide students with an environment that would assist them to use knowledge as they developed it. Since that time, their students are required, as a basis for advancing and graduating, to develop and demonstrate abilities in a context of whatever discipline or professional field they are studying. The abilities include problem solving, among others like communication and aesthetic response (Alverno College Faculty, 1989).

Specifically, as a result of their ongoing study of how students learn problem solving, they rewrote the levels as follows:

Level 1 The student articulates her problem-solving process when given a problem by making explicit the steps she takes to approach the problem. At level 1, the student needs to be introduced to, and use appropriately, a problem-solving vocabulary. She is also introduced to a problem-solving process (either generic or discipline – or profession-specific)

Example from Instructional Syllabuses. Psychology 101/General Psychology:

(Paul Smith): "The purpose of this assignment is for you to demonstrate your ability to discuss and evaluate your own preferred processes for solving problems."

Level 2 The student practices discipline or professional problem-solving frameworks to approach the problem(s). At level 2, the student develops a basic understanding of problem solving within a discipline by being presented with typical problems from within a discipline. This includes practicing problem-solving frameworks within the course context, practicing various strategies within a specific discipline framework, understanding problem definition in the context of the discipline, and using discipline problem-solving vocabulary.

Example from Instructional Syllabuses. A 136/Studio Art 2: Two-Dimensional Design (Nancy Lamers):

"You are able to discern in both structured and unstructured assignments what the problem is, and you are able to clearly state what your goal is. You are able to identify alternative strategies for problem solving and can defend your decision-making reasons. This means in this context that you demonstrate an ability to: 1) identify the types of problems that are characteristic of art making; 2) reformulate problems into smaller component parts; 3) create and visualize potential solutions; and 4) interpret and redefine the problem."

Example from Instructional Syllabuses. Psychology 101/General Psychology:

(Paul Smith): "The purpose of this assignment is for you to demonstrate your understanding of how psychologists approach problem solving. You will apply your understanding in finding and summarizing research published in a professional psychology journal."

At levels 1 and 2, ideally the problems should be solvable. If the students can arrive at an answer they are better able to articulate their problem-solving process and understand how a discipline framework is used to solve a problem. If this is not possible, the instructor should define what conditions the problem will be considered solved.

Level 3 Given a problem in a discipline or profession, the student uses a discipline problem-solving framework to develop the solution(s).The major difference

between levels 2 and 3 is meta-cognition. At level 2, the instructor is demonstrating and explaining – and the student is practicing – discipline problem-solving frameworks and strategies. At level 3, the student becomes aware that she is a problem-solver. Rather than practicing a discipline problem-solving framework (level 2), she selects and uses discipline problem-solving frameworks and strategies. The student develops self-awareness as a problem-solver, makes decisions among various frameworks, makes decisions among various strategies, questions the solution(s), and brings together analytic thinking and problem-solving.

Example from Instruction Syllabuses. Education 225/Integrated Reading Curriculum 1 (Jackie Hass):

"Student selects or designs appropriate frameworks and strategies to solve problems."

Level 4 The student independently examines, selects, uses and evaluates various approaches to develop solutions. The emphasis of level 4 is that the student independently chooses the framework and strategy she perceives to be most appropriate to develop solutions. She then evaluates her selections and problem solutions.

Example from Instructional Syllabuses. Biology 251/Microbiology (Leona Truchan):

"Problem-solving, level 4 will be partially achieved using a problem-solving process to select and implement procedures that will lead

to the identification of your unknown organism. You must be able to explain your problem-solving approach."

Example from Instructional Syllabuses. Dance 340/Dance Composition and Performance 1 (Cate Deicher):

"You will invent, employ and evaluate problem-solving techniques as you work through the choreographic process. This will introduce you to choreography as a revisioning process and will involve such skills as deep listening, (consulting your intuition), risk taking, peer consultation and cooperation." (Dathe, O'Brien, Loacker,& Matlock, 2001, pp. 290-292)

(For additional information in reference to how to implement PBL, refer to Appendix B; how to write a PBL problem, refer to Appendix C; and how to assess PBL, refer to Appendix D.)

Why Institutions of Higher Education Should Use PBL

According to Savin-Baden, there is a sense, in the unstable state of higher education, that the continual renegotiation of frameworks, structures and ideals means that we are, in a sense, always in crisis. Reflexive modernization, the process by which the classical industrial society has modernized itself, has resulted in a sense of crisis characterized by a "risk society" (Beck, 1992). This type of society with its emerging themes of ecological safety, the danger of losing control over scientific and technological innovations and the growth of a more flexible labor force will have a profound effect upon higher education. Jansen and Van Der Veen (1992, p. 276) have argued:

> The study and practice of adult education cannot afford to ignore these themes, if adult education pretends to contribute to solutions for actual social problems. The most fascinating question for adult education is how these new themes will be translated into new methods. Will these methods shed new light, for example, on the integration of instrumental, expressive and sociological learning, on experiential learning and on mutual directivity between facilitator and participant?

Ways of managing this fragmenting culture might be seen not just as living with risk but as living in the borders, not moving towards the end of higher education or the end of the university, but along the brink, along the edges of the end (Savin-Baden, p. 135).

Therefore, Savin-Baden continues to write that PBL for critical contestability offers us a means of breaching the chasms between professional education, and public and private sector. This is because PBL of this sort both offers and demands that students, tutors and professionals in the field transcend the boundaries imposed through systems. In the context of Model V (Table 2.2), learning outcomes may be defined in advance in order to satisfy professional and academic agenda. But for the staff and students involved in such PBL programs it should be possible to negotiate these and therefore offer students learning experiences that are seen and experienced as valuable to their identity construction. Thus, students will be helped to come to know that personal knowledge is as important as prepositional knowledge and practical skills. They will begin to see that transcending frameworks; their own and those with which they are presented, will equip them to become effective practitioners for the future, more so than merely acquiring a sound body of knowledge or a set of narrow competencies. (p. 147)

As we move into an increasingly fragmented form of higher education, Savin-Baden states that what will become crucially important will be universities, of whatever genre, where the untold stories, not just of the students, but also of the staff and the managers, can be central to learning. Weil (1999, p. 172) writes that we need to be asking of ourselves and of our organizations: "how staff and students in higher education can be supported in generating and sustaining more interwoven positions, across institutions, disciplines and new domains for knowledge generation; how we can begin to evolve and allow alternative understandings of "rigor" and "quality" that are more inclusive and respectful of diverse epistemological stances". (Savin-Baden, p. 148)

According to Bereiter and Scardamalia (2000), in collaborative knowledge building, problem-centered theory construction is singled out as one of the major activities students may engage in. Scaffolds are provided that signal "my theory," "I need to understand," "new information, " and "what we have learned". Teachers are encouraged to shift the focus of work from finding answers to improving theories. This has, first of all, the effect of raising quality of the problems that students formulate. Students have been found to formulate quite different kinds of questions, depending on whether they anticipate that they will be expected to find answers to them (Scardamalia and Bereiter, 1992). When they are expected to find answers, they tend to ask what we call "text-based" questions, questions of the kind that routinely accompany textbooks and for which the answers are to be found in the text. When freed of the obligation to find answers, they ask what they call "knowledge-based" questions, questions that arise from their own puzzlement or perceived lack of understanding. These are questions that teachers and independent raters judge to be of considerably greater educational potential than text-based questions. Bereiter and Scardamalia have found that shifting the emphasis from

finding answers to improving theories encourages students to formulate knowledge-based problems (Scarmadalia, Bereiter, Hewitt, and Webb, 1996). Having posed a problem, students next advance their initial theories as solutions. Then, as they acquire additional information by whatever means, they work to improve their theories. This is always possible, whereas finding an answer to a knowledge-based question often is not. The second advantage of shifting from finding answers to improving theories is that it engages students in a process much more like real science, where practitioners seldom expect to discover final answers but rather work to improve on existing knowledge (Bereiter et al., 1997).

Bereiter and Scarmadalia continue to note that another sort of whole-person outcome that is receiving attention these days, however, is that of producing people who will remain able and willing throughout life to pursue new learning. The need for this is highlighted by technological changes that alter job requirements. In scientifically grounded professions like medicine, there is not only the need to master technology but also the need to continually revise practice in light of advances in knowledge. (pp. 188-189)

Standard PBL practice sends students out in search of knowledge required to solve the immediate problem, write Bereiter and Scarmadalia. To the extent that this experience has long-term effects on dispositions, it should promote one kind of lifelong learning. You could call it a lifelong disposition to do web searches. That is not a trivial development. The way things are heading, we may see a widening divide between those who utilize web searches in dealing with life's problems and those who do not. Those who do not will most likely be making poorer decisions, receiving poorer services, and paying more money for inferior goods. (p. 189)

However, they remark, there is another side to lifelong learning, which is not a matter of obtaining information relevant to immediate action. It is exploiting the potentialities of new knowledge – revising one's beliefs and practices in light of it, building more powerful conceptual frameworks, and coming up with new ideas. This second kind of lifelong learning is problem based as well, but the problems are of a different kind. They are not means-end problems with new knowledge providing the means. Rather, they concern the knowledge itself – its meaning, validity, and implications, its relation to other knowledge, and its possibilities of application. (p. 189)

Bereiter and Scardamlia conclude that both kinds of learning are of obvious lifelong importance. Both are essential to staying on top of one's field. When professional journals arrive we are likely to read them with a knowledge-building purpose. Then we put them on the shelf where, if they are ever taken down again, it is likely to be with a means-end purpose in mind. Our work in schools could be criticized for slighting the means-end kind of learning. PBL could be criticized for slighting the more open-ended, knowledge-centered kind of learning. (p. 189)

Woodward (2000) writes that according to Mentkowski and Doherty, 1987, students develop problem-solving ability to increasingly complex levels. Three studies suggest PBL promotes long-term (three months to two years later) recall of information studied (Coulson, 1983; Eisentadt et al, 1990; Tans et al, 1986). Eisenstadt et al (1990) invited randomly selected students to participate in a PBL course rather than a lecture-based hematology-tranfusion segment of a second-year pathphysiology course. Over a three-year period, 59 students participated in the PBL course. PBL students, consenters to PBL and non-consenters, did not differ in socio-demographic characteristics or prior performance. In the end-of-course objective examination, PBL students scored lower;

but, their performance remained near the original level two years later, by which time the performance of the control group had declined and matched the PBL group. (p. 300)

Woodward continues to report that similar results are reported by Tans et al (1986), who studied physiotherapy students randomly assigned to PBL or lectures for a muscle physiology course, according to Woodward. PBL students' scores were significantly lower on a multiple-choice exam directly after the course. When asked to recall core knowledge gained in the course in a free-recall situation six months later, PBL students remembered up to five times more concepts than the lecture group. Coulsen (1983) reported somewhat poorer initial performance by PBL students, but a more precipitous drop-off in information retained among conventionally taught students. A study by Martensen et al (1985), has also been used to suggest better retention for PBL. (p. 300)

According to Woodward, all of the studies reviewed by Albanese and Mitchell (1993, p. 63) suggest that "students generally perceive PBL environments in a positive light; certainly these curricula are not perceived as less humane." Vernon and Blake (1993, p. 554) who formally developed effect size and vote counting procedures to categorize the studies they reviewed, agree: "No sample was found in which the students' attitudes did not favor PBL to some degree". Students in PBL curricula report spending far less of their time engaged in rote learning without conceptual understanding (Moore et al, 1990; Regan-Smith et al, 1994). An examination of the time formally scheduled with classes and labs for traditional curriculum and PBL students, invariably finds PBL students have more time to engage in self-initiated learning activities (Kaufman, 1985; Moore et al, 1990).

In a recent survey of all practicing Ontario-based members of the College of Family Physicians of Canada who were certified between 1989 and 1991 and graduated from an

Ontario medical school (N=320), significant differences were noted among physicians' satisfaction with "the extent to which medical school has prepared you for practice" (Woodward et al, 1994). PBL graduates (McMaster) were much more likely to report being satisfied or very satisfied (65.7 percent compared to 39.7 percent) and fewer (10.4 percent) were dissatisfied than graduates of the other four schools (25.5 percent). This question, buried among other questions, forms one of 16 items of a Professional Satisfaction Scale for physicians developed at the Rand Corporation (McGlynn, 1988).

Since PBL has been used extensively in the field of medicine to train future physicians (Jonas, Etzel, and Barzansky, 1989), the rationale for using this approach rests in part on four propositions that, in the judgment of Bridges with Hallinger, apply with equal force to the preparation of administrators:

1. Students retain little of what they learn when taught in a traditional lecture format (Bok, 1989).

2. Students often do not appropriately use the knowledge they have learned (Shmidt, 1983).

3. Since students forget much of what is learned or use their knowledge inappropriately, instructors should create conditions that optimize retrieval and appropriate use of the knowledge in future professional practice.

4. PBL creates the three conditions that information theory links to subsequent retrieval and appropriate use of new information (Schmidt, 1983): activation of prior knowledge, similarity of contexts in which information is learned and later applied, and opportunity to elaborate on that information. (Brides with Hallinger, p. 8)

The context in which information is learned resembles the context in which it will later be applied (referred to as encoding specificity). Research shows that knowledge is much more likely to be remembered or recalled in the context in which it was originally learned (Godden and Baddeley, 1975). Encoding specificity in PBL is achieved by having students acquire knowledge in a functional context, that is, in a context containing problems that closely resemble problems they will encounter later in their professional careers. (p. 9) According to Prawat (1989, p. 18) the advantage of such an approach is that students become much more aware of how the knowledge they are acquiring can be put to use. Adopting a problem-solving mentality, even when it is marginally appropriate, reinforces the notion that the knowledge is useful for achieving particular goals. Students are not being asked to store information away; they see how it works in certain situations which increases the accessibility. (Bridges with Hallinger, p. 9)

Bridges with Hallinger write that information is better understood, processed, and recalled if students have an opportunity to elaborate on that information. Elaborations reduce redundancy in the memory structure, which in turn reduces forgetting and abets retrieval. Elaboration occurs in PBL in various ways, namely, discussing the subject matter with other students, teaching peers what they first learned themselves, exchanging views about how the information applies to the problem they are seeking to solve, and preparing essays about what they have learned while seeking to solve the problem. (p. 9)

According to one major theory of motivation, the effort that people are willing to expend on task is a product of two factors (Good and Brophy, 1991). One factor is the degree to which they expect to be able to perform the task successfully if they apply themselves, and the other is the degree to which they value the rewards that successful performance will bring (Good and Brophy). In line with the tenets of expectancy theory,

instructors should use more motivational strategies that address these factors. Furthermore, instructors should create the preconditions that are essential to the effectiveness of any motivational strategy (Good and Brophy). (In Bridges with Hallinger, pp. 9-10).

Intrinsic motivation strategies are based on the idea that students will expend effort on tasks and activities they find inherently enjoyable and interesting even when there are no extrinsic incentives. Each PBL project contains six elements that most students, according to Good and Brophy, find enjoyable or intrinsically rewarding:

1. *Provides opportunities for active response.* In each PBL project students learn by doing something. They engage in a wide array of activities – leading, recording, discussing, facilitating, making decisions, developing and revising schedules, making oral presentations, holding conferences, and the like.

2. *Includes higher-level objectives and divergent questions.* At the heart of each PBL project are a problem to be solved, a situation to be analyzed, knowledge to be applied, alternatives to be evaluated, and consequences to be forecast. All these tasks involve higher-order intellectual skills. The hallmark of PBL is applying knowledge, not simply recalling it.

3. *Includes simulations.* In a PBL instructional environment, the instructor incorporates simulations into most PBL projects. For example, students participate in mock meetings of a board of education and a superintendent's cabinet. Students also role play conferences, handle in-basket items, and conduct classroom observations by viewing videotapes of classroom teaching episodes.

4. *Provides immediate feedback.* In a PBL environment, instructors position themselves to observe students and how they are using or misusing the knowledge they are attempting to master. When it becomes clear that students either do not understand a particular concept or are unable to use it appropriately, the instructor can supply immediate feedback.

5. *Provides an opportunity to create finished products.* Most PBL projects conclude with a product (for example, a memo to the superintendent or a classroom observation report), a performance (such as a post-observation conference with a teacher or an oral presentation to a board of education), or both. These products challenge students and heighten their level of concern.

6. *Provides an opportunity to interact with peers.* Since the basic unit of instruction is a project and students work as members of a project team, students interact extensively with peers. Every student has a role on the project team and participates actively in accomplishing the project's objectives. The person occupying the project facilitator role is responsible for ensuring that all team members are actively involved in the team meetings and that no one dominates the discussions. (Bridges with Hallinger, pp. 11-12)

According to Bridges with Hallinger, Bridges (1977) analyzed the work of a student and the work of an administrator along four dimensions: the rhythm of the work, the hierarchical nature of the work, the character of work-related communications, and the role of emotions in work. Based on this analysis, Bridges concluded that there is a major dysfunction between the work of a student and the work of an administrator. He also contended that this dysjunction may result in trained incapacity; in essence, to paraphrase

Kenneth Burke (1935), the student "becomes unfit by being fit for an unfit fitness". (p. 12).

PBL narrows the gap between the work of a student and the work of an administrator in several ways; therefore, it is more likely to result in trained capacity rather than trained incapacity. (p. 12)

With respect to *rhythm of the work,* the tempo of a student's work in a PBL environment more closely corresponds to the accelerated work pace of the administrator than does the work of a student in a conventional instructional environment. Students work under time constraints to complete a PBL project, and the time available is rarely sufficient. Moreover, the modes of thought and action that students use in a PBL environment differ from those that students use in conventional instruction. Time deadlines in the PBL environment force students to balance the need to understand (that is, analyze) with the need to act. Since they are judged on the feasibility of their actions, as well as the thoroughness of their analysis, they are less likely to become victims of "analysis paralysis". (p. 12)

According to Bridges with Hallinger, the *hierarchical nature of the work* of a student in a PBL environment also more closely resembles the work of an administrator. In a conventional instructional environment, students occupy subordinate roles. Their work is largely individualistic and competitive; the deficiencies of "fellow employees" enhance rather than diminish their standing in the workplace. The student's work in a PBL environment is strikingly different. Students serve as team leaders, facilitators, and members of a project team. Through these experiences, students come to appreciate the

dependency inherent in managerial roles, the necessity of delegating responsibilities to others, and the difficulties and frustrations inherent in trying to obtain results through other adults. (pp. 12-13)

The *character of work-related communications* contrasts sharply in PBL and conventional instructional environments. In conventional instructional environments students spend most of their time in receiving roles, they rely heavily on the written mode of communication using the impersonal language and the detached style of the academician, and they engage in one-way communication. The character of work-related communication in a PBL environment more closely resembles those of the administrator. PBL students, like administrators, spend roughly equal amounts of time in sending and receiving roles, rely heavily on oral modes of communication, prepare written memos (the dominant form of written communication for administrators), and work in small face-to-face interpersonal settings that are conducive to two-way communication. (p. 13)

The *role of emotions in work* also is quite different in the two types of instructional environments report Bridges with Hallinger. In a conventional instructional environment students work in a relatively placid emotional climate. Ideas, not feelings, are the currency of the realm. Affective neutrality is the dominant expressive state as it is congruent with the contemplative and scientific character of academic work. In a PBL environment, the emotional tone of the interpersonal environment is more varied and jagged. Students, like the administrators they aspire to be, encounter the emotional problems of working with people. These occasions create opportunities for students to test their competence in interpreting and responding to the feelings of others. When projects go awry, students also acquire insights into how they deal with frustration, anger, and disappointment. (p. 13)

Bridges with Hallinger also showed that when comparing traditional programs in medical education, PBL yields superior or equivalent results on all but one of the outcome measures studied (see Table 2.3). Students in the PBL program express substantially more positive attitudes toward their training than do students in more traditional programs. The former are inclined to praise their training, especially those aspects that are unique to problem-based learning, whereas the latter are more likely to describe their training as boring, irrelevant, and anxiety-provoking (deVries, Schmidt, and deGraaff 1989 and Schmidt, Dauphinee, and Patel 1987).

According to Bridges with Hallinger, besides expressing more positive attitudes toward their training, students in PBL programs also adopt more desirable approaches to studying than their traditional program counterparts. Students in traditional programs are more likely to adopt a *reproducing orientation* to studying, that is, use rote learning and seek to reproduce factual information in the syllabus. PBL students, on the other hand, are more likely to adopt a *meaning orientation*, that is, to be intrinsically motivated by the subject matter and to strive to understand the material (Coles, 1985; deVolder and deGrave, 1989; Schmidt, Dauphinee, and Patel, 1987). Moreover, PBL students seem to expend equal, if not greater, amount of time and effort on their studies (deVries, Schmidt, and de Graaff). (p. 16)

Another study, according to Bridges with Hallinger, by Mennin and Martinez-Burrola, (1986), brought forth information highlighting costs studied in terms of the time instructors spent on teaching. There were no differences in the amount of time spent on teaching; however, there were substantial differences in how instructors spent their time. In the PBL track, instructors spent 72 percent of their time in contact with other students and 28 percent in preparation for this contact. The reverse was true in the traditional

track, where instructors spent 61 percent of their time in preparation and only 39 percent in contact with their students. (p. 17)

Table 2.3 PBL in Medical Education, Summary of Research

Basic research question: Do PBL programs produce better outcomes for students than traditional programs?

Outcomes Studied	*Results*
1. Attitudes toward the instructional environment	1. PBL substantially more positive.
2. Approaches to studying	2. PBL students adopt meaning orientation (desirable outcome); traditional students adopt reproducing orientation.
3. Career preferences	3. PBL students more likely to become primary physicians (desirable); traditional students become specialists.
4. Completion time and rates	4. PBL students complete in less time and at higher rate than traditional students.
5. Knowledge of basic disciplines	5. Small differences favor traditional programs but PBL students show steeper growth during period of study.
6. Clinical competence	6. Small differences favor students in PBL programs.
7. Study loads	7. No major differences.
8. Self-directed learning skills	8. Not investigated.

Woodward writes that little empirical work has been done to examine whether or not the contents of PBL curricula are easier to alter than in conventional curricula. The notion has face validity. Change in a PBL curriculum may be as easy as changing the relative emphasis given to identifiable issues in a problem, adding a new wrinkle to a problem or substituting one problem for another. Cost savings may result during the maintenance and updating phase of a PBL curriculum. Answers to this question may be of interest to faculty and administrators. (p. 303)

Three other potential longer-term outcomes of PBL may be of interest to faculty and students, Woodward continues to explain. First, PBL may make the transition from education to practice easier or less stressful. The evidence to support this idea is scanty yet compelling enough to take a look at this issue. As a faculty advisor to medical students who grapple with PBL, the author noted that the stduents initially complain that they never know if/when they know enough about a topic. Within the first year of PBL, these students develop their own comfort levels about information needed related to a problem. About two years ago (1995), while conducting a focus group of family physicians, then five to eight years in practice, about their early practice years, several physicians mentioned their initial anxiety about not knowing enough to practice effectively. The two McMaster graduates in the group demurred. For them, this type of anxiety had faded within the first year of medical school. Is this observation generalizable to other PBL students and schools? At this time, no information is available. (p. 303)

Second, according to Woodward, the interpersonal learning that occurs in small PBL tutorial groups is likely to be an underrated aspect of PBL. The numerous interactions with peers in work groups which occur during their medical education may refine PBL

students' communication skills and make them more aware of how they react to others and how people react to them. One PBL graduate, when asked what was the most important learning that she attributed directly to PBL, said that it helped her learn to get along with people she did not like, an important interpersonal skill. Further research that probes such interpersonal learning is needed. (pp. 303-304)

Finally, Woodward concludes, PBL creates a more egalitarian learner/teacher relationship than is typical in conventional curricula. Does this have an impact on the kinds of relationship PBL-educated physicians form with their patients? No evidence is available, but the question is important. (p. 304)

Bridges and Hallinger reflect on how the adoption of PBL has influenced them as faculty members. PBL has resulted in numerous benefits to them, many of which they have noted in their writings. These include:

1. Healthier relationships between faculty and students.
2. More balanced relationships with practitioners.
3. Broader and deeper familiarity with significant problems of practice.
4. Sharpened awareness of how their empirical research and conceptual analyses relate to practice.
5. More productive practice-focused research with professional doctoral students.
6. More positive responses from students concerning the outcomes of their learning.
7. More demonstrable, steeper growth in students' cognitive and affective capacities for group leadership.
8. Greater insight into both what and how students are learning.

9. Renewal and reinforcement of the fundamental belief that as instructors they do have something of substance to contribute to the improvement of professional practice. (p. 147)

Thomas (1992) identifies three types of cognitive theories upon which teaching strategies can be based. Information processing theory explains how the mind takes in information. Knowledge structure theories depict how knowledge is represented and organized in the mind. Social history theory explains the vital role of cultural context in the development of individual thinking. Together, these three perspectives offer a comprehensive view of cognition. In this view, Thomas writes, learning is characterized as an active process in which the learner constructs knowledge as a result of interaction with the physical and social environment. Learning is moving from basic skills and pure facts to linking new information with prior knowledge; from relying on a single authority to recognizing multiple sources of knowledge; from novice-like to expert-like problem solving.

Johnson and Thomas (1992) present five general principles and related teaching methods that integrate aspects of all three perspectives:

1. Help Students Organize Their Knowledge. External memory aids such as concept maps (visual representations of concepts and their relationships) ease the information overload on working memory.

2. Build on What Students Already Know. Advance organizers such as rules, analogies, or concrete instances help students recognize the similarities between new information and previously acquired knowledge.

3. Facilitate Information Processing. Teachers model problem solving, demonstrating their thought processes, strategy selection, and response to mistakes.

4. Facilitate Deep Thinking through Elaboration. Cooperative learning techniques such as peer tutoring or paired problem solving (in which one student thinks aloud during the process of solving a problem) make students observe and modify their own thinking process.

5. Make Thinking Processes Explicit. In reciprocal teaching, the teacher models desired metacognitive processes by reading a paragraph, asking questions, summarizing, and predicting what would happen next in the text. Students gradually take on the teacher's role.

These strategies demonstrate that the teacher's role in developing thinking skills differs from traditional instruction. One metaphor for this new role is "a guide on the side rather than a sage on the stage" (Thomas, 1992, p. 54). The following teacher behaviors promote cognitive development (Chalupa, 1992; Lee, 1989; Thomas, 1992):

1. Requiring justification for ideas and probing for reasoning strategies.
2. Confronting students with alternatives and thought-provoking questions.
3. Asking open-ended questions.
4. Requiring students to be accountable for class discussion.
5. Serving as a master of apprentices rather than a teacher of students.
6. Using Socratic discussion techniques.

Classroom environments that support higher order thinking have the following characteristics (Stasz et al., 1990; Thomas, 1992):

1. Reflections of real-life situations and contexts.
2. Collaboration among teachers, disciplines, and students.
3. Encouragement of curiosity, exploration, and investigation.
4. Responsibility for learning vested in the learner.
5. Failure viewed as a learning opportunity.
6. Acknowledgement of effort, not just performance.

According to Burch, (1997), six sets of criteria offer reasons for considering PBL as an augment to one's standard teaching repertoire:

1. *From teachers*: Many students retain information and concepts better using PBL than using other teaching methods because PBL employs an integrated set of teaching techniques. These techniques embody the basic premise of PBL: many students will better learn information if they need to use it, and they will better see the need to use it as they try to solve specific problems. The PBL approach encourages students to learn in a hands-on style in the context of a problem, to use immediately the knowledge they discover, to apply the information, and to teach or explain it to others. With these techniques, especially in combination, students retain dramatically more information.

2. *From students, educational psychology:* PBL is a form of "active learning", which educational research demonstrates is the most effective technique for students to learn, apply, integrate, and retain information (e.g., Bonwell and Eison, 1991). Many students also prefer to learn in this active style.

For example, results from the Myers-Briggs Type Indicator, according to Burch, reveal that in a typical classroom, over 70% of the students are most excited by the external phenomena of people, events, and experiences rather than the internal world of

ideas and concepts. Externally-oriented students learn most comfortably by devoting their energy and attention outwardly toward experiences, interactions, and talking. These students learn best by acting and discussing, then generalizing from the specific situation to broader conceptual or theoretical themes. While many courses contain some "active" activities, most courses do not emphasize them, thus skewing the learning experience away from active learners. Conversely, internally-oriented students can learn best by directing energy inwardly toward thinking, feeling, reflecting, and writing. These reflective students, comprising about 30% of the general and student population, learn best by doing what we typically call "studying" – that is by mentally pondering and rehearsing specific material. These are the activities and skills emphasized in most courses.

Burch continues to write that relatedly, a different 70% of the students in a typical classroom prefer to receive information through the senses, by observing and participating in activities, by mastering step-by-step sequences, and by focusing on real or actual situations. These students prefer to focus on practical applications and concrete details. In contrast, only about 30% of students effectively think in abstract or theoretical ways that enable them to see "the big picture", imagine possibilities, or trace future prospects. Students that prefer abstract thought more comfortably acquire information in terms of large patterns, trends, and trajectories, alternative possibilities, or relationships and connections among facts.

Table 2.4 below indicates the distribution of learning styles. The matrix assumes that active/passive learning and concrete/abstract learning are independent conditions. Psychological studies do not clarify the relationship since correlations may be socially-learned.

Table 2.4 Matrix of Student Learning Styles

	AL Active Learners (70% of population)	PL Passive Learners (30% of population)
CS Concrete-Sequential learners (70%)	49% of pop. (.7 x .7 = .49)	21% (.3 x .7 = .21)
AP Abstract-Pattern learners (30%)	21% (.7 x .3 = .21)	9% (.3 x .3 = .09)

Teachers, however, are different according to Burch. He writes that a sample of University of Delaware faculty from all departments confirms more general national studies: over 54% of university teachers are disposed to learn, thus teach, in a manner that emphasized inward reflection and requires students to complete solitary reading, writing, and contemplation assignments. Similarly, over 63% of university teachers prefer to learn and teach in terms of big picture abstractions and theoretical frameworks. Thus, as Table 2.5 reveals, the PL-AP teaching strategy of the majority of university teachers meets the preferences (needs?) of 9% of students assuming independent variables (and no more than 30% of students, assuming complete congruence of variables). Conversely, a mere 17% of teachers teach in a style that corresponds to the preferences or needs of 49% of the student population (Myers, 1993, pp. 4-7).

Table 2.5 Matrix of University Teachers' Teaching and Learning Styles

	AL Active Learners (46% of population of university teachers)	PL Passive Learners (30% of population of university teachers)
CS Concrete-Sequential learners (37% of univ. teaching pop.)	17% of university teaching pop. (.46 x .37 = .17)	20% of university teaching pop. (.54 x .37 = .20)
AP Abstract-Pattern learners (63% of univ. teaching pop.)	29% (.46 x .63 = .29)	54% (.54 x .63 = .54)

3. *From cognitive development:* PBL moves students from the brute collection and comprehension of facts to application, analysis, and evaluation. These are the highest levels of cognitive development as indicated by Bloom's (1956) taxonomy, a standard classification in educational development.

4. *From intellectual development:* PBL moves students from crudely dualistic and idiosyncratically subjective notions of knowledge into an appreciation of knowledge and decision-making as contextually-relative. These are the highest levels of intellectual and ethical development, as indicated by Nelson's (1989) modification of Perry's (1970) work, another standard model in educational achievement (see Table 2.6).

Table 2.6 The Perry Model of Intellectual and Ethical Development

Stages of Cognitive Development	*Transitions in Cognitive Development*
#1 Dualistic Thinking • students generally believe knowledge is certain and unambiguous: black/white, right/wrong • questions have immutable, objective answers • students generally believe authorities possess valuable wisdom that contains eternal truths	
	Certainty yields to uncertainty and ambiguity
#2 Multiplicity • students come to believe that where uncertainty exists, knowledge and truth are essentially subjective and personal	
	Students come to recognize that mere opinion is insufficient because specific criteria help evaluate the usefulness and validity of knowledge claims: • methodology • empirical evidence • explanatory power • predictive power • logical consistency • positive vs. normative conclusions
#3 Contextual-Relativism • students come to believe that even where uncertainty exists, people must make choices about premises, frameworks, hypotheses, and theories to apply; policy conclusions are not self-evident	
	Students may come to recognize that even in a world of uncertainty, they must make choices (whether about ideas, hypotheses, theories, or policies) and these choices require methods of critical thinking.
#4 Context-Appropriate Decisions • students may come to acknowledge that choices require analysis *and* values. Knowledge, theories, and methods are imperfect and uncertain, thus personal choices are required acknowledging personal responsibility that follows personal values.	

5. *From educational psychology, theories of learning:* The PBL cycle of learning moves students through several stages of learning – concrete experiencing, reflective observing, abstract conceiving, and active experimenting – as advanced by the Kolb

6. (1984) model of experiential learning. Furthermore, PBL's student-centered format moves students from passive recipients of knowledge to active learners and participants.

7. *Business, government, parents, and society:* PBL meets the express goals of business, government, and parents by developing in students basic competencies and skills that will improve their competitiveness in the workplace. When involved with PBL, or active learning more generally, students also develop personal qualities of discipline, tolerance, and creativity, as well as the socially desirable qualities of working with others, compromise, teamwork, leadership, organization, and cooperation.

Finally, Burch writes, as one teacher reported to the Wall Street Journal, active learning in the classroom is not a welter of noise and formless chaos. Instead, active learning shifts classroom activities from teaching to learning; helps students learn in their preferred sequence from concrete to abstract; helps students structure and organize information in the ways most appropriate for them; affords students more and better feedback from teacher and peers; sets high expectations; enhances student confidence and willingness because they can see and feel their progress; thus students learn by doing (Keck, March 4, 1997: A19). Indeed, Burch adds, in this teacher's judgment, her students learn better to think critically, ask questions, collect and evaluate information, analyze, communicate, work logically, construct logical arguments, work cooperatively, negotiate and compromise.

In conclusion, Burch writes that PBL does not require complete or fundamental change in one's teaching strategy. PBL can become an effective augment to current techniques and performances. Indeed, PBL activities may spark excitement and interest in active learners without confounding reflective learners. By combining PBL with traditional writing and testing assignments, all students acquire a "fuller" learning experience. Thus, each student participates in as set of activities that, as a whole, challenge and build upon her/his skills and preferences.

Limitations to PBL

According to Bridges with Hallinger, PBL is an innovation; like most innovations, its implementation is hardly straightforward. Numerous obstacles await those who decide to try this approach. Although these barriers to adoption will vary from one institution to another, some are quite predictable and are likely to be present in nearly every institution. Based on what the authors have read and experienced, the most frequently occurring barriers relate to the institutional reward system, the scarcity of resources, and the pre-existing attitudes and expertise of faculty. (pp. 88-89)

Organizations are giant Skinner-boxes dispensing rewards for some behaviors and punishment for others. Higher education organizations differentially value teaching, research, publication, service, and fundraising. Despite public declarations to the contrary, professors recognize that certain behaviors, namely, research publication, and fundraising, are far more likely to be rewarded than teaching. As long as this reward system prevails, most professors understandably will seek to maximize their rewards by engaging in those behaviors that their institution weights most heavily when determining salary increases and promotions. Since PBL is an instructional innovation, the institution

is unlikely to provide extrinsic rewards that act as incentives for professors to use this approach. Instead, the reward system my actually create disincentives. (p. 89)

Bridges and Hallinger state that two types of resources may also serve as barriers to implementing PBL. The first of these is time, a scarce resource in nearly every organization. PBL makes at least two major demands on professors that exceed those inherent in conventional instruction. Based on their experience with PBL, they recognize that creating instructional materials consumes a great deal of time. Each PBL project requires from 120 to 160 hours to construct, field-test, and revise. As one becomes familiar with the process, the time consumed moves closer to the lower estimate than the higher one. (p. 89)

PBL also may involve spending more contact hours with students. Brides and Hallinger have found it difficult to manage more than three groups (five to seven students each) simultaneously. To maximize the outcomes from this kind of approach, they have deemed it advisable to limit the number of students being taught at one time by dividing a PBL-course into two or more sections. Consequently, the professor may double or triple the time spent with students in teaching the course. In some of the medical schools offering a dual track, professors who choose to teach in the PBL track also teach in the conventional track. Their instructional responsibilities in the PBL track represent an overload that they voluntarily accept because of their strong commitment to this approach. (pp. 89-90)

A university's budget sets limits on what the organization may undertake. The more enlightened and perhaps more well-to-do universities (a vanishing breed) earmark 1 to 2 percent of increases in the budget for new initiatives. Most, however, lack the resources

to implement such a policy. As a result, those who adopt PBL must compete with more established programs for the fiscal resources needed to implement the program. (p. 90)

To implement PBL, according to Bridges and Hallinger, faculty will require release time for course planning. If instructors are hired on a temporary basis to replace faculty who are involved in planning PBL-based courses, funds must be provided for this purpose. (p. 90)

Additional money may also be required to purchase equipment (examples are video cameras, microphones, VCR's, electronic chalkboards, and easels), instructional materials (such as films and cases) and supplies (for example, butcher paper, marking pens, and blank videotapes). If program planners choose to use practitioners who are expert on the content of particular projects as consultants, funds will be needed to underwrite these costs as well. (p 90)

Faculty knowledge, skills, and attitudes represent a third potential barrier to implementing PBL. Few faculty members are aware of what PBL is, the forms it may take, the rationale underlying it, and how it operates. Most faculty members have been taught by the two instructional methods most commonly used in preparing educational administrators – lecture and discussion. As a result, they probably lack a number of the skills inherent in PBL. Some of the major skills likely to be missing include proficiency in creating PBL projects, expertise in using the method as a mode of classroom instruction, and skills in recognizing and solving problems that may arise in the course of a PBL project. (p. 90)

Finally, Bridges and Hallinger warn that faculty members may also harbor attitudes about instruction and learning that may prevent them from considering PBL. They may be convinced that students will not actually learn what they need to know unless the

instructor stands and delivers. Moreover, some professors may even regard their teaching as being synonymous with student learning. Professors with convictions like these and/or strong attachments to the ways in which they were taught will be reluctant to try an instructional approach that radically alters the role of teacher and student. Their faith in and fondness for "tried and true" instructional approaches are potentially formidable barriers to adopting and implementing PBL. (p. 91)

According to Lovie-Kitchin (2001), there may also be concerns for students and group participation when using a PBL model. In open-ended comments, the final-year optometry students the author taught indicated advantages and disadvantages of small-group work and the problem-based approach, compared to traditional lectures. (p. 208)

One advantage clearly expressed is that students are strongly supportive of the interaction allowed by small-group work and the ability to learn from each other, writes Lovie-Kitchin. The improved communication between students generates more and different ideas, enables more information to be gathered but spreads the workload. Of interest is the effect of group pressure "forcing" students to answer the set questions each week because they feel a responsibility to their peers. The students also indicated that the PBL process is much more like real clinical situations. Understanding is improved because information is retained when students have to find it themselves. The process leads to broad reading around topics and also forces the students to contact outside groups. They report that the process is more interesting, enjoyable and helpful than traditional lectures. (p. 208)

On the other hand, Lovie-Kitchen cautions, some comments reflected some concerns about working in groups. These refer to various aspects of group dynamics such as reliance on other members and disagreements within groups. Because of time

constraints, information is not always shared or discussed. There is occasional resentment because some group members do more work than others. Some students indicated discomfort with the process in their comments that there is insufficient direction; they request more feedback on success or failure or are unsure whether all relevant areas have been covered. (p. 208)

In reflection, Lovie-Kitchin adds her own perspective to teaching using PBL and finds the interactive process with students most enjoyable and stimulating. The students' approaches vary from year to year, so teaching the same subject each year is no longer boring. Topics have arisen for discussion which Lovie-Kitchin had never previously covered in lectures and students occasionally find new references or make contacts with community groups of which she was unaware. (p. 209)

However, she adds, there is extra work involved with PBL compared to lectures – as the only person to use this approach at her school, this involved compiling comprehensive resource information and providing overnight feedback on, and copies of, the summaries. It was also difficult to find a large classroom, as opposed to a lecture theater, conducive to group discussions. (p. 209)

Most advocates of PBL recommend one tutor per group of eight students, and Lovie-Kitchin notes that she has one tutor to assist her with six groups of up to six students. It can be difficult to be aware of the interactions between students within each of the groups and ensure involvement of all members. However, there are some advantages in having the groups work without the tutor at times. Students have to take greater responsibility for their work, they may feel less inhibited about suggesting ideas and for the university the cost is lower. (p. 209)

Gibbs (1982) indicated that lecturers are held back from change because of their role perceptions of teachers. According to Lovie-Kitchin these form a number of constraints, but they include the time required to undertake the design of a new approach, and the fear of loss of authority and status. She continues by writing that she felt quite insecure the first time when she used PBL because students have to be trusted to work alone. However, it has been demonstrated that the quality of student learning can be maintained (many say improved) by relying on students' autonomy and personal responsibility and less on formal teaching (Gibbs, 1982) and the author has found this to be true. (p. 209)

According to Gilbert and Foster (2001), both professors of business who use PBL in their curriculums, the main contextual constraints center upon three foci: the participants – staff and students; the content – business and management and subjects; and the social-financial-political environment. (p. 246).

They continue writing that the future prospects of the two groups (faculty and students) also differ. For students, it is said that their skills in group communication, problem solving and disciplinary integration are prized in the business settings where they may find future employment. For faculty, career prospects with respect to their involvement in PBL are less rosy. Their academic future is seen as being determined by research and publications lists, not by how well they learn to tutor PBL groups. Other universities or institutes where they may work in the future are likely to use traditional teaching methods. Program evaluation in the faculty also includes focus on student ratings of tutor performance. This could have a positive effect on staff motivation and performance. Faculty time, real and perceived, remains a key limiting factor to incorporating the PBL process into educational institutions where efficiency of resource utilization over-rides pedagogical discussion. (p. 248)

Some colleagues and students probably long for a return to lectures, write Gilbert and Foster. Business and economics faculty are oriented toward efficiency perhaps more than are medical faculty. Lecturing to large classes looks efficient compared with meeting large numbers of small groups. A good lecture may inform students, elucidate difficult areas in their study and even inspire deeper thought and study. Lectures in general provide the same kinds of facts that can be found in textbooks whereas the attainment of deeper approaches to learning (Marton, 1984) is served by a focus on applying those facts to solve 'comprehension' problems. It is the promotion of these deeper approaches, coupled with social problem-solving skills and attitudes, that characterizes what is meant by effectiveness as in PBL, where the learning process is continually in focus and participants are encouraged to integrate and apply their growing skills to identify, analyze and resolve increasingly complex situational problems. (p. 248)

The financial climate surrounding higher education, the growth in distance learning programs and development of Internet degrees present real challenges for PBL. Case studies have a long history in business and management education. Case study can be considered to be an early "proto"- form of PBL. Although PBL is often described as "imported" from medical education, the "Harvard case study method" in management is probably best considered PBL's "grandparents". Case study traditions are weaker for general economics where some faculty members frankly state that PBL is not compatible with the ways they organize their field. Other colleagues express doubts that students lack motivation to study anything that may not appear directly on their examinations. Furthermore, the reported gain in student abilities in group communications and problem solving are said by some to be at the expense of developing their skills of written

expression also prized by potential employers. These questions need to be addressed further in educational research and evaluations of PBL. (pp. 248 -249)

Drinan (2001) writes that the possible permutations and combinations of design variables in PBL are endless (Barrows, 1986). It is an amalgam of teaching strategies, not all of which are employed in all problem-based forms. Typically, they include an activity that addresses a challenging or problematic situation in a particular context. The situation is multi-faceted; much of the activity is conducted with small groups of students; and students are expected to participate actively in their own learning – i.e. four different strategies. The term PBL does not seem restricted to the first of these but to the totality. It is important that this is recognized, because each of these strategies needs to be independent and contextual consideration in the design of the curriculum, if the full potential is to be realized. (p. 334)

Not all forms of PBL, according to Drinan, seem capable of developing all of the qualities listed above, even through their inclusion of potentially powerful strategies. Indeed, some PBL becomes mechanical in practice, destined merely to train students to solve problems and acquire the knowledge needed for this. In these cases, the potential for stimulation of deeper, holistic and creative thought is lost through prescribed problem-solving pathways and processes: the opportunity for development of interpersonal and communication skills disappears in proportion to ill-chosen or non-intervention by teachers, and innate independent learning skills wither through lack of stimulation by teachers who find it difficult to resist the urge to give of their knowledge and wisdom. (p. 334)

He suggests that it might be helpful to confine the term "problem-based learning" to a defined territory of learning purposes. According to Drinan, this restriction might be

made through a distillation of the essences of PBL forms and derivatives and ordering them from the original, to those that have emerged with growth of understanding:

1. Motivation for learning through use of professionally relevant material.
2. Developing the ability to make decisions.
3. Acquisition of, or exposure to, a body of knowledge.
4. Raising awareness of the complexity of real-world issues.
5. Developing the capacity for self-directed learning.
6. Developing the ability to extend learning beyond the presented situations into new ones.
7. Generating the desire and ability to think deeply and holistically.
8. Generating an enthusiasm for learning from all of life's experiences in personal, professional and community development.
9. Encouraging a search beyond one's own perceptions, becoming ultimately innovative and positively critical with respect to self and one's profession and society.

The term "problem-based learning" might be restricted to curricula embracing purposes 1-5 above, where the desired or attainable end-point is the acquisition of relevant information and its organization into making decisions, and the capacity to go on learning independently. This does not necessarily require the reflection and conceptualization that would mark attainment of the full set. (pp. 334-335)

Restriction of the term "problem-based learning" requires that another be used to include those forms, which additionally embrace the higher purposes (6-9) above, as described, for instance, by English et al (1994). "Experiential learning" seems to accommodate them all, and requires fulfillment of all stages of the cycle so well

elucidated by Kolb (1984). Thus, reflection and conceptualization on any experience, whether contrived or real, a problem or opportunity or life happening, should involve a depth and breadth of thought which might ultimately lead to the freedom to challenge, rework and appreciate one's most cherished fundamentals. Perhaps all forms of education founded on problem-based learning might have this endpoint, but such a goal would be unrealistic. We should be more precise in our terminology so that we understand and can signal to others the purposes of our curricula. (p. 335)

Drinan explains that there is also a need to resolve a number of pragmatic issues that currently stand in the way of effective and efficient adoption of PBL. Prominent among these is student assessment, but the relative importance of the process and content of learning, age and experience differences among students, and resource requirements, are also important barriers. (p. 335)

He also adds that it can be too easy in problem-based courses for students to believe that they are only required to solve a problem and so guess their way from problem to solution without seriously engaging either sources of information or mental facilities. This deficiency should show if student assessment clearly reflects the purpose of the curriculum. That it sometimes does not is an example of the lack of appreciation of the need for different approaches to assessment in PBL, and/or of the difficulty in devising such approaches. (p. 335)

Most forms of assessment used in conventional courses, he notes, are designed to test recall of information and ability to apply it in intellectual or physical processes. There are particular difficulties in transplanting these forms of assessment to problem-based curricula, based as they are on different conceptions of knowledge (Hager and Butler, 1994). *Inter alia*, the body of information is more diffuse and less prescribed,

relationships are as important as the bits and pieces, problems are complex and often non-linear, and awkward matters such as personal values and belief systems intrude. Clearly, conventional assessment methods are of limited value, and the future progress and credibility of PBL depends heavily on encouragement of innovative thinking and practice in this respect. (pp. 335-336)

Drinan continues to explain that exponents of PBL argue that the process by which students learn is of critical importance in helping them to conduct themselves appropriately in their future professions, and that they will acquire the information they need as they need it. It is in his experience that students can and do access information according to need, but that their capacity to do so outside a directive curriculum is dependent on age and motivation, which themselves appear to be related. Drinan adds that he doubts the capacity and motivation of many students who emerge direct from school into tertiary education, and we do them a grave injustice if we do not support them with facilitators who care to watch, challenge, encourage, constructively criticize and retrieve them from the holes into which they occasionally fall. (p. 336)

He states that the need for facilitation seems to be somewhat less for the students who have left school for some time, as they generally have better considered purposes in selecting a particular course. However, perhaps this group needs a different type of facilitation, with emphasis on challenge and critique. Facilitation requires attributes that are substantially different to the usual ones on which academic staffs are hired. A genuine and personal care for students, a real enthusiasm for learning and a commitment to modeling the principles inherent in experiential learning, are probably the most crucial qualities in such persons. There are not enough quality facilitators, perhaps because our

traditional education systems are unlikely to encourage the desired characteristics. (p. 336)

Cautioning that the above remarks are also relevant in the extent to which teachers may feel comfortable about "letting go" of their focus issues and moving on to fully experiential learning, Drinan writes that the construction of most problem-based curricula involves much work in developing and packaging a series of focus problems or case studies. Having invested so much effort, teachers are understandably reluctant to change the issues or seize the opportunity to immerse students in real-time issues in the real world. This spells danger because the issues become stale and increasingly irrelevant, and the richness and stimulation available to students and teachers alike in the real world is forgone. Teachers who are willing to respond to learning opportunities, who trust themselves in the real world, who are capable in the theory of the target profession, and who truly care for their students should be an objective and outcome of all problem-based curricula. (pp. 336-337)

Curriculum designers quickly collide with the realities of resource availability, and none more so than those who seek to use problem- or experience-based approaches. The apparent "efficiency" of large groups of students being lectured stands in stark contrast to the seeming "inefficiency" of small groups groping for information and understanding, supported by teachers who are never quite sure what they may be asked to do next. Obviously, such appearances are misleading, because the foundations and purposes of the two approaches are so different. Nevertheless, the development of the better graduate we seek through experience-based learning can be more expensive, but it need not be so with imagination and good management. If it is more expensive, this is not unreasonable in view of the superior quality of the graduates. However, evidence on the latter claim

remains somewhat equivocal (eg, Schmidt et al, 1987), though care should be taken in interpreting comparisons to ensure they address the criteria sought in experience-based programs. (p. 337)

Drinan concludes with stating that the resource squeeze of the nineties constitutes a major obstacle to problem- and experience- based curricula. Greater student:staff ratios, increased proportions of non-tenured and less experienced teachers, and fewer discretionary funds constrain curricular innovation. Administrators perceive them as being more costly, and teachers whose futures in the institution are short do not have the time or incentive to invest in curriculum redesign. If they are junior staff, their reluctance to innovate may be reinforced by lack of confidence and senior support, as well as by the damaging emphasis given to research over teaching in university pronouncements and recruitment and promotions practices. On the other hand, the implications of quality assurance might counterbalance this, alongside growing awareness of the need to focus on learning rather than teaching, and of the relativity or contextualization of knowledge. Thus might student learning gain priority over institutional and staff concerns. (p. 337)

Is PBL the Only Way?

Coles (1997) writes that during the 1970's several researchers attempted to identify the optimum approaches for studying in higher education. Marton identified what he called deep and surface processing (Marton and Saljo, 1976). Deep processing was said to occur when students understood the meaning of what they were learning, and was associated with high scores on tests of their knowledge. Surface processing occurred when students merely memorized what they were studying, and was associated with poor test scores. (pp. 313-314)

According to Coles, in the United Kingdom, Entwistle measured various learning approaches and proposed a mathematical model (Entwistle, 1983): students' scores on approaches contributed positively towards their learning success were added, while those shown to be counter-productive were subtracted. He called the resultant score a prediction of success, which he claimed correlated positively with students' examination grades. (p. 314)

In the early 1980's, the Entwistle learning inventory was used with medical students, and the first study comparing conventional and problem-based medical schools was reported in 1985 (Coles, 1985a). Further studies demonstrated comparable results (Martenson, 1986; Newble and Clark, 1986). Students studying under the conventional curriculum arrangement showed a deterioration in their approaches to studying, while those in a problem-based curriculum did not, and indeed might actually improve (De Volder and de Grave, 1989). (p. 314)

These findings supported other studies (Coles, 1985b; Maddison, 1978; Mountford, 1989; Simpson, 1972), which suggested at the very least that the conventional curriculum arrangement was educationally unsound, and some researchers went further to claim support for a wider introduction of PBL (Newble and Clark, 1986). However, both of these conclusions are oversimplistic, as will be pointed out. (p. 314)

Coles continues to argue that the kind of learning students should engage in, not just in higher education generally, but more particularly when preparing for a profession, should reflect "deep processing". People going into a profession should understand the meaning of what they are learning. However, there are several reasons why this may not be so. (p. 314)

While empirical studies have shown that students who adopt a surface approach to processing do rather badly in their courses, they have not clearly shown that those who adopt a deep approach do well (Coles, 1985b; Newble and Clark, 1986). In one study, a surface approach was relatively to induce experimentally in students but not a deep one (Marton and Saljo, 1976). (p. 314)

Coles states that the deep and surface processing analysis has not been supported by a clear theoretical explanation, nor has it been shown what are the mechanisms that could be operating educationally in situations, which purport to induce one approach or the other. Attempts have been made to describe a theoretical basis for PBL (Schmidt, 1983), but these have had to draw rather widely on diverse theoretical structures, which lack cohesion. (pp. 314 – 315)

Evidence now exists that deep processing students are less successful than those who elaborate their knowledge – that is who see the interconnections and links between different knowledge areas (Coles, 1990) – who not only gain the highest scores in examinations which test that knowledge but are more able to retrieve and use in some novel situation the information they have learnt. Broadbent (1975) argues that remembering is more likely when the learner has "multiple routes of access" to the stored information. The greater the network of knowledge and multiplicity of linkages between stored information, the more likely will be its retrieval and use. Mayer (1979) also argues that what he calls "the far transfer of knowledge" is only possible when there has been "elaboration to schema". (p. 315)

According to Coles, this kind of learning also seems necessary for professional practice. Norman (1988) suggests that "there is an accumulation of evidence that problem solving in medicine is dependent on…elaborated conceptual knowledge", and

the works of Gale and Marsden (1983) and Bordage and Zacks (1984) shows that successful clinical reasoning is dependent upon having access to an appropriately structured memory comprising a deep, rich knowledge. (p. 315)

However, he continues, elaborated learning is rare under normal educational conditions, though it was found when medical students revised their basic science knowledge for an examination not at the end of the pre-clinical years but one year after beginning their first clinical attachments, and also (Patel and Dauphinee, 1984) when re-taught a basic science course during their final clinical attachments. In both cases the educational mechanisms are the same and embody three elements. (p. 315)

First, students needed a concrete context for their learning, which was provided for them by their first-hand experiences. Second, they had available related theoretical information, provided in one case by their revision notes and in the other by a taught course. Third, students had the opportunity of handling this abstract information in such a way as to relate it to their clinical experiences. This analysis suggests a generalizable model, which has been called "contextual learning" (Coles, 1985b, 1990). (pp. 315 – 316)

Perhaps the most important feature of contextual learning, Coles explains, is the establishment of an appropriate context in which learning can take place. Once such a context has been established, elaboration will almost inevitably (although not necessarily) occur. The context forms a basis or framework within which learners can receive the information they need to know. It begs questions, and enables the learners to enquire. It creates an instability in the learner's mind, a wish to learn, a desire to create (Rogers, 1960), and a want to (as opposed to a need) to know something more about the subject. (p. 316)

Contexts for learning exist at different levels of concreteness. Perhaps the highest is actual experience and may be the most universally appropriate, though contexts at lower levels of concreteness may be appropriate in certain circumstances. Thus, curriculum plans should incorporate contexts for learning at an appropriate level of concreteness for students' current state of understanding and the nature of the knowledge they need to acquire. (pp. 316 - 317)

When attempting to contextualize learning, Coles writes, the most important feature of the information being provided is that potentially it should be relatable to the already established learning context. In many cases, this will mean that the choice of content will be determined by decisions already made concerning those contexts, and it should be recognized that this is likely to be the reverse of the decision-making process in conventional curricula, where the choice of content usually lies in the hands of individual teachers – especially those teaching theoretical courses. The choice of content and of contexts can and should be closely negotiated by all interested parties. (p. 317)

Once the content has been agreed, there are other considerations such as the way in which the information is to be made available to students and how to present it. Behind those decisions lies a concern about how much information students should be expected to gather for themselves and how much they should be given. (p. 317)

Coles adds that in a conventional curriculum, students often say they are unclear about what they should be doing with the information they are being taught. It

is the responsibility of the curriculum planners to build into the curriculum suggestions about how students should be making sense of what is being taught. For elaboration to occur, students should see their task as linking together aspects of knowledge both within and between subjects, and relating what they are learning now to what they already know.

Students should be "structuring" the information they are acquiring. They should be making connections, and in professional courses perhaps the most important consideration is the linking of theory and practice (Coles, 1990). Where students have an appropriate learning context and the necessary information, they report "things come together". This is the very essence of elaboration but it does not occur automatically. Thought should be given to providing opportunities, which allow students to handle the information and relate it to their prior knowledge or experiences so that elaboration will occur. (pp. 318 – 319)

An important feature of this handling of information is that students should do it for themselves. However much their teachers may have elaborated their own knowledge, it is for the students to make the connections in their own minds. It is for this reason that learning must be an active process on the part of the learner (Rogers, 1960). (p. 319)

While elaboration is something only an individual student can do, it can of course occur when students work in groups (Walton, 1973). Coles continues by stating that the contribution of group work to each student's elaboration processes is that it allows the opportunity to articulate one's thoughts in a safe environment, and to receive constructive feedback from peers (Coles, 1989). The role of the teacher is to facilitate this elaboration, and this often requires considerable patience as students grapple for themselves with their uncertainties. (p. 319)

Coles further explains that the three features of the contextual learning model, which include the context of learning, the type of information students are being taught, and opportunities for handling the information, closely relate to what can occur in problem-

based learning. At the beginning of a PBL sequence, students are presented with a case or problem. This could well establish an appropriate context for learning. At the very least, it allows students to raise questions in their own minds concerning why the problem is occurring, what is going on, and what the resolution might be. Then, in a problem-based curriculum, students acquire information in order to understand that problem more fully, and possibly to solve it. This represents the second phase of the contextual learning model. Following this, students have the opportunity, often in groups, to solve the problem, or at least to work towards its resolution. Clearly this is a curriculum strategy, which closely relates to providing opportunities for handling the information in such a way that students can elaborate their own knowledge. (pp. 319-320)

Having said this it is also clear that the problem may not always provide an appropriate context for learning, and there is some evidence to suggest that this can occur to the detriment of students' knowledge acquisition (Haas and Shaffir, 1982; Olson, 1987). Coles states that perhaps one difficulty is that often the problem comprises a paper and pencil case which is described as being at a lower level of concreteness than some other contexts, such as first-hand experience or even a live or recorded demonstration. Also, in PBL students are often expected to acquire the information for themselves, but under certain circumstances it might be appropriate to make the information available to students. Similarly, the problem-solving activity in PBL can, but does not necessarily, provide an opportunity for handling the information in such a way that elaboration occurs for all students involved. (p. 320)

The contextual learning model also seems to relate closely to what has been called experiential learning. Kolb (1984) describes the ideal learning cycle as proceeding from concrete experience to observations and reflections, and then through the formulation of abstract concepts and generalizations to testing the implications of these concepts in new situations, and thus new experiences. (p. 320)

A third innovate approach to education, according to Coles, which closely resembles the contextual learning model has been called reflection on practice, as seen especially in the work of Schon (1983; 1987) and of Boud (Boud et al, 1985). Reflection on practice is made possible because of the learner's prior experiences, and this clearly relates to establishing an appropriate context for learning. This provides a basis for the generation by the learner of abstract thought in relation to those experiences, which equates with the information phase of contextual learning. The outcome of reflection is that the learner gains new perspectives on experience and has the possibility of changing behavior. This phase has been called "resolution" in which learners experience "a coming together or creative synthesis of various bits of the information previously taken in" (Boyd and Fales, 1983), which seems closely to relate to what has been called elaboration here. (p. 321)

Coles concludes by stating that a generalized model has been proposed called contextual learning. This suggests that elaboration can occur if three conditions are met: students must have an appropriate context for learning; they must be provided with or acquire information potentially relatable to that context; and they should have opportunities to so handle the information that they make connections. (p. 323)

Coles then asks where does all of this leave PBL? The implication is that PBL is an unnecessary complication to the educational scene. It has been an interesting and worthy experiment but now that we know about the contextual learning model we no longer need to reinvent it. Certainly conventional courses should not be abandoned in favor of problem-based ones. Rather they should be helped to evolve in line with the principles of contextual learning outlined here. (p. 323)

Current Research on the Implementation of PBL in Medical Curriculums

After extensive research on the effectiveness of PBL as a teaching methodology in programs of higher education administration, the researcher found there were very limited findings in this area. Since PBL originated in schools of medicine and was also tested in the New Pathway Program at Harvard University, the following studies were used to provide more information on the effectiveness of PBL when it is used as a teaching methodology in schools of higher education, particularly in medical school curriculums.

According to Albanese (2000), one of the most consistent findings in evaluations of PBL is a "more humane learning environment that promotes collegial interactions". Albanese concludes that this is a worthwhile goal in and out of itself. So why is promoting collegiality so important? Albanese continues to write that in the U.S. and elsewhere, we are in a period of increasingly scarce resources available to support the health needs of an increasingly aged population. As physician groups grapple with these

realities, the result has sometimes been what appears to be "turf wars" and petty bickering over reimbursement formulas. The competitive learning environment found in most premedical programs and many medical schools do little to prepare students for working together to address such issues, and, due to their competitive nature, may actually contribute to the hostilities that often occur. Better preparation of physicians in jointly solving problems, such as resource allocation, is needed. This preparation needs to include experiences that allow students to disagree, work through disagreements, and ultimately solve a problem jointly that is too complex to solve individually. Such activities serve to foster greater understanding and respect for the contributions made by peers from various specialties and with differing amounts and types of experience. PBL provides a first step in this direction with students working together in a cooperative environment, learning to trust one another, and building their skills in achieving group consensus. Students who are at the top of the class by traditional measures of accomplishment can learn that other students in the class can make meaningful contributions to solving problems through expertise and ability in areas such as: 1) effectively organizing tasks; 2) managing conflict; 3) negotiating agreements; and 4) facilitating interpersonal communications. Students who rank lower in their class by traditional measures can gain confidence in their ability to contribute meaningfully to solving problems with their higher rank peers. All students gain practice in skills such as engaging in dialogue that requires all participants to suspend judgment long enough to entertain alternative points of view. In these dialogues, students can also practice management of emotions (e.g. controlling anger, frustration and its associated behaviors)

while discussing contentious issues. These interactions might help create a degree of respect and affiliation that will carry over to future discussions of contentious issues such as the optimal allocation of resources among specialties to achieve excellent patient outcomes. Having physicians working collegially to address the critical problems facing health care is likely to yield a better result for health care of the nation than will acrimonious interactions born of insecurities, inexperience in working out disagreements and disrespect for the contributions that various specialists can make. Thus, while PBL may not produce the gains in technical, clinical expertise that some had hoped, it may yield something that in the long run is more important – peer collegiality. (pp. 729-738)

Blake, Hosokawa and Riley (2000) compared performances on Step 1 and Step 2 of the United States Medical Licensing Examination (USMLE) following the implementation of a problem-based learning curriculum. The method they used were the performances on Step 1 of the USMLE for four classes at the University of Missouri-Columbia School of Medicine that completed a new problem-based curriculum (1997, 1998, 1999, and 2000) were compared with those of the last two classes to learn in the traditional curriculum (1995 and 1996). Performances on the Step 2 of the USMLE for the classes of 1997, 1998, and 1999 were also compared with those of the classes of 1995 and 1996. The authors analyzed matriculation data (GPAs and MCAT scores) for all six classes. They compared all data with those of U.S. and Canadian first-time USMLE tests.

The results showed that the mean scores were higher on USMLE Step 1 for classes in the problem-based learning curriculum than for classes in the traditional curriculum.

The mean scores for Step 2 were above the national mean for classes in the revised curriculum and below the national mean for classes in the traditional curriculum. The admission profiles of these classes were essentially the same before and after the change in curriculum. The researchers concluded that major PBL revisions of the curriculum did not compromise the performances of medical students on the licensing examinations; in fact, they may have contributed to higher scores.

According to Blake et al., previous studies have found that students exposed to a PBL curriculum scored lower on standardized tests of basic science knowledge and higher on tests of clinical knowledge than students who completed a traditional curricula. At UMC, students in the second, third, and fourth classes, completing the new PBL curriculum, performed substantially better on Step 1 (basic science) and Step 2 (clinical science) of the USMLE than did previous classes at the school. While these students had MCAT scores that were slightly below the national average, their USMLE scores exceeded the national means. According to the researchers, Step 1 of the USMLE increasingly frames questions as clinical vignettes; students in a PBL curriculum may be at an advantage with such questions.

Blake and Parkison (1998), evaluated the new curriculum at UMC by interviewing faculty members and asking them to compare students who had completed the new curriculum with students who had completed the traditional curriculum. The majority of faculty rated students who completed the first two years of the new curriculum superior in knowledge of pathophysiology and disease processes, ability to obtain an appropriate history, and clinical reasoning and problem solving. (Blake, Hosokawa, & Riley, 2000)

Since 1970, the Ohio State University College of Medicine and Public Health has offered medical students a choice between two basic science pathways, lecture discussion (LD) and independent study (IS), according to Way, Hudson, and Biagi (2000). Since 1991, the college has offered entering students a choice among three pathways, LD, IS and problem-based learning (PBL). The purpose of their study was to investigate outcome measures (other than USMLE test scores) such as student activities and achievement in clinical education, and affective measures of student and faculty satisfaction. Additionally, the researchers sought to assess the effect of pathway choice on admissions, and to determine factors influential in determining student pathway choice.

Way et al. report that Ohio State University is the only medical school in the country where entering students have a choice of three preclinical pathways, making it fertile ground for comparison of the effects of different curricula. Learning objectives, content material, and structure (organ-based organization) are very similar across all three pathways. The three also share faculty, staff, and administrative oversight. What differs across pathways are the teaching and learning methods.

According to Way et al., in 1997-1998 the college formed a task force to study the benefits and overall desirability of maintaining the three preclinical pathways. Specifically, the task force was charged to look at all three pathways in terms of their educational importance, student and faculty preferences, and participant satisfaction.

Until recently, the traditional LD was the most commonly chosen pathway among the 210 matriculating students each year. The primary mode of teaching in the pathway is

large-group lecture supplemented with small-group discussions and labs. The IS pathway, established in 1970 as the first alternative to the LD, offers students the flexibility to learn on their own through the use of highly structured reading materials, computer-based materials, and diagnostic practice examinations. The PBL pathway, established in 1991, emphasizes student-centered, self-directed learning. Unlike IS students, PBL students are introduced to basic science concepts through the analysis and discussion of clinical cases during small-group meetings. Students then work independently on learning issues that are defined by the group before coming back together to discuss their studies.

Way et al. continue to explain that like any educational innovation, both IS and PBL programs have had to prove their effectiveness as alternatives to the traditional lecture-based teaching. Lecture-based teaching has existed primarily for its efficiency, not necessarily for its effectiveness. As medical schools struggled to develop alternatives to lectures, investigations comparing alternatives to traditional lecture curricula such as IS and PBL were reported in the literature. Such investigations have generally found little or no difference in examination scores or clinical performances when comparing lecture-based courses with alternatives. The authors compared alternative curricular approaches in one college and determined that no difference in average USMLE Step 1 scores existed across alternative basic science pathways when controlling for pre-matriculation differences.

According to Way et al., the literature on IS in the health professions reveals the following:

1. There is little or no significant difference in learner performances as measured by examinations and patient care compared with traditional lecture-based curricula.

2. IS offers both faculty and students more flexibility and portability in learning when compared with lecture-based learning.

3. IS promotes lifelong, independent learning, self-pacing, and self-responsibility in learning.

4. Students who participate in IS tend to pursue more research and full-time faculty positions than students in lecture programs.

5. After start-up costs are accounted for, IS costs the same as or less than traditional lecture-based courses.

The literature on PBL in the health profession also reveals:

1. There is little or no significant difference in learner performance as measured by examinations or patient care compared with traditional lecture-based curricula.

2. Differences that have been reported generally indicated the same or less factual knowledge but better clinical performance and patient management for PBL students.

3. Both faculty and students find PBL more enjoyable and prefer PBL to "traditional" lecture courses.

4. PBL students tend to use "backward" reasoning (working from clinical information backward to theory) when solving clinical problems, whereas traditional students reason "forward" (from theory to clinical practice).

5. PBL students have a greater tendency to use evidence-based medicine practices (more journals and literature searches) than "traditional" students.

Way et al. write that this article reports part of a larger, more comprehensive institutional research project conducted by a task force of clinical and basic science faculty supported by consultants from the College of Medicine's Office of Academic Services (OAS) for Medical Education. Both qualitative and quantitative data were gathered for this report using a variety of methods: document analysis, survey methods, and interviews with key educational staff members.

The authors mention that annual reports dating back to 1991 from each of the three pathways were reviewed and summarized by task force members. Surveys for both student and faculty were developed, pilot tested, and summarized by task force members with help from the OAS consultants. Surveys were administered in spring quarter of 1997 to all students. First- and second-year students were surveyed in their respective class locations, as a group; third- and fourth-year students received paper copies in their college mailboxes. Return rates were much lower for clinical-year students due to clinical assignments and the time of the survey. Faculty surveys were distributed through internal mail services to faculty with 50-100% academic appointments. Likert-type survey items were analyzed using descriptive statistics: frequencies, percentages, cross-tabulations, means, and standard deviations. For reporting purposes "very satisfied" and "satisfied" were combined into "satisfied" and "very unsatisfied" and "unsatisfied" were combined into "unsatisfied." Documents, interview notes, and other qualitative data were analyzed using domain analysis of key words and phrases.

According to Way et al., the academic outcomes produced no differences across pathways that were observed for graduation rates or grades on clinical rotations, but more IS students were in Alpha Omega Alpha (24% IS, 17% LD, 14% PBL) and higher

percentages of both IS and PBL students received more departmental awards than did LD students.

Way et al. also stated that the student survey was designed to learn how students choose their pathways and assess their satisfaction with their choices. The students were also asked to comment on their impression of all three pathways. Of the 839 student surveys distributed, 467 usable responses were returned (55.6%). The return rate was biased toward the basic science classes (year one = 92%, year two = 76%, year three = 43%, and year four = 11%). Return rates by basic science pathway for each class surveyed resembled the proportion of students enrolled across pathways (LD = 69%, PBL = 17%, and IS = 12%). Because so few fourth year students returned the survey, their data were not used..

Having a choice of pathways was a significant factor in the students' decisions to come to the college: 56% of the respondents agreed that choice of basic science pathway influenced their decision to attend the school. Based on the students' responses, the factors that contributed to a student's choice of pathway were learning style, experience with nontraditional learning methods, personal and family needs, and needs for socialization. Sixty-two percent indicated that the LD pathway was their first choice. Many students stated a preference for it because it was a method with which they were familiar. Some felt that because of perceived weaknesses in their basic science backgrounds they needed the structure provided by LD. Social factors that contributed to pathway choices were distance from campus, need for contact with students and teachers, and need to make friends and network.

Way et al. explained that PBL is the only pathway that caps enrollment at 35. Twenty-eight percent of the survey respondents (131 students) identified PBL as their

first choice of pathway; of these, nearly 40% (52 students) matriculated into other pathways. Students stating preferences for PBL said that they either had previous experience with group work in the past or believed that through PBL they could learn clinical reasoning skills early.

Nine percent of the respondents identified IS as their first choice. However, 12% reported participating in the IS pathway. Some students from the PBL wait list had chosen the IS pathway once it was determined that they would not be admitted into the PBL pathway. The students who chose IS as their first choice cited the flexibility of the pathway as their primary reason. This pathway tends to attract more nontraditional students such as older students with families, married students, or students in the MD-PhD program. Many stated that they would not have been able to complete medical school without the flexibility offered by the pathway. Others appreciated the opportunity to manage their own time by either accelerating or decelerating their pace through the basic sciences.

Overall, Way et al. reported that student satisfaction with their basic science pathways was high: almost 82% were satisfied with their pathways; only 9% reported being unsatisfied. Across the three pathways, PBL students reported being the most satisfied (91%), and 93% of the PBL students would have chosen it again. The IS students were almost as satisfied with their pathway, with 86% reporting satisfaction, although only 76% said that they would choose it again. The LD students were the least satisfied, with 79% stating that they were satisfied and only 63% said that they would choose that pathway again. No difference across cohorts was observed. The proportion of students expressing a preference for a given pathway was the same for each class: 42% said that they would pick LD, 41% said they would pick PBL, and 17% said they would pick IS.

According to Way et al., overall, 52% of the students felt that they had missed something offered by the other pathways (54% of LD, 41% of PBL, 51% of IS students). Many LD students felt that they missed the clinical experience, case studies and active learning that was offered by PBL. On their own initiative, non-PBL students started a case-study interest group in an effort to make up for this perceived need. Alternative-pathway students felt that they missed out on well-presented and organized material from content experts, comprehensive coverage, pressure to perform, and proper pronunciation of medical terms.

The overwhelming response by students was that choice was very important and that students have different learning styles. They felt that choice attracts a higher caliber of students and shows that the school is a progressive medical school. Over 90% of the respondents agreed that the school should continue to offer multiple basic science pathways.

In the final analysis, Way et al. reported that out of all 568 faculty with 50% or greater appointments who were surveyed, 133 (23.4%) responded. Of the 133 respondents, 23% were from basic science departments, 48% from clinical sciences, and 29% did not provide their departments. Nineteen percent of the respondents reported no teaching experience in any pathway. Sixty percent taught in only one pathway (LD 50%, IS 1.5%, PBL 7.5%). Fourteen percent of the respondents reported experience in two pathways (LD/IS 4.5%, LD/PBL 7.5%, IS/PBL, 2.3%). Seven percent participated in all three pathways.

According to the results, the faculty respondents were generally satisfied with their student interactions in each pathway (54% of LD, 53% of IS, and 87% of PBL faculty). The basic science and clinical faculty disagreed on the appropriateness of the distribution

of their teaching, research, and service time: 80% of the basic science faculty were satisfied with the time, while only 47% of clinical faculty were satisfied. When asked, "In your opinion is it important that the College of Medicine and Public Health continue to offer three preclinical pathways?" the faculty responses of those who expressed an opinion were split almost evenly (38% yes, 39% no, and 22% no opinion). For the faculty who identified their departments, approximately half replied in the affirmative (47% of basic science faculty, 50% of clinical faculty), and 19% had no opinion.

Based on student and faculty opinions from surveys and comparison of pathway outcomes for 1993 to 1997, the task force unanimously recommended that the college maintain three basic science pathways, reported Way et al. The presence of three preclinical pathways provides the college the tremendous flexibility to accommodate student learning styles and time requirements. Students highly value the commitment of the college to medical education by accommodating their different student learning styles. Providing three pathways is also an important factor in the recruitment and admission of high-quality students. Differences in outcome measures are small and may be attributed to higher prematriculation statistics for IS and PBL students. The three basic science pathways are important in maintaining the positive image of medical education at the college. This is true both for current medical students and for those applying. Requests for the PBL pathway from entering students averaged 46% of the entering classes of 1994 –1997, and IS enrollments have increased dramatically. Faculty are generally satisfied with student interactions in the LD and IS pathways, but are most satisfied with their interactions with the PBL students.

Way et al. point out that the three pathways provide for differences in learning styles, as well as offering time for independent learning, research, and outside interests. Time

flexibility by pathway is greatest with IS, followed by PBL, and least with LD. Student satisfaction with their current pathway is very high: 91% of PBL, 86% of IS, and 79% of LD students were satisfied with their basic science pathways. In spite of the high satisfaction levels, however, approximately half of the students felt that they had missed something in their pathways that was available in another pathway. Student comments indicated that this lack was not one of content material, but rather in the social and pedagogic opportunities with faculty and other students. Eighty-seven percent of the students agreed that the college should continue to offer three basic science pathways; only 5% disagreed.

Unfortunately according to Way et al., low faculty response rates, lack of teaching experience in the pathways, and "no opinion" responses made it difficult to interpret the faculty surveys. Therefore, the task force recommended educating faculty about the importance of the three pathways and their recruiting and retention benefits.

Another study was recently conducted by Schmidt and van der Molen (2001) in which the purpose was to study the self-reports of the professional competencies by graduates of a problem-based medical curriculum. Schmidt and van der Molen sent a questionnaire to all graduates from a medical school and a faculty of health sciences with a problem-based learning curriculum asking them to compare their own performances in 19 domains with those of colleagues trained at schools with conventional curricula.

In the spring of 1999, all alumni of Maastricht University School of Medicine were sent a questionnaire inquiring about their current perspective on the quality of their training. They were asked to rate themselves on 19 professionally relevant skills. Their task was to compare themselves with colleagues who had been trained elsewhere, and to indicate on a five-point scale whether they considered themselves less competent, equally

competent, or more competent than these colleagues (3 = equally competent). Participants were 820 graduates of the medical school of Maastricht University, 418 women and 402 men, who responded to the survey. These graduates represented 39% of the total population of physicians who had graduated from this school since its inception and who had entered practice up to 19 years previously. As a comparison group, responses from 1, 448 graduates (1,109 women and 339 men) from the health sciences faculty of the same university were included. Both curricula employ problem-based learning as their instructional approach, emphasizing problem-solving, small-group work, and directed learning. The health sciences data are reported in the results merely to put the medical school's data into perspective.

The responses by competency of medical school graduates (and faculty of health sciences graduates for comparison only) are shown in Table 2.7. Medical school alumni rated themselves as better in the competencies of cooperation, problem solving, interpersonal skills, skills relevant to running meetings, and the ability to work independently. They did not rate themselves as better in the possession of general academic knowledge and writing reports or articles.

To control for the possibility that the medical school graduates may have overestimated their own competencies or underestimated those of others, Schmidt and van der Molen established a baseline by using the scores of competencies for which there is no reason to assume that graduates from Maastricht University School of Medicine perform better than graduates from elsewhere. For instance, previous research showed that Maastricht's medical students have no more medical knowledge than do students from conventional schools (Verwijnen, Van der Vleuten, and Imbos, 1990). Nor is there

reason to believe that their general academic knowledge, report writing, presentation, and research skills are more advanced, because the Maastricht curriculum pays no more attention to these topics than do other medical schools in The Netherlands. The researchers deduced that the average self-reported competency scores on these items would be around 3.0 if these ratings were based on actual observations of one's own behavior compared to that of colleagues trained elsewhere. Because the average score on these items was 3.26, the researchers considered a fair estimate of the amount of self-over-estimation to be 0.26. To be conservative, they established a baseline score of 3.3 to represent the value at which no difference in competence was observed.

Taking this correction into account, their findings suggest that graduates' self-assessments of greater competency in cooperation, problem-solving, and independent work reflect real differences rather than simple self-overestimation effects. This may be particularly true for self-reports of competency in interpersonal skills, which align with findings from other studies in this area (Mennin et al., 1996; Santos et al., 1990; Woodward and McAuley, 1983.) Table 2.7 illustrates the results from the study conducted by Schmidt and van der Molen. (For further information as to how medical schools implement PBL, please refer to Appendix E.)

The facts listed below, correspond to Table 2.7:

*In 1999, all graduates were asked to rate their competencies in comparison with the competencies of their colleagues from non-PBL schools using a five-point Likert-type scale
(1 = less competent, 3 = equally competent, 5 = more competent).

+ Reported only for comparison. No statistical test is reported. (Schmidt & van der Molen, 2001)

Table 2.7 Self-reports of Competency in 19 skills by Graduates of a Problem-Based Curriculum, University of Maastricht School of Medicine*

Responses

Competency	School of Medicine	Faculty of Health Sciences +	Mean +
Problem solving skills	3.8	3.7	3.7
Cooperation skills	3.9	3.8	3.8
Possession of profession-relevant knowledge	3.2	3.1	3.1
Possession of general academic knowledge	3.0	3.3	3.2
Interpersonal skills	4.2	3.9	4.0
Skills relevant to running meetings (e.g. chairing a meeting)	3.8	3.8	3.8
Writing reports or articles	3.0	3.5	3.3
Paper presentation skills	3.3	3.4	3.4
Research skills	3.3	3.3	3.3
Self-directed learning skills	3.6	3.5	3.6
Use of information resources	3.7	3.6	3.6
Professional skills (such as physical examination)	3.6	3.0	3.3
Producing new ideas to do one's work in a better way	3.6	3.6	3.6
Helping colleagues	3.7	3.7	3.7
Productivity	3.5	3.5	3.5
Ability to work independently	3.8	3.9	3.9
Planning skills	3.6	3.7	3.7
Efficiency, time management	3.4	3.5	3.4
Ability to work under pressure	3.4	3.5	3.4

In 2000, Peters, Geenberger-Rosovsky, Crowder, Block, and Moore published an article in Academic Medicine describing how they evaluated the long-term effects of an innovative curriculum, the New Pathway (NP) Program, on behaviors and attitudes related to humanistic medicine, lifelong learning, and social learning at Harvard Medical School. This was a long-term follow-up of Harvard Medical students who participated in a randomized controlled trial. It was a descriptive study using 1998 telephone interviews of 100, 1989 and 1990 graduates (50 who had studied with the NP curriculum, and 50 who had studied with the traditional curriculum). The NP Program consisted of problem-based learning tutorials, with coordinated lectures, labs, experiences in humanistic medicine, and clinical experiences; the traditional program consisted of basic science lectures and labs. The results showed that of 22 measures on the survey, NP and traditional students differed significantly on only five (three humanism; two social learning): 40% of NP students and 18% of traditional students went on to practice primary care of psychiatry. NP students rated their preparation to practice humanistic medicine higher than did traditional students and expressed more confidence in their ability to manage patients with psychosocial problems. NP students were more likely than were traditional students to believe that faculty from the first two years continued to influence their thinking. NP students liked the pedagogic approaches of their program more than traditional students did. There was no difference between the groups on measures of lifelong learning. Differences between NP and traditional students in the humanism domain first appeared during medical school and residency and remained significant well into practice, suggesting that humanistic medicine can be taught and learned.

The authors also added that documentation showing that PBL improves learning, knowledge retention, and long-term habits of study remains elusive. Constructivist cognitive theory would lead us to assume that the clinically relevant context in which PBL occurs would result in retention of information superior to that afforded by lecture-based learning (Resnick, 1989). This should be especially true in integrated curricula such as the New Pathway. However, prior studies of the outcomes of PBL in medical education have shown no short-term advantage over other methods in terms of knowledge acquisition, as measured by standardized examinations, or clinical reasoning (Block et al, 1994; Moore, 1991; Albanese & Mitchell, 1993; Vernon & Blake, 1993). In a rare study of the long-term effects of PBL, researchers found that graduates of a PBL curriculum (McMaster University) were superior to graduates from a traditional medical school on a measure of lifelong learning; they were more knowledgeable about new recommended guidelines and successful approaches to enhance compliance in treating hypertension (Shin et al., 1993). While the authors' study did not reveal major self-perceived differences in the lifelong-learning domain, there were subtle differences in approaches that suggest that the PBL-based NP curriculum did make a difference in the approach to continued learning.

Colliver (2000) wrote an article in Academic Medicine based on his extensive review of medical education literature on PBL. The purpose of his article was to provide a critical overview of PBL, its effectiveness for knowledge acquisition and clinical performance, and the underlying theory. The focus of the paper was on (1) the credibility of claims (both empirical and theoretical) about the ties between PBL and educational outcomes and (2) the magnitude of the effects. Colliver reviewed the medical education literature, starting with three reviews published in 1993 and moving on

to research published from 1992 through 1998 in the primary sources for research in medical education. For each study, the author wrote a summary, which included study design, outcome measure, effect sizes, and any other information relevant to the research conclusion.

In looking at three reviews, Colliver found that a major problem with most of these (and subsequent) studies is that they were not randomized: the PBL students were self-selected, and evidence shows that students who select PBL are generally better students as indicated by MCAT scores, undergraduate GPAs, and other indicators (Cariaga et al., 1996). Colliver continued with stating that the problem is that this superiority of PBL students at entry to medical school would seem to be sufficient to account for the small differences in reported outcomes. So it seems fair to say, he says, that the three reviews show no convincing evidence for the effectiveness of PBL in fostering the acquisition of basic knowledge and clinical skills; the effects are small at best and easily accounted for by pre-existing differences.

In summary, he writes that the randomized studies show no effect of PBL, maybe even a negative effect, on performances on the NBME licensure examinations. Some writers tend to dismiss these findings and argue that multiple-choice measures of knowledge such as the licensure examinations are not appropriate for testing the effectiveness of PBL. However, one of the theoretical claims of PBL is that it imparts better and deeper learning such that knowledge is better organized and structured and more readily accessible to recall. Be that as it may, the randomized studies also showed no effect on diagnostic reasoning and clinical problem solving; and even the highly confounded results for interpersonal skills assessed with standardized patients in the New Pathway study showed only weak to moderate effects even with the confounding.

Presumably, these measures are appropriate for testing the effectiveness of PBL. The non-randomized studies reported some effects, but the differences would seem to be attributable to selection differences and to the use of outcomes that directly reflect the activities and experiences of the curriculum tracks. With respect to the latter, one non-randomized study did report large differences between PBL and traditional students in the first seven months of medical school (Hmelo, 1998), but the outcomes tapped directly into the activities the PBL track focused on during that period, activities that traditional students would encounter later in their training.

Colliver concluded that the review of literature revealed no convincing evidence that PBL improves knowledge base and clinical performance, at least not of the magnitude that would be expected given the resources required for a PBL curriculum. The results were considered in light of the educational theory that underlies PBL and its basic research. The ties between educational theory and research (both basic and applied) are loose at best. He recommends that we reconsider the value of thinking in terms of this imprecise theory about underlying hypothetical cognitive mechanisms and of pursing basic research that attempts to tests its indefinite predictions. Also, we should rethink the promise of PBL for the acquisition of basic knowledge and clinical skills. PBL may provide a more challenging, motivating, and enjoyable approach to medical education, but its educational effectiveness compared with conventional methods remains to be seen.

Directions for Future Research for PBL

According to Vernon and Blake (1993), conducting a high-quality evaluative research on PBL has been difficult for a variety of reasons. The more independent

variable, 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, all of which are difficult to regulate and are often not very well defined in research reports. The outcome variables that are often most highly valued and best exemplify the special features of PBL are often complex, multidimensional, and difficult to measure. (p. 560)

In light of Vernon and Blake's statement, however, Bereiter and Scarmadalia (2000) write that the point of PBL research is the improvement of practice. On this basis, the reported research must be judged as preliminary, for it is almost all descriptive or correlational. Such research may at times indicate what needs changing, but it cannot be expected to guide invention and experimentation. Still, as Drucker (1985) pointed out in different context, one of the great spurs to innovation is the unexpected findings. Accordingly, Bereiter and Scardamalia write that it is worth considering further analytic research that holds promise of unexpected findings. The following are a few ideas as to what might lie beyond the current research:

1. Research into PBL tutorials as self-organizing systems. The Koschmann, Glenn, and Conlee study (2000) is a case study that strongly suggests the potential of this approach. What emerges in the tutorial process cannot be explained by the individual actions of tutors and of students, but neither can it be illuminatingly explained by an additive of factors, as in the Schmidt and Moust model (2000). Self-organizing systems are characterized by emergent complexity, giving rise to structures that are not predictable from the inputs. Accordingly, they frustrate research of the variable-manipulating kind. However, if as seems obvious, the definitive task for social research

on PBL is to understand emergent behavioral patterns, then it is necessary to bite the bullet.

2. Development of proximal outcome measures. Faidley, Evensen, Salisbury-Glennon, Glenn, and Hmelo (2000), after demonstrating a coherent patter of relations among students' perceptions and observed group performance, note that their measures were "probably too unrefined to test for the relation between performance and group effectiveness." Although effectiveness must ultimately be judged by what students have learned, learning measures are too distant from the process to be helpful in improving it. A more immediate result that needs to be evaluated whether a collaborative problem-solving episode made progress – advanced toward a solution or toward fuller understanding. Assessing the progress of a discourse remains a challenge that discourse analysts have not fully met, but it is a challenge that surely needs to be taken up by PBL researchers.

3. Opportunistic research. When graduate students undertake research using transcripts of recordings, they typically strive for exhaustive classification, using some predetermined scheme. They don't want to miss anything. Yet if they find out anything interesting, it almost comes from noticing something that lies outside their classification scheme. The approaches range from "What's interesting here?" to "How can we exhaustively describe the multilayered processes represented here?" The situation does not permit a fair comparison of these approaches, but based on readings of related research over the years, Bereiter and Scardamalia (2000) would say that the first approach is decidedly superior, provided that there is a sufficiently well-developed conceptual framework within which to judge what is interesting. The authors therefore want to conclude their pundity by urging researchers to be less concerned about coding,

to stand back from their data, to ask themselves, "What's interesting here?" and then to pursue those interesting observations until they begin to yield insight. (pp. 193 – 194)

If the ultimate objective is improvement of PBL, however, then at some point there needs to be a shift to design experiments (Brown, 1992), where results are fed back into further cycles of design. The only program Bereiter and Scarmadalia (2000) can see is for PBL to become a principled program of ongoing instructional design. (p. 194)

Kelson and Distlehorst (2000) suggest a few areas of research that look at the efficacy of variants of PBL and identify the essential elements, which will produce the expected student outcomes or do both:

1. In theory, providing faculty-designed didactic sessions, learning objectives, references, or related readings, or relevant readings could influence students' developing ability to respond to problem affordances and consequently their ability to become independent in recognizing and responding to learning demands. Empirical evidence is needed to evaluate these claims.

2. In theory, providing faculty-designed didactic sessions, learning objectives, references or relevant readings could change the student's goal for learning from one that is problem centered to one that is assignment centered, with the assumption that the latter contributes less to retention and usability. Again, evidence is needed to test the problem-centeredness of the PBL model.

3. There are no data to support the conclusion that expertise in the hypothetico-deductive process can be developed through experience (Elstein et al., 1978). In theory, problems that demand full inquiry can provide such experience. However, there is a great economy of time, in both curriculum development and in delivery, to be gained

through the use of sequential disclosure problems. Empirically, however, little is known about trade-offs with such adaptations.

4. The Barrows (1992) model holds that the hypothetico-deductive reasoning process is a natural response to problem challenges; one, however, that improves with experience. Consequently, students should be merely guided in this natural process rather than having a process imposed on them. Other models hold that teaching and holding students to specific algorithms produce the more efficient and effective problem solver. Studies are needed to compare the two models.

5. Not all groups develop a climate of mutual responsibility for each other's excellence. Kelson and Distlehorst would hypothesize that the absence of grades contributes to such a positive climate. Having the tutor's evaluation directed openly within the group rather than privately is also important. Finally, making the development of this climate the group's responsibility, with the tutor initiating group evaluation of its status, would seem to be critical. Empirical evidence is needed to test these notions. (pp. 181 – 182)

Bridges with Hallinger follow up with writing that they see four major challenges confronting those who are interested in exploring the role of PBL in teaching aspiring and experienced administrators. These challenges include: (a) explicating student-centered learning; (b) creating programs that prepare administrators to become independent, self-directed, lifelong learners; (c) conducting research on the effectiveness of PBL; and (d) exploring how PBL might be used in other contexts with education administrators. (p. 108)

According to Bridges with Hallinger, there are two major versions of PBL: problem-stimulated and student-centered. These two versions differ primarily in terms of who

selects the learning objectives and the learning resources. In problem-simulated learning, the instructor makes the choices, whereas in student-centered learning students decide. According to the proponents of PBL, student-centered learning affords students a greater opportunity to develop some of the lifelong learning skills they will need after graduation, namely, skills identifying their own learning needs and in locating resources that meet these needs. (pp. 108 – 109)

Since student-center learning promotes important learning objectives and has not been fully explicated as an instructional strategy, its utility in preparing administrators should be explored. Future explorations might take one of several forms. The first and simplest approach would involve transforming problem-stimulated projects into student-centered projects by omitting the learning objectives and the resources. Under this arrangement, students would read a project, decide on their learning objectives, and proceed to locate those resources most closely matching their self-defined learning needs. (p. 109)

A second approach to student-centered learning might take the form of students working on current problems of practicing principals. A third approach involves students in creating and field-testing a problem-stimulated project. (p. 109)

One of the major goals of PBL is to promote skills in lifelong learning, according to Bridges with Hallinger. If administrators are to become independent, self-directed, lifelong learners, they will need a broader range of skills and knowledge than are typically emphasized in student-centered learning. Manning and DeBakey (1987) have studied the continuing educational practices of physicians. Their work prompts questions like the following:

1. What are the obstacles to independent, self-directed learning by administrators?

2. How have and how might administrators overcome these obstacles?

3. What methods have administrators used or might they use in their quest to be lifelong learners?

4. What techniques and strategies have administrators used or might they use to maximize the benefits they receive from their self-study activities?

5. How have and how might administrators use the fruits of their self-study?

6. How do or might administrators model for others the importance of self-study?

7. How might administrators organize their own work in order to learn from experience and to plan their own program of continuing education?

In meeting the challenges associated with designing a PBL curriculum to develop lifelong learning skills, designers might use a three-step strategy. First, they seek answers to the seven questions listed above. Second, they develop PBL projects that acquaint students with the range of practices and possibilities for independent, self-directed, lifelong learning. Finally, designers identify and develop the skills underlying the practices and possibilities. If these challenges are met, the field of administration will move to the forefront of all professions in fostering independent, self-directed learning skills. (pp. 110 – 111)

Research is needed that probes the effectiveness of PBL in preparing administrators. There are at least two distinct approaches that might be used in conducting this research. One follows the lead of medical educators and asks a variant of this basic question: Do PBL programs produce significantly better student outcomes than traditional programs? The outcomes that might be studied include knowledge, administrative skills, problem-solving skills, lifelong learning skills, attitudes toward the instructional environment,

approaches to studying, completion rates, perceived value of theory and research, and perceived relevance of the training. (pp. 111-112)

The other approach asks a variant of the following question: How effective are the various species of PBL in achieving the different goals of administrative preparation? One might explore this question in several ways. By way of illustration, research might examine the differential effectiveness of problem-stimulated and student-centered learning in achieving the goals of the curriculum. Alternatively, research might focus on particular features of PBL. (p. 112)

Regardless of whether future research on PBL addresses a variant of the first or the second question, it seems important to avoid some of the problems inherent in the research conducted by medical educators. Research on the effectiveness of PBL in training physicians has followed the pattern observed in most program evaluations. Program evaluators have not tended to "describe fully, let alone measure, how the programs in 'experimental' and 'control' situations actually differ from one another – or even to certify that they do" (Charters and Jones 1975, p. 342). Researchers who examine the effectiveness of PBL in preparing administrators should define their programs with considerable precision and should certify that these programs actually operated as they were described. (pp. 112- 113)

When studying differences in medical knowledge, researchers generally measure the student's knowledge in cued contexts (that is, on examinations in which the student is provided with questions and alternative answers). Given the rationale for PBL, it seems far more reasonable to study whether *students spontaneously use the knowledge in*

noncued contexts (Bransford and others 1989) *and whether they use the knowledge appropriately*. (p. 113)

Finally, Bridges with Hallinger write that the final challenge relates to how PBL may be used in contexts other than higher education to prepare administrators. Three possibilities are suggested: district-sponsored training programs for administrative aspirants, district-sponsored staff development programs built around major problems facing the district, and workshops and conferences sponsored by external agencies. (p. 115)

According to Savin-Baden (2000), PBL operates within an organization, but also stretches over the boundaries of other organizations. In particular, it sits at the interface of industry (public and private sector) and higher education. Thus, those utilizing PBL for critical contestability must learn to live life in the border country; an area where learner identities can be explored and (re) constructed and learning contexts can be refashioned to allow for the "opening up of communicative spaces" (Niemi and Kemmis, 1999), spaces where networks of communication can be identified and created and in which critical contestability can emerge. (p. 137)

Yet, at the same time, PBL can interrupt and disable the organizational culture as well as be disrupted by it. For example, Savin-Baden argues, PBL can prompt "creative destruction" (Schumpeter, 1934) in an organization whereby the innovation challenges and destroys established practice. New innovations are intended to displace old innovations. This, in turn, is expected to create a pattern whereby new solutions are generated through the solving (or managing) of problems. This may be the case in many

organizations, but difficulty arises when innovations such as PBL are bolted onto courses but are believed by some staff to be a new innovation. Other staff may ignore its very existence or argue that they "have been doing PBL for years", even if their conceptions of PBL differ markedly from other broad interpretations of its use. The consequence is that PBL will not displace the old innovation but will become displaced by the old, as it comes adrift amidst seats of power and competing staff agenda. (p. 137)

Savin-Baden continues to write that one of the central difficulties with universities is that, as organizations, they nowadays tend to adopt strategies focused upon solving problems. The epitome of this could be said to be in the Dearing Report's (NCIHE, 1997) emphasis on predominately operational solutions (see for example Weil, 1999). Furthermore, in recent years, the shifts in the structure of universities worldwide have been to emulate business organizations, as seen in the adoption of an enterprise culture. What is emerging is an image of a competent university manager as one who is able to solve the technical problems encountered by blue chip universities. Therefore, at the top there is an executive team characterized by ideologies that concentrate on the application of the private sector management values and practices, such as customer care, outcome measures, benchmarking and performance-related pay. Under this can be found layers of lecturers who are unlikely to be attuned or even prepared to engage with this culture; instead they maintain a collegial or bureaucratic structure, depending on what supports their purposes, and reinforce the bunkers around their disciplines. Meanwhile students are being encouraged, through approaches such as problem-based learning, to manage complexity and challenge frameworks. (p. 138)

Savin-Baden adds that there are also organizational issues to be considered by those wishing to implement PBL, and perhaps by those wishing to evaluate current PBL curricula, which are as follows:

1. The declining unit of resource in higher education will impact on the student experience in terms of fewer resources (rooms in which to meet, and study and library materials) and staff time available for students. Staff who are on short-term contracts or who are brought in for short periods of time are less inclined to help students when they are only paid to teach and not necessarily to facilitate learning. A further concern is that interprofessional education is being seen by some staff and university executives as a means of teaching more students with less resources, and PBL is being increasingly viewed as a vehicle for its implementation.

2. The shift to mass education can offer variety and choice for those who have previously had little or no access to the system. At the same time it also offers greater diversity for students about when and how they learn, in a culture where the level and availability of grants and loans mean that many study from home. The idea that students migrate to engage with a kind of liberal education that equips them for life, as well as to be taught within a discipline, is available to few. Part-time higher education is much more likely to be the future. This may also mean an increase in degree completion time, because students can perhaps only afford to undertake one module per year. As a result, full-time undergraduate learning, which includes the types of opportunities that promote learning with and through others, such as PBL, may only become an option for the affluent or for those universities who can manage to develop learning communities

across cyber space.

3. In the United Kingdom, the impact of the Research Assessment Exercise on teaching and learning is encouraging elitism in research to the extent that some staff are put aside to undertake research to ensure continuing high attainment. Taylor et al. (1998) have argued that, despite recent government initiatives in Australia, respondents in their study believed that the under-value of teaching compared with research continued to persist in higher education. Staff (rather than students) may also be "dumbed down" (Simon, 1996) to teaching, or even become part of a strategic move to shift them, as a department, into another university that has more of a teaching focus, because they are too much of a risk to be part of the RAE. There seems to be a fissure appearing between teaching and research. The same proportions of staff in both the old and the new universities believe that teaching has become less important in their discipline generally (Harley and Lowe, 1998). Despite the Dearing Report and the creation of the Institute of Learning and Teaching, it is likely that alternative opportunities for knowledge creation that promote learning for critical contestability will become marginalized by political motivations to gain research monies and status at the expense of teaching. Yet the key problem with the RAE is that:

> management discourse may indeed have found it hard to penetrate the walls of academe, management practice has not…the RAE is such an effective mechanism of management control precisely because it does not *need* to replace one type of discourse with another. In co-opting peer review for managerial ends, the RAE offers individuals the possibility of securing material and symbolic rewards without ostensible violence to the traditional value systems which constitute academic identity. (Harley and Lowe, 1998)

Thus, PBL, which is a form of learning that puts research and evaluation at its core, stands to be excluded from universities that do just that. This is because it is a method that demands much of its staff in their role as facilitators; yet it is these very skills and abilities for which staff will receive little kudos at the elite (research-led) end of the university sector.

1. Student diversity is increasing and higher education of the future will have a significant number of mature students. This is particularly pertinent as the percentage of mature and part-time students has increased compared with full-time and younger students (AUT, 1995). It is also likely that there will be an increased gender shift. Currently UK and USA schoolgirls are performing better than boys, and this may mean that the higher education of the future will need to recognize women's requirements in order to both attract and retain them. Yet, although higher education at one level would appear to be more accessible (in the shift to a mass system), there seems to be little change in the ways in which, overall, the institutions have adapted their processes to meet the needs of the new customers in the system. Seemingly there is not even recognition by higher education institutions that a cultural change is required to address these shifts in an attempt to match the needs of a growing and diverse student population.
2. The impact of the Institute of Learning and Teaching (ILT) in the UK is something that is viewed by many with a degree of sceptism. The Institute of Learning and Teaching is a virtual institution formed as a result of recommendations by the Dearing Report into Higher Education (NCIHE, 1997). The idea is that this institution will accredit programs, which have been set up to train and establish lecturers' teaching effectiveness, to enhance research and development into teaching and learning, and to

stimulate innovation in teaching and learning. There are those who feel that whilst it may be something that is required in the higher education of the future, the current low status of teaching in general along with the token funding the ILT has received means that it will have little lasting impact on the face of higher education. There already seems to be confusions in the messages being proffered by those involved, in terms of structures and mechanisms, who act as if it were possible or even desirable to create and perpetuate a stable state. This is particularly apparent in relation to notions of accountability and improvement. As Weil has so aptly pointed out: "The Dearing Report stresses the management of change in HE through structures and incentive/reward processes that support continuous systematic learning and inquiry in action or transdisciplinary innovation and responsiveness" (Weil, 1999, p. 184). Although the ILT has been severely criticized there are important opportunities to be gained by the alliance of those who have already proven experience in this field (for example the Staff and Educational Development Association (SEDA). Such alliances may also be a step towards raising the status of teaching in the UK and elsewhere. However, better equipped and enabled teachers in higher education will not necessarily mean that they have an impact on the culture of their institutions or on the kinds of learning and research that are and are not rewarded. It might mean though that they are able to equip students to learn effectively and to decide from the myriad of learning experiences and technologies on offer what might challenge and best equip them to be critical learners and workers for the future.

3. "Talking Heads" used to demonstrate exemplary practice is being mooted as a way forward to help to improve teaching practices. The idea is to video "so-called" experts in teaching (Talking Heads) who exhibit flawless practice so that others may mimic this behavior across the UK. Yet this seems to be an attempt to move back to

apprentice-style methods. The whole idea of exemplary practice brings with it the notion of a "right way" to do things, rather than any kind of real notion of Talking Heads *a la* Bennett (Bennett, 1988), has who offered diverse perspectives on life through the previously untold stories of people's lives. It seems odd that, while the Dearing Report has argued for more effective and innovative teaching, there continues to be such suggestions as Talking Heads and a rise in "How to" guides and seminars that deny any sense of critique or analysis of proffered frameworks. Instead, these guides present a rational world in which tasks are to be achieved by mastering the necessary skills and abilities, and thus any real sense that to be a lecturer in higher education encompasses multiple ways of knowing and being is denied. (pp. 139 – 141)

Savin-Baden continues to write that organizational structure and culture can affect the way in which PBL is implemented and enacted, particularly since the broad shift from collegial models of higher education to those of enterprise cultures has occurred (McNay, 1995). For example, the shift to enterprise cultures has brought with it closer links between industry and higher education and the "good of the client" is now seen as paramount. Accountability, competencies and professionalism are all features of this culture, but it is also a culture that can bring a loss of educational coherence through an over dominance of market related values in curricula. Mixtures of cultures and structures adopted across one institution can also result in problems of fit between institutional research policies centered around a collegial system, and the flexibility required at the same time for the university to compete in the market-place. Add into this the adoption of a matrix structure and there is the following scenario. The university has adopted an enterprise culture overall and is seeking to sustain this through a view of leadership that is seen as a group function within a changing organization, and therefore leadership is

seen to take on a number of different forms. At departmental level, there is a head of department who seems himself as a chief executive, who espouses corporate values and who has adopted a matrix structure in order to encourage innovative and adoptive behavior in the staff. This means that a large and often fragmented department, such as medicine, can be team driven and transcend subject specialism, such as haematology, psychology, and orthopedics. Yet the needs of those within the specialism destroy the team culture because in fact the department is bureaucratic in nature and therefore the matrix structure does not work. Instead, the department is undermined through conflicts between subject and team loyalties. This results in teams failing to undertake their roles effectively because they find it too difficult to break free of their subject driven loyalties. In such a situation PBL can become the scapegoat for wider organizational concerns, or collapse during implementation because it was a team remit subsequently destroyed by subject-based agenda. (p. 142)

Management in higher education is rapidly becoming seen as a means to replace scarce resources and to provide organizational solutions to something that in many ways could be seen as an economic and social problem. For example, staff who were interviewed (Savin-Baden, 1996) reported that the business ethic of the university was affected by the overall quality of the courses on offer, and that this was worsened by the institutional emphasis on procuring funds and research monies rather than valuing quality learning. At the same time, the shift to teaching larger student numbers and with it the management decisions to build larger and larger lecture theaters has meant that there is less (if any) space for small group teaching, and little overall flexibility for courses that have adopted alternative teaching and learning methods to lecturing. However, what appears to be coming to the fore is the importance and value of leadership in higher

education (Middlehurst, 1995). This seems to be because of the sheer magnitude of change occurring in higher education that is prompting a view that leadership can help the organization to develop a broader range of strategies for change than in former years. As a result, leadership is being seen as important in managing change, which in turn will make a significant contribution, at the interfaces of the curricular structure, to the department and the organization, and to the implementation of approaches such as PBL. PBL, too, could be said to offer students opportunities to develop leadership abilities because of the way it encourages students to manage multiple meanings, and to develop strategies for critical action. (pp. 142 – 143)

Curricular frameworks have shifted towards modularization in order to offer students more flexibility and choice, yet many undertaking education for the professions feel that is has created less of both and, at the same time, created a more fragmented curriculum than in former years. The curriculum may not actually be more fragmented. Curricula may have been disparate in former years but it might now be the case that modularization points up the fault lines in the structure since it tends to show up areas of disintegration more clearly than courses that were structured around a build-up of content. In some cases, however, PBL in modular programs can provide a holding mechanism to enable students to fuse knowledge and skills across modular boundaries as long as PBL is seen as the core principle into which lectures, seminars, and skills laboratory sessions feed. A further difficulty is the notion of a common course structure designed to offer students opportunities to choose other modules beyond their course, one which rarely works in practice. Requirements from professional bodies mean that students opting into and out of modules, for instance in health sciences, is not practicable. What tends to occur is that PBL itself becomes modularized, only occurring in particular areas of the curriculum.

Students then experience PBL as an approach to learning that promotes integration of knowledge and abilities but only within given modules rather than necessarily across them. Dual qualification systems seem to have complicated this issue further. For example, the necessity of fulfilling the requirements of a professional qualification with clearly defined objectives, as well as the curriculum guidelines of the university, often results in curricula containing highly structured components, leaving students ill-equipped to organize their time during PBL components of the course. (pp. 143 – 144)

Information and Communication Technology (ICT) has far reaching implications for universities in general since the emphasis on technological learning is likely to increase as resources decrease. It will be argued by some that overuse of ICT will result in just high quality infotainment, but technological learning can offer students alternative choices for gaining knowledge and information. At the same time current trends and policies are promoting strong links between PBL and ICT. For example, the Institute for Public Policy Research has established a pilot project at Ultralab at Anglia Polytechnic University. This project has been set up to examine the concept of an online learning network. What is significant about this project is that its initial premise was that "online communities flourish when the participants are self-directed and participate in designing their learning" (Heppell and Ramondt, 1998, p. 8), which is also a central premise of many problem-based curricula. What is more, it is likely that with increases in student numbers the notion of PBL groups in seminar rooms will become instead "virtual learning communities" and furthermore research into such communities would suggest that there need not be a loss in the quality of learning. In curricula where large student numbers mean more lectures, more PBL "large-group style", and less seminars, virtual learning communities could in fact improve the quality and experience of learning for

terrestrial courses, as well as solving some of the difficulties of small group work, such as the demand for rooms when dealing with cohorts of over 250 students. (p. 144)

Savin-Baden writes that PBL for critical contestability offers us a means of breaching the chasms between professional education, and public and private sector. This is because PBL of this sort both offers and demands that students, tutors, and professionals in the field transcend the boundaries imposed through systems. In the context of Model V (table 2.2), learning outcomes may be defined in advance in order to satisfy professional and academic agenda. But for the staff and students involved in such PBL programs it should be possible to negotiate these and therefore offer students learning experiences that are seen and experienced as valuable to their identity construction. Thus, students will be helped to come to know that personal knowledge is as important as prepositional knowledge and practical skills. They will begin to see that transcending frameworks; their own and those with which they are presented, will equip them to become effective practitioners for the future, more so than merely acquiring a sound body of knowledge or a set of narrow competencies. This may go some way to resolving some of the difficulties in current PBL curricula where students repeat the same model of PBL consistently through the whole program and rarely, in reality, receive the opportunity to stretch themselves intellectually. (p. 147)

Summary

Chapter 2 contains an overview of PBL and a summary of various components of this teaching methodology. It was noted that PBL has its own taxonomy of several various methods of implementation, as well as tremendous discourse as to its viability and effectiveness. It was important to look at this review of literature to address the first

research question of this study, "What Does PBL Look Like?" in order to use this information along with the results of the faculty survey and the graduate student survey to further understand PBL as a teaching methodology.

Changes in higher education as well as the current focus on student learning, have brought PBL more into the forefront as a method that can be utilized in the classroom to develop deeper student learning and critical thought. Both public and private entities are pressuring institutions of higher education to produce a more mature student, one who can think on their own and find solutions to problems using creative resources. PBL may be one of the panaceas that can resolve these concerns. However, there is still much more research to be conducted regarding the effectiveness of this type of teaching and its effect on the student learner. As PBL continues to cross disciplinary boundaries from medicine to business to education, it will be important to observe and test its success and viability over time.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Introduction

This research study was exploratory and descriptive in nature using a mixed-method design. Even though the literature is replete with readings and related research concerning PBL, there have been few investigations of what it looks like or how it is being implemented in graduate programs of higher education. Today, there seems to be a heavy emphasis on understanding the university as an organization and on promoting scholarly research, however, what goes on inside the classroom is still critical to the mission of universities and the preparation of scholars and the future professoriate.

To investigate the implementation of PBL in Higher Education, a mixed-method design was chosen to examine the nature of PBL from the perspectives of both faculty and graduate students, first through a survey, then a more in-depth examination through open-ended interviews with selected participants in a case-study format. Two surveys on PBL were developed – one for faculty and one for graduate students – in order to collect the data necessary to fill this void by addressing the three research questions: 1) What does PBL look like?; 2) What do professors who profess to use PBL report as the advantages, disadvantages, and challenges of PBL?; and 3) What do graduate students

who have experienced PBL report as the advantages, disadvantages, and challenges of PBL? The surveys were formatted based on the information the researcher gleaned from the review of literature. They were then distributed to faculty members from the list of AAHE institutions and received back from the same members who acknowledged teaching with PBL and from their graduate students. These data were supplemented with three in-depth interviews with respondents that were analyzed qualitatively. This added further enrichment and a deeper understanding to the research, because the nature of qualitative research is to understand the experience of the participants in their social contexts (Merriam, 1998).

A descriptive case-study design was used as a qualitative methodology. A descriptive case study in education is one that presents a detailed account of the phenomenon under study – a historical case study that chronicles a sequence of events, for example (Merriam, 1998). Case studies are used to understand real-life events and to describe in depth how things were from the participant's perspective rather than trying to explain why (Stake, 1995). They are also useful in presenting basic information about areas of education where little research has been conducted (Merriam, 1998).

Subjects/Participants

The identification of participants began in August of 2002 when the American Association of Higher Education (AAHE) was contacted via e-mail. A directory of all universities/colleges in the United States who offered graduate programs in higher education was secured. The AAHE was purposely selected because it had developed a current list of graduate schools that offered graduate degrees in the fields of Higher Education. Since the use of PBL in programs of Higher Education was assumed to be

scanty, it was decided to contact all department chairs of all universities who offered any type of degree in higher education including higher education administration, student services, and all other specialty graduate degrees in higher education. Since a graduate degree in Higher Education is a professional degree, it was presumed that such programs might mirror professional programs in the sciences, business and medicine where the use of PBL in preparation programs had already been established.

There were 189 AAHE member institutions with such programs according to the list provided by the AAHE. This list was shared with the UNLV Cannon Center for Survey Research in September of 2002, where Pam Gallion, Survey Manager, and her staff provided assistance on the study by contacting appropriate departments at institutions on the list via telephone calls. When contacts were successful, an invitation to participate in the study was extended. The calls began on October 31, 2002. During this first wave of calls, three attempts to reach each of the members were made. The first three attempts were completed by November 4, 2002. By that time, 15% (N=28) of the institutions were eliminated because they reported that they did not use any form of PBL. An additional 8% (N=15) of the potential participants were also eliminated because the faculty telephone numbers had not been listed. In these cases, interviewers had been instructed to call directory assistance and attempt to elicit a working number for the institution but this also had been to no avail. That lowered the number of potential respondents to 146. From this pool, with further follow-up by the Cannon Center staff, 42 instructors were identified as having used PBL and agreed to participate. Survey packets were prepared and mailed out to these 42 instructors during the third week of

November, 2002. It was decided that no further attempts would be made to solicit participants. Because the investigation was designed as an exploratory study, this pool of participants being diverse and roughly representative of AAHE institutions was deemed adequate and appropriate for the intended purposes.

Instruments of Data Collection

During the summer of 2002 and early fall of 2002, two survey instruments were initially developed by the investigator. The first was constructed to secure data from faculty who taught courses using PBL. The second was to be used to solicit information from students in classes where a PBL structured format was employed. Both surveys were of a length that would not be too long and time consuming and thus risk contributing to a failing return rate. They were comprised of items directly relevant to the research questions that had been posed. Both instruments were submitted to the UNLV Cannon Center for Survey Research for final formatting. Each survey was polished as to wording and formatted for simplicity of response so as to be easy to complete in a short amount of time.

The final faculty version of the survey was entitled, "A Survey of Problem-Based Learning in Higher Education Curriculum", and was composed of 18 questions based on themes related to the review of literature. The estimated completion time of approximately 15 to 20 minutes seemed conducive to an acceptable return rate from the faculty participants. The questions were designed to solicit information on: (1) the Carnegie classification of the institution employing the faculty member; (2) the number of years the faculty member had been teaching; (3) the course content area(s) the faculty

member had been teaching; (4) the number of years the faculty member has been using PBL; (5) the particular definition of PBL the faculty member prefers; (6) how the faculty member structures the assignments to be completed when using PBL; (7) the amount of time the faculty member spends on designing and preparing a PBL curriculum; (7a) whether the faculty member spends more or less time on designing and preparing PBL courses than on preparing and designing other curriculum courses when using other teaching strategies ; (8) the reason(s) the faculty member chooses to use PBL or a version of PBL as his or her teaching method; (9) the strength of administrative support when PBL is being used; (10) the strength of support from colleagues when PBL is being used; (11) how a faculty member finds appropriate PBL problems to use in their curriculum; (12) the challenges the faculty member has faced when using PBL; (13) how the faculty member introduces PBL to the graduate students at the beginning of each class; (14) types of assessment the faculty member may use to assess the performance of students in his or her PBL course; (15) ways in which the faculty member judges results from using a PBL curriculum; (16) disappointments the faculty member has experienced when using a PBL curriculum; (17) whether the faculty member believes that PBL is here to stay, will most likely fade over time, or is here to stay but will be modified and improved over time; (18) the gender of the faculty member taking the survey; and (19) the age of the faculty member. At the end of the survey, there is a statement asking for the faculty member to voluntarily share examples of PBL lesson plans, "problems" or "case studies" that they have used in their course(s), as well as examples or explanations of their examination or assessment methods. (see Appendix G for a display of "A Survey of

Problem-Based Learning in Higher Education" faculty survey). Again, the intent of the survey was to collect data that would address the research questions of the present study.

The questions varied in format but most called only for the respondent to read the question and check one answer (or sometimes as many as applied). The fact that the questionnaire could be completed relatively easily and quickly promised a high rate of returns.

The student survey, entitled "A Survey of Problem- Based Learning in Higher Education. Graduate Student Survey", was composed of 19 questions based on themes related to the review of literature and the intent of this survey was also to glean data that was exploratory and descriptive in nature. The questions were likewise brief and the survey was constructed to take between 15 to 20 minutes to complete. The questions addressed the following elements: (1) the particular academic degree the student was working towards; (2) the degree specialty the student would be seeking; (3) the student's age; (4) the number of courses the student has taken that utilized PBL methodology; (5) the course content area(s) in which the student had encountered PBL methodology; (6) the advantages of PBL perceived by the student; (7) the nature and extent of training the student received relative to PBL; (8) the definition of PBL that the student would ascribe to PBL; (9) descriptions the student would choose to differentiate a PBL course from a more traditional course; (10) the relative effectiveness of PBL compared to lecture-based traditional learning; (11) the relative advantages of PBL compared to more traditional methods of instruction; (12) during a term, the proportion of time the instructor lectured or employed strategies other than PBL; (13) whether expectations for PBL courses were

higher, about the same, or lower than other instructional approaches; (14) frustrations the student felt when working in a PBL class; (15) comparison of contact hours the professor spent with a student in a PBL course with that in a traditionally designed course; (16) when learning about theories and models, as well as knowledge content, whether the student learned more, less, or learned about the same in a PBL course as in a more traditional course; (17) the advantages the student attributed to PBL courses compared to more traditional courses; (18) the disadvantages the student experienced when taking PBL courses compared to traditional courses; and (19) if offered the opportunity to take a future PBL course would the student definitely do so, probably do so, elect not to do so, or do so only if required. (see Appendix G for a display of the student survey, "A Survey of Problem-Based Learning in Higher Education. Graduate Student Survey.")

The researcher submitted both of these survey instruments to the UNLV Social Behavioral Institutional Review Board and received approval for their use in October and November (see Appendix D).

Collection of Data

Because the study was planned to procure results within the fall semester of 2002, it was decided to format the survey and send it out to the 42 potential faculty respondents who indicated they would willingly participate. One faculty and several student surveys were mailed together in a single packet to each of the 42 professors during the week of November 26, 2002. A cover letter accompanied the surveys which contained a request in regard to the student survey. It was explained that the student survey, "A Survey of

Problem-Based Learning in Higher Education. A Graduate Student Survey", was not intended to analyze the teaching ability of the faculty member and would not be used for that purpose. The student surveys were only to glean another perspective on PBL. This was done in order to assure faculty members that student response data would be aggregated, used only in a general context and would not be linked to any individual faculty member from who they had taken coursework. It also requested that the faculty member select a nonbiased third party to administer the student surveys in a PBL class taught by the participating faculty member and encourage the students to return them directly to Pam Gallion, Survey Manager, at the UNLV Cannon Center for Survey Research. The reason for soliciting responses in this way was to ensure that every graduate student had indeed been exposed to PBL.

In addition, each of the student questionnaires had an individualized and personalized cover letter worded to generate interest and encourage participation, much as the cover letter to the faculty member had. (see Appendix F for a display of these cover letters) Finally, a postage-paid, return envelope was provided with each of the faculty and student surveys.

Both survey instruments were formatted in such a way that responses could be easily tabulated through an available computer system upon return. The responses were entered into a data file via optic scanner, using TELEFORM software. The coding protocol was applied directly to each completed survey instrument. This system also improved data accuracy.

Unfortunately, only 11 responses from both faculty and graduate surveys were received by January 1, 2003. Therefore, since this represented an inadequate return rate, it was determined that a second wave of calls be made to increase the response rate. Those calls began on January 21, 2003. They were made to both the 42 instructors who had previously agreed to participate and see that additional surveys were distributed to graduate students. Calls were also placed to some of the discarded numbers that were still deemed "live" because the earlier call was either not answered or terminated because the staff member was unable to reach the correct contact person.

As of January 24, 2003, 18 additional universities agreed to participate. This included 13 new universities and 5 universities from the original list of 42 institutions. Out of this total, there were approximately 300 possible additional graduate student survey respondents. The standard packet of materials was sent out to the 18 additional faculty members that had been identified. These were mailed out during the week of January 27^{th}.

As of February 13, 2003, 13 faculty surveys had been returned along with 13 graduate surveys. The Cannon Research Center called 188 numbers and each number had been attempted a minimum of 5 times. One university returned their surveys to the UNLV Cannon Research Center with the response that they did not use PBL. A faculty member from another university sent back his survey stating that he did not use PBL. In summary, this brought the faculty total number to 59 who at some point agreed to participate but three who agreed to participate the first time decided not to participate. This left the potential of receiving 56 returns. Of the total population that were

contacted, 39 institutions reported that they did not use PBL, 4 institutions did not have a workable telephone contact number, 8 institutions had been perpetually busy on the telephone on all attempts, 41 had been perpetual answering machines, 11 were perpetual no answers, and 1 was on sabbatical. Out of the original 42 affirmatives, there were still 18 who were unable to be reached on February 4th, however, 4 more new institutions agreed to participate on this date and materials were sent out. An attempt was made to contact the 18 who had not been reached, and the 25 remaining were called back to see if they received the surveys. As of March 13, 2003, the Cannon Research Center had received a total of 40 graduate student surveys and a total of 17 faculty surveys.

Case Study

As a means of further illustrating the experiences of the faculty in relation to PBL, three faculty were selected for in-depth interviews for further analysis and description of the problem. Multiple case studies involve collecting and analyzing data from several cases and can be distinguished from the single case study that may have subunits or subcases embedded within (such as students within a school) (Merriam, 1998). "By looking at a range of similar and contrasting cases, we can understand a single-case finding, grounding it by specifying how and where and, if possible, why it carries on as it does. We can strengthen the precision, the validity, and the stability of the findings" (Miles and Huberman, 1994, p. 29). Therefore, examining data across multiple cases through comparison and contrast can add a dimension of confirmation by design to the survey data in this study.

Case Selection

A total of 11 faculty were contacted by e-mail asking for further information. The faculty members were chosen randomly by the researcher, one from each of the following states: Illinois, Iowa, Arkansas, Kentucky, Alabama, Washington, Montana, West Virginia, Massachusetts, Missouri, and Tennessee to allow a semblance of geographical representation. The e-mail message stated the importance of enriching the study with detailed information that would provide more insight into the use of PBL in the classroom. Out of 11 faculty who were contacted, 3 were willing to provide more information, 4 were not willing to provide more information, and 4 did not respond.

Interview Protocol

The main purpose of an interview is to obtain a special kind of information. The researcher wants to find out what is "in and on someone else's mind" (Patton, 1990, p. 278). Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them (Merriam, 1998).

The researcher contacted one faculty member by telephone per his request and conducted a telephone interview on March 15, 2003. Questions were sent via e-mail to the two other faculty who agreed to respond via e-mail with their responses to the researcher. They were encouraged to add additional information if they chose. One responded to the questions on March 17, 2003 and the other responded to the questions on April 6, 2003. The structured in-depth interview consisted of the following questions:

1. What type of courses do you teach using PBL?
2. What factors caused you to adopt PBL as your teaching methodology?

3. What type of PBL model do you use? PBL models include case-based lectures, modified case-based, problem-based learning, and close-looped problem based learning.

4. What differences exist between PBL and constructivist learning?

5. What are the positive results when using PBL as a teaching methodology?

6. What are the negative results and challenges when using PBL as a teaching methodology?

7. What was the ease of transition when switching from traditional teaching methodology or lecture-based instruction to PBL methodology?

8. What strategies did you use to successfully implement PBL in the classroom?

9. What advice would you offer faculty members who want to use PBL as a teaching methodology?

10. What type of assessment methods did you employ when evaluating the use of PBL during a course?

11. What level of satisfaction did you experience when using PBL as a methodology?

12. What do students cite as the strengths of PBL, as well as the weaknesses?

13. Do students see PBL as having a successful impact upon their ability to learn compared to courses that offer traditional instruction?

14. How will faculty be able to determine the success of PBL in relation to the effect it has on a student's long-term success in their professional careers? Do students acknowledge that exposure to PBL has a successful impact on their career and do you have any data that illustrate this?

15. Is there any additional information you would like to provide regarding PBL?

A final cut-off date of Friday, March 21, 2003 was set to cease gathering data for the study. As of this date, a final total of 18 faculty surveys had been collected and a total of 44 graduate surveys had been collected. Thus, the faculty return rate was 43% (18 returns out of 42 mailed) and the graduate student return rate was 16% (44 returns out of 272).

The frustrations of efforts to collect data as planned can be exemplified by one example. Fifty graduate surveys were returned unopened from one institution of higher education when the faculty from the graduate department of higher education claimed that they did not use PBL, even after they had confirmed that they did use PBL through a telephone interview with the UNLV Cannon Research Center.

Analysis of Data

Data obtained from all survey sources during the course of the study were analyzed to display frequency distributions on the items of the survey instruments in order to answer the three research questions. Frequency tables were used for both the faculty data and the graduate student data.

There were the additional data obtained from the three faculty members using a prescribed interview format and qualitative analysis methodology that was applied to those data. One interview was taken using the telephone and the other two interviews were given using the internet through e-mail exchange.

The interviews were constructed as narrative stories. Narrative analysis is the study of experience through stories. Emphasis is on the stories people tell and on how those stories are communicated – on the language used to tell the stories. First-person accounts of experience form the narrative "text" of this research report. (Merriam, 1998).

Once the narrative stories were gathered by the researcher, categories and subcategories were constructed through the comparative method of data analysis. Coding occurred at two levels – identifying the information about the data and interpreting the constructs related to the analysis. Units of data were sorted into groupings that have something in common and would reveal information relevant to the study. (Merriam, 1998) Data gleaned from the narrative analyses garnered two main categories. One category included the implementation of PBL and the other category included the results of using PBL. The subcategories under the category, "The Implementation of PBL", included course design, content knowledge, the role of the professor, the role of the students, group structures, and methods of assessment. The subcategories under the category, "The Results of PBL", included time management when implementing PBL, the challenges of using PBL, and the advantages and disadvantages of using PBL.

Summary

Fifteen out of eighteen faculty from institutions across the United States that belonged to the AAHE, and offering graduate degrees in higher education, provided quantitative data that addressed the first two, simple research questions at the core of this study: 1.) What does PBL look like; and 2.) What do professors who profess to use PBL report as the advantages, disadvantages, and challenges of PBL? Eighteen faculty responded to the survey instrument, however, only fifteen faculty professed to using PBL in their curriculums.

Forty-four graduate students provided quantitative data that explored and defined PBL from the student perspective and thus addressed the remaining research question: 3.) What do graduate students who have experienced PBL report as the advantages, disadvantages, and challenges of PBL? In addition, an in-depth interview with faculty

use of PBL was used to procure more information from three faculty volunteers. Qualitative methods were applied to this latter data.

CHAPTER 4

FINDINGS OF THE STUDY

A Survey of Problem-Based Learning (PBL) in Higher Education Curriculum

Summary of Results

This chapter will present the results of the study. Responses will be revealed for both the faculty survey and the graduate student survey for each item on the instruments and in the same sequential order as the items appeared. While responses to items that are directly relevant to the research questions are of the most importance, some demographic data on the respondents and their institutions are also displayed for the information of the readers. In all instances, the findings are presented in both graphic and narrative form.

Faculty Survey

Of the 42 questionnaires mailed to faculty in departments of higher education, who teach at colleges and universities that belong to the AAHE, 18 were completed and returned. Thus, the overall return rate was 43% percent. Within the respondent pool, Question 1 was addressed by 83% of the respondents, with 15 out of 18 clarifying what type of institution they worked for. Results showed that one-third of faculty respondents worked at research extensive institutions (N=5) and similarly, a third of the respondents

worked at comprehensive institutions (N=5). Twenty percent (N=3) worked at research intensive institutions and 13% (N=2) worked at comprehensive doctoral institutions.

Responses to Question 2, pertaining to the number of years faculty had taught courses in higher education totaled 17 for an overall response rate of 94%. Twenty-nine percent (N=5) had taught between one and five years; and the same percentage, 24% (N=4) was given in each category which included having taught between either 5 and 10 years, or between 10 and 20 years, or more than 20 years.

Fifteen faculty responded to the item on their gender, which was an overall response rate of 83%. Of these fifteen, 67% were male (N=10), and 33% were female (N=5).

There were a wide variety of responses in regards to the types of courses the faculty teach in response to Question 3. They could select from five categories that included law, finance, student services, organization and foundation, as well as select "other" and specify what that class is. The leadership category was created because four respondents responded that they teach some form of leadership class. Thirty-nine percent (N=7) teach "foundation" classes; 33% (N=6) teach law and/or foundation classes; 28% (N=5) teach finance classes; 22% teach leadership classes (N=4); and the fewest number of faculty (N=3) teach in the areas of student services which represents 17% of the respondents. Fifty percent of the faculty who responded reported teaching in an area "other" than those listed which included Adult and Continuing Education, Counseling Application, Distance Education, Training and Development, and Teaching and Learning Curriculum.

Finally, to determine if the faculty used PBL as a teaching methodology, question 4 addressed this area and three faculty respondents stopped at this point in the survey because they did not use PBL. Of the 15 faculty who continued, 80% (N=12) replied that

they have been using a form of PBL for two years or more and 20% (N=3) responded that they have been using a form of PBL for one to two years.

A complete presentation of the data gleaned from responses on the survey instruments is presented below in both graphic and narrative form. Results are presented on an item-by-item basis in the same sequence in which the questions appeared on the survey instruments.

Section 1: Demographic Information - Faculty from 18 institutions returned completed surveys.

Classification of institutions:

Q1. The institution I work for is classified as:

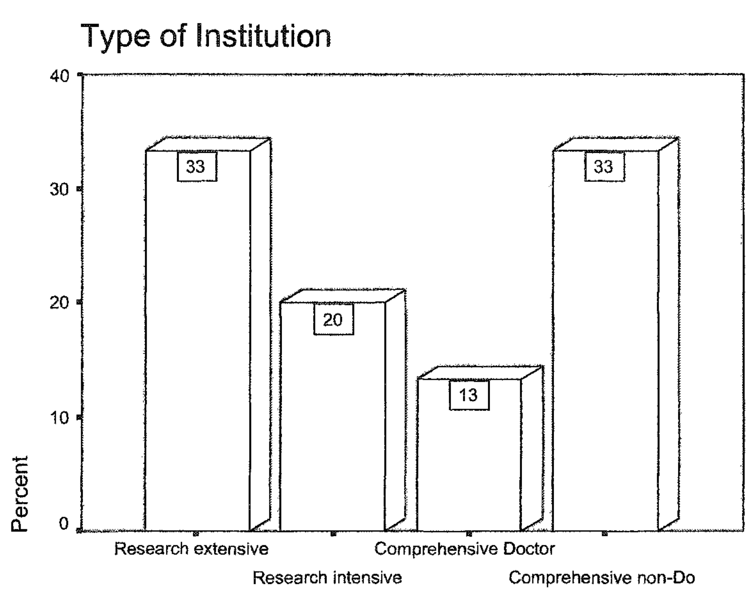

Figure 4.1. Type of institutions according to Carnegie Classification System.

- One-third (N = 5) of faculty respondents work at a research extensive institution. Likewise, a third of respondents work at a comprehensive non-

doctoral institution.

- Twenty percent (N = 3) faculty respondents work at a research intensive institution.

- Comprehensive doctoral institutions were the least represented with 2 respondents (13%).

Q2. I have taught courses in the area of higher education for:

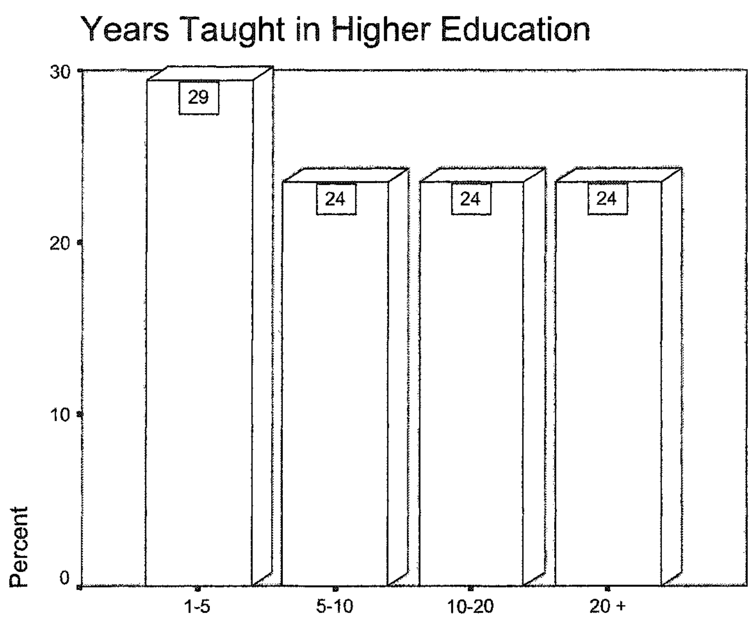

Figure 4.2. Number of years faculty have taught in higher education.

- Twenty-nine percent (N = 5) of respondents reported that they have been teaching in the area of higher education between one and five years.
- Twenty-four percent (N = 4) of faculty have been teaching in the area of higher education between 5 and 10 years.
- Twenty-four percent (N = 4) of faculty have been teaching in the area of higher education between 10 and 20 years.

- Twenty-four percent (N = 4) of faculty have been teaching in the area of higher education for twenty years or longer.

Q3. The types of courses that I teach are (select all that apply):

Respondents could select from five categories (law, finance, student services, organization, and foundation) as well as select "other" and specify what that class is. The leadership category was created because four respondents specified that they teach some form of leadership class.[1]

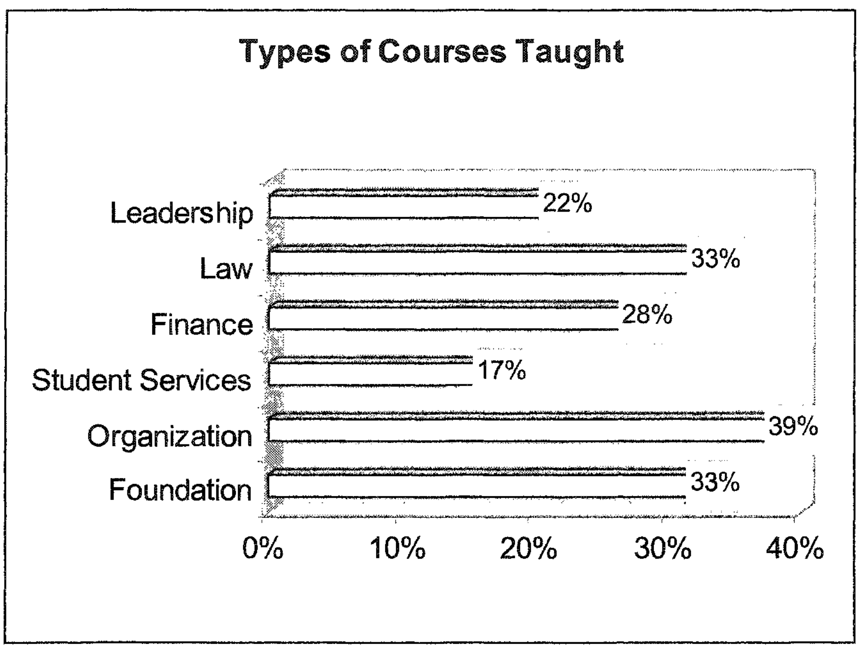

Figure 4.3. Percent of faculty who teach courses in higher education leadership, law, finance, student services, organization and foundations.

- Thirty-nine percent (N = 7) of faculty reported that they teach "foundation" classes, making this the type of class that most respondents teach.

[1] The leadership categories specified as "other in question 3 are: Administrative leadership (N=1), Leadership (N=2), and Institutional leadership (N =1).

- Thirty-three percent of faculty (N = 6) teach law and/or foundation classes.
- Twenty-eight percent (N = 5) respondents are teaching finance classes.
- The fewest number of faculty (N = 3) teach in the area of student services which represents 17 percent of the respondents.
- Fifty percent of respondents reported teaching in an area "other" than those previously described.
- "Other" classes are: Adult and Continuing Education, Counseling Application, Distance Ed; Training and Development, and Teaching and Learning Curriculum.

Q4. I have used PBL or a form of PBL in teaching (years):

The survey began with the collection of the demographic data. Faculty respondents that reported that they have "never" used PBL in teaching (N = 3) stopped the survey at this point. There are no further responses from this group.

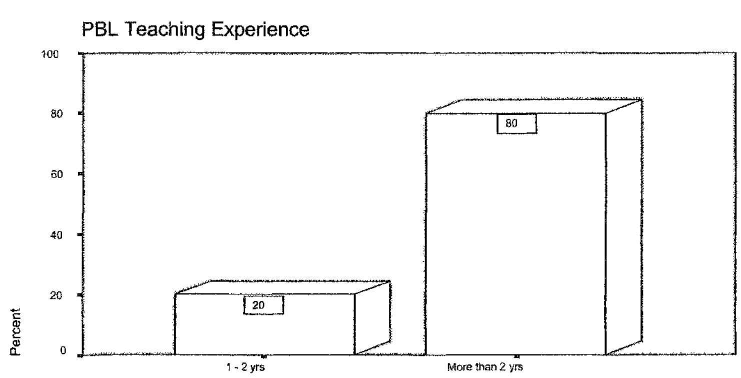

Figure 4.4. Percent of faculty who use PBL and how long they have used it in their curriculum.

- Among the faculty who use a form of PBL, 80 percent (N = 12) have been using it for more than two years.
- Twenty percent (N = 3) of faculty reported that they have been using a form of PBL for one to two years

Section 2: Problem Based Learning

In question 5, the respondents were given six definitions of PBL and asked to select the one that he/she uses when teaching. The five definitions of PBL used in this survey are:

a. Lecture-based cases – students are presented with information through lectures and then case material is used to demonstrate that information. Case-based lectures – students are presented with case histories or vignettes before a lecture that then covers relevant materials.

b. Case-method – students are given a complete case study that must be researched and prepared for discussion in the next class.

c. Modified case-based – students are presented with some information and are asked to decide on the forms of action and decisions they make. Following their conclusions, they are provided with more information about the case.

d. Discovery – students are presented with a macro problem within which there are multiple smaller problems that must be addressed. Students construct their knowledge of education practices by working their way through the various problems.

e. Close-loop problem based – this is an extension of the discovery method where students are asked to consider the resources they used in the process of problem solving in order to evaluate how they may have reasoned through the problem more

effectively.

In addition, faculty respondents were able to select "other" and specify their own definition of PBL. Two respondents elected to do so. Following are their definitions of PBL.

a. "Students are presented with cases that require them to draw on material from reading they have completed. They report on their discussion and analysis. These reports are then discussed further to draw out principles and make connections to theory."

b. "I'd categorize what I do as construction/discovery based with extensive background resources and a performance-based culmination(sic)."

Q5. The definition of Problem-Based Learning that I utilize when teaching is:

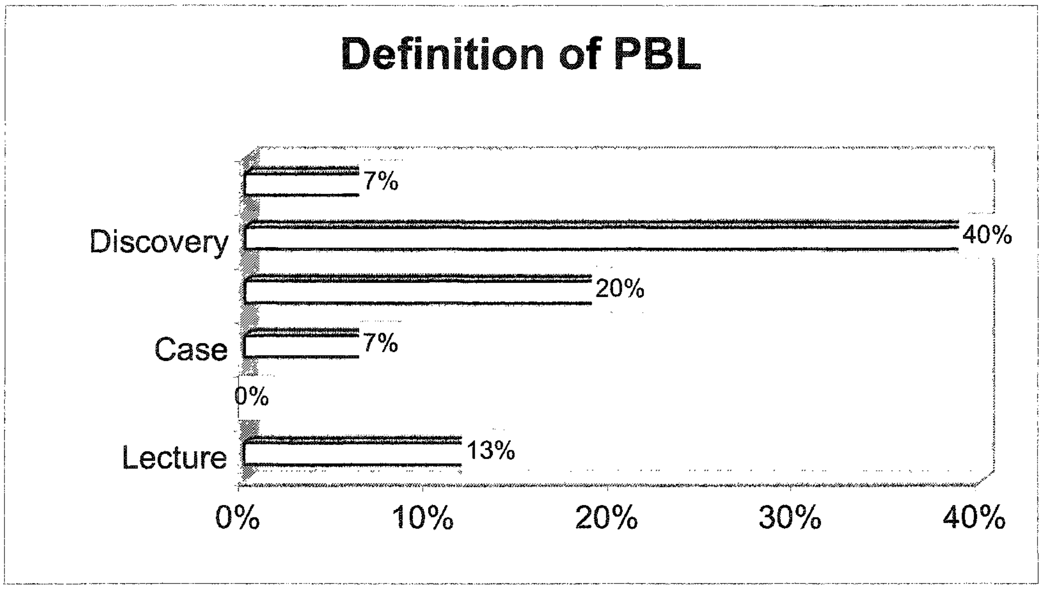

Figure 4.5. Percentages of faculty based on how they define PBL.

- The most selected definition of PBL was "discovery" selected by forty percent of the faculty respondents (N = 6).
- Twenty percent (N = 3) of faculty respondents reported that "modified case" is the PBL method used in their teaching.
- Thirteen percent selected "lecture based" as the definition of PBL; this represents 2 faculty respondents.
- One respondent selected "close-loop problem based" and one respondent selected the "case-method". One respondent represents 7 percent of the faculty that are using PBL.
- None of the respondents selected "case-based lectures" as their definition of PBL.

The majority of faculty, 40%, selected "discovery" as the type of methodology they are using when implementing PBL. This definition is the same for PBL, only discovery was selected as another way of defining PBL because students are "discovering" solutions to problems.

Q6. In using PBL, I structure the assignments to be completed:

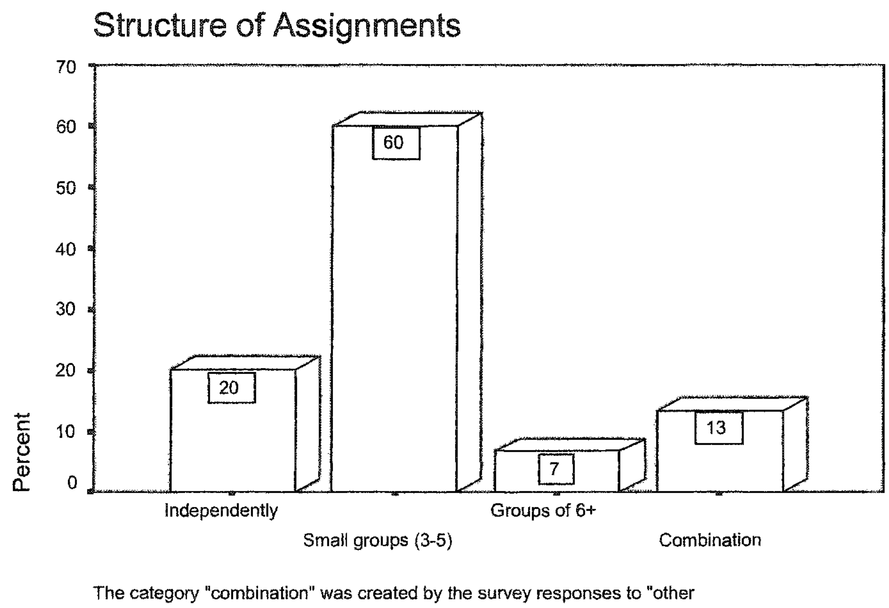

Figure 4.6. Percentages of faculty representing how they grouped students when using PBL.

- Nine of the 15 faculty respondents (60%) reported that they structure assignments by having students work in small groups of three to five. This was the most selected response.
- Three faculty respondents (20%) reported that they have each student work independently.
- Only one respondent (7%) reported that assignments were structured so that students work in groups of six or more.
- Two respondents (13%) reported that their assignments are structured by using a combination of methods that include: individual and small groups and individual and large groups.

According to these responses, the majority of the faculty who did respond (80%) are using the small group concept when using forms of PBL which has been found to be the most effective way of gaining optimum results from students. In small groups, students can learn teamwork, negotiation skills, delegation skills, dialogue to espouse their views, critical thinking, and have an opportunity to look at problems from different viewpoints to create variable options to solve problems. Only 20% of the faculty chose to have students work independently on PBL assignments and this could be based on the type of course and how the faculty member structured the course. Independent study could also result from the type of PBL problems that the faculty member used and the results they were interested in achieving from their students. Faculty members could also prefer that students work independently than in groups.

Q7. The amount of time I spend on designing and preparing my curriculum when using PBL compared to the amount of time I previously used with other methods is (percent)?

Q7a. Is the percentage of time that you spend "more time" or "less time"?

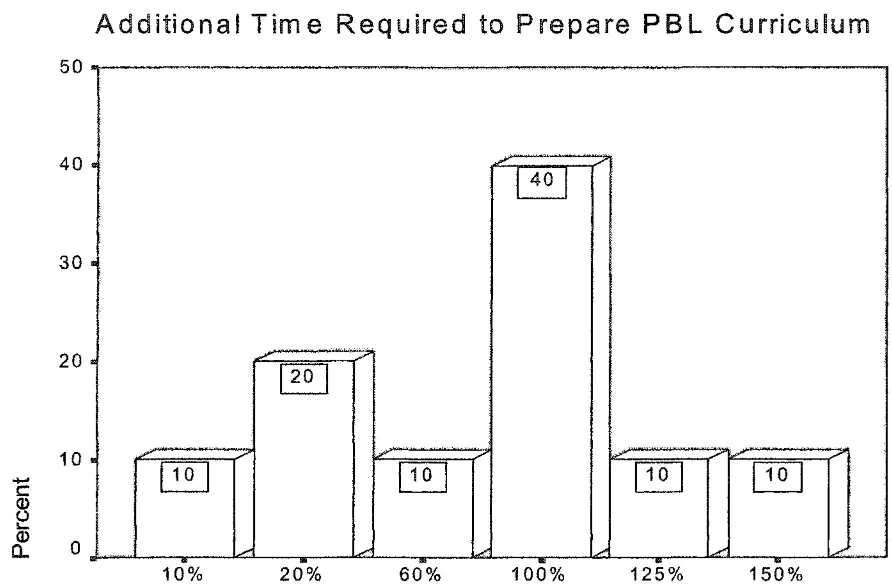

Figure 4.7. The amount of time percentages of faculty spend preparing a PBL curriculum.

- Of those faculty that spend "more" time creating and preparing curriculum for PBL than other methods, forty percent (N = 4) reported that they spend 100 percent more time. This was the highest incidence.
- Twenty percent (N = 2) of faculty respondents spend 20 percent more time in the preparation of PBL curriculum.
- At the lowest end of the scale, one faculty respondent (10%) reported spending ten percent more time on a PBL curriculum while at the high end of the scale one respondent spends 125 percent more time and one respondent spends 150 percent more time on PBL.

All faculty respondents except one reported that they spend "more" time designing and preparing a curriculum for PBL compared to other methods. The faculty member that reported spending "less" time reported that he/she spends 10% less time. There did

seem to be some confusion with the question. Three faculty members filled in 100% but indicated that it was the same amount of time. Two other faculty members reported that they spent more time, yet did not indicate what percentage of more time they spent.

Even though there was confusion as to how to display the amount of time it takes to implement a PBL curriculum over and above a traditional curriculum, clearly it shows that the majority of faculty respondents stated that a PBL curriculum takes more time to implement than a traditional curriculum which is consistent with previous research concerning the time involved implementing PBL methodology.

Q8. I chose to use PBL or a version of PBL as my teaching method because (select all that apply):

Respondents could select as many as apply from a list of ten reasons why PBL is employed as a teaching method. In addition, they could specify any additional reason they might have. None of the respondents specified any other reason for using PBL as a teaching method. In the following table, the responses are presented in rank order from the most selected reason to the least selected reason that faculty use PBL in their teaching.

Table 4-1 Rank Order of Reasons Responding Faculty Use PBL

RANK	REASON USING PBL	NUMBER	PERCENT
1	Students will be better prepared in professional positions	13	87%
2	Challenge students & increase critical thinking skills	12	80%
3	Prefer using constructive or "hands on" approach	10	67%
3	Want students to assume ownership for their learning	10	67%
3	Challenge students to develop problem solving skills	10	67%
4	Prefer being a facilitator/coach versus other roles	9	60%
4	Students able to apply education theories in real life situations	9	60%
5	Students will receive more in-depth education	7	47%
6	Students were not learning/responding to lectures	1	7%
6	Students unsuccessful in applying education theories in coursework/exams	1	7%

- Almost all of the faculty respondents (87%, N = 13) reported using PBL so that students will be better prepared in professional positions, making it the response with the highest incidence.
- A high percentage of responding faculty (80%) also indicated that they use PBL to challenge students and increase critical thinking skills.
- Sixty-seven percent of faculty respondents (N = 10) reported using PBL for such reasons as: PBL allows students to assume ownership for their learning, PBL challenges students to develop problem solving skills, and PBL provides a "hands on" approach to teaching.
- Sixty percent (N = 9) prefer being a facilitator/coach and feel that PBL allows students the ability to apply educational theories more readily in real-life situations.
- Two of the response options were only selected by one respondent each making them the response options with the lowest incidence of selection.

This is indicative that this group of faculty is using PBL because students were not responding to lectures, or students were not successfully applying educational theories in coursework or exams.

Based on these results, PBL may be characterized as faculty driven according to how a faculty member wants to design his or her curriculum and what he or she hopes to gain from using PBL as a methodology.

Q9. Administrative support for implementing PBL in my curriculum has been:

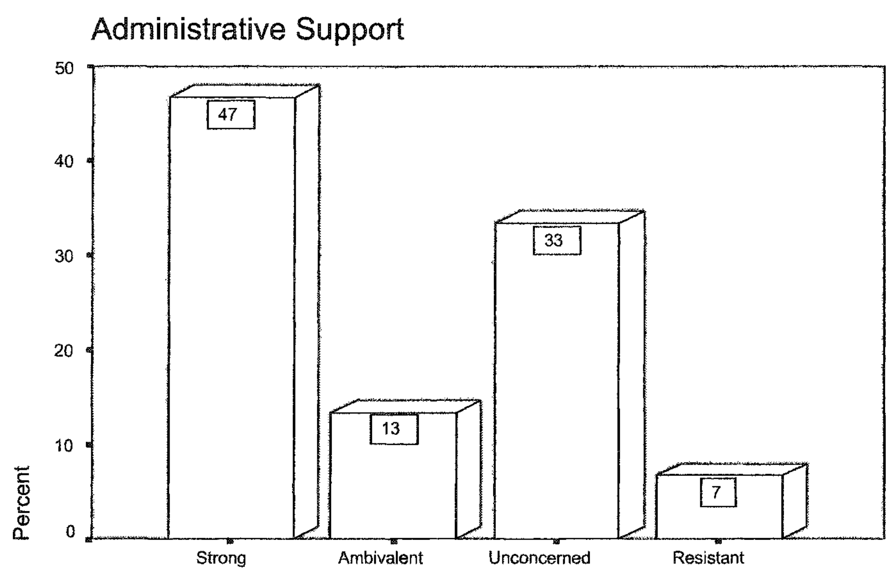

Figure 4.8. Percent of administrative support faculty claim they receive when using PBL.

- Forty-seven percent (N=7) of faculty respondents reported that they have "strong" administrative support for the implementation of PBL into the curriculum.

- Thirty-three percent (N=5) reported that their administrations are "unconcerned" with the implementation of PBL into the curriculum.
- Two respondents (13%) answered that their administrations were "ambivalent" towards the implementation of PBL into the curriculum.
- Only one respondent (7%) reported that his/her administration was "resistant" to the implementation of PBL into the curriculum.

Q10. Colleague support for implementing PBL in my curriculum has been:

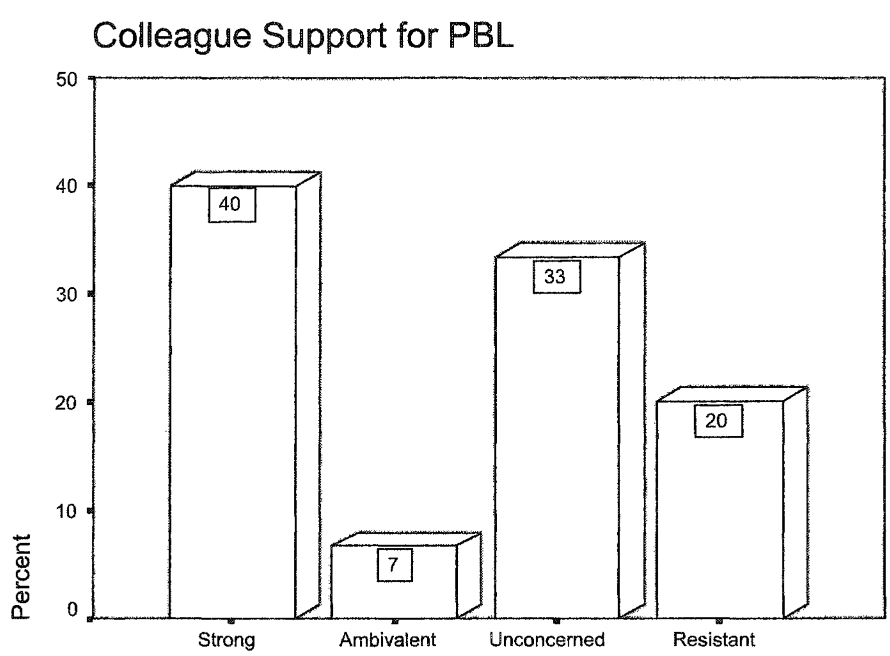

Figure 4.9. Percent of colleague support faculty claim they receive when using PBL.

- Forty percent (N = 6) reported that the support from their colleagues for implementing PBL into the curriculum is "strong".

- A third (N = 5) reported that their colleagues are "unconcerned" with the implementation of PBL into the curriculum.
- One respondent (7%) reported that his/her colleagues were "ambivalent" towards the implementation of PBL into the curriculum.
- Three faculty respondents (20%) answered that their colleagues were "resistant" to the implementation of PBL into the curriculum.

When comparing administrative support with faculty support in using PBL, there is a slight difference in strong administrative support (47%) compared to strong faculty support (40%). However, there is more of a discrepancy between administrative resistance to the use of PBL (7%) and faculty resistance to using PBL (20%). Further research would have to be conducted to understand why faculty are resistant, although the amount of time it takes to implement PBL could have a bearing on their resistance, as well as the answers to Question 12 that outline faculty responses to the challenges of using PBL.

Q11. When trying to find appropriate PBL problems, I (select all that apply):

Respondents could select as many as apply from a list of seven ways to find appropriate PBL problems. In addition, they could specify any additional methods they might employ. Four of the respondents specified "other" ways of finding appropriate PBL lessons than those in the list. Those ways include:

- "Student generated"
- "From case books that I edited"
- "Computer simulation"
- "Case Books"

Two of the possible methods for finding PBL problems were not selected by any of the respondents. Those methods are: "have a formal curriculum committee design the problem", and "belong to a faculty committee which designs the problems".

In the following table, the methods of finding appropriate PBL problems are presented in rank order from the most selected method to the least selected method.

Table 4-2. Rank Order of Methods That Faculty Use to Find PBL Problems

RANK	METHOD OF FINDING PBL PROBLEMS	NUMBER	PERCENT
1	Use practicing practitioner's real-life problems	13	87%
2	Write my own problems based on my pervious experience	11	73%
3	Use outside resources	8	53%
4	Some other method[2]	4	22%
5	Use problems from other university programs	3	20%
6	Have purchased a PBL program[3]	1	6%

- Nearly all (87%, N = 13) of the faculty respondents reported using real life problems as a method of obtaining class appropriate PBL problems.
- Seventy-three percent (N =11) of faculty write their own problems based on previous experience.
- Fifty-three percent (N = 8) use outside resources.
- On the lower end of the scale, 3 respondents (20%) use problems from other university programs, and one respondent (6%) has purchased a PBL program.

[2] Methods are listed above.

[3] Respondents were asked to specify where programs were purchased from but the respondent elected not to answer this part of the question.

Q12. The challenges of using PBL have been (select all that apply):

Respondents could select as many as apply from a list of seven possible challenges of using PBL. In addition, they could specify any additional challenges they might think of. Two of the respondents specified "other" challenges to PBL. Those challenges include:

- "Timing PBL within a semester."
- " Student resistance to taking an active role"; "Student resistance to ambiguity."

None of the respondents selected "cost prohibitive" as a challenge to using PBL.

In the following table, the challenges of using PBL are presented in rank order from the most selected challenge to the least selected challenge.

Table 4-3. Rank Order of Faculty Challenges to Using PBL

RANK	CHALLENGE TO USING PBL	NUMBER	PERCENT
1	It's time consuming	12	80%
2	Finding & implementing problems that are authentic, engaging, & contemporary	6	40%
3	Having to address teamwork issues or interpersonal conflicts among students	5	33%
4	Having less control over what students have internalized regarding learning objectives and knowledge.	3	20%
5	Feeling a lack of colleague support	1	7%
5	Feeling a lack of administrative support	1	7%

- The challenge to using PBL with the highest incidence is "it is time consuming", selected by 80 percent (N = 12) of respondents.
- Forty percent of faculty respondents (N = 6) reported that finding and implementing problems that are authentic, engaging and contemporary is a challenge to using PBL.

- Having to a address teamwork issues or interpersonal conflicts among students was cited by 33 percent of respondents, while having less control over what students have internalized regarding learning objectives and knowledge was cited by 20 percent of respondents.
- At the low end of the scale, one respondent (7%) selected feeling a lack of colleague support, and one respondent selected feeling a lack of administrative support as a challenge to using PBL.

Again, it is clearly seen that the amount of time PBL takes is a challenge, as well as finding problems that are authentic, engaging and contemporary. PBL is not only time consuming to implement, but as one faculty member responded, "Timing PBL within a semester" which faculty could find difficult when trying to balance teaching the class material and orchestrating PBL groups. Another challenge is resolving student teamwork issues and conflicts, or as another faculty member responded, "Student resistance to taking an active role. Student resistance to ambiguity." This was an area of concern when using PBL.

Q13. At the beginning of the course, I introduce the PBL process by (select all that apply):

Respondents could select from two possible course introductions to PBL methodology. In addition, they could specify any additional course introductions they might use.

Each of the course introductions that were supplied on the survey instrument were selected by 40 percent of faculty respondents (N = 6). Those course introductions were:

- Verbally describing PBL, its elements, merits, and the format that will be used.
- Presenting a PBL scenario and working through it as an in-class experience.

Five faculty respondents included their own course introductions. They were:

- "Discuss case method. Don't call it "PBL".
- "Describe it in my syllabus" (N = 2).
- "PBL is introduced at beginning of program and students generate problems that we use." "After begin with focus on understanding and framing problems of practice."

Forty percent of faculty (N=6) selected the response that they introduce PBL in their classes by describing PBL, its elements, its merits and the format that will be used during the class. Another forty percent (N=6) selected the response that they present a PBL case and explain it as they work through it as an in-class experience. Five faculty members also stated that they included their own course introductions as described above.

Q14. I assess the performance of students in my PBL course through grading of (select all that apply):

Respondents could select as many as apply from a list of five possible criteria for student assessment. In addition, faculty could specify any additional assessment practices they might use. Four of the faculty respondents specified "other" methods of student assessment. Those methods include:

- "Group report (written)."
- " I use informal learning tools in class; I do not evaluate these experiences typically."

- "I interact with the students, each individual problem presenter, and assess at class break and at the end of class."
- "Expert assessment of solution.".

In the following table, assessment methods used in PBL are presented in rank order from the most selected assessment method to the least selected assessment method.

Table 4-4. Rank Order of Assessment Methods Used by Faculty in PBL Curriculums

RANK	ASSESSMENT METHOD	NUMBER	PERCENT
1	Oral group presentations	10	67%
2	Self and peer assessments by the students	7	47%
2	A final written report by each student	7	47%
2	A combination of a final written report and a group oral presentation	7	47%
3	A comprehensive final exam taken by each student on the problem area	2	13%

- Oral group presentations were selected by 67% (N = 10) of the responding faculty making it the assessment method used most often.
- Nearly half (47%, N =7) of all respondents are using "self and peer assessment by students," "a final written report from each student," and "a combination of a final written report and a group oral presentation" as assessment methods.
- Two respondents (13%) reported that they use a comprehensive final exam.

It is interesting to note that according to these findings, students are not only assessed by the instructor, but by their peers and their own self when faculty choose to use PBL. This allows a comprehensive 360 degree assessment of a student versus the traditional method of test-taking which is only a partial assessment tool and offers limited feedback for the student.

Q15. I see results using PBL in the following ways (select all that apply):

Faculty respondents could select as many as apply from a list of 10 possible results of using PBL. In addition, faculty could specify any other results they might have had using PBL methodology. One of the faculty respondents specified an additional result of using PBL: "Problems studied and solutions are implemented in practice."

In the following table, results of using PBL are presented in rank order.

Table 4-5. Rank Order of Results From Faculty Who Used PBL

RANK	RESULT	NUMBER	PERCENT
1	Students are better able to effectively apply content of what they have learned	11	73%
1	Students demonstrate they are better able to solve practical problems	11	73%
2	Students become self directed learners	9	60%
3	Former students, who are practitioners, report resolving real problems in their professions	8	53%
4	Students are better able to retain and/or recall information	7	47%
4	Students show they know how to work more cooperatively in teams	7	47%
5	Students perform better on their master and/or doctoral comprehensive or preliminary exams	2	13%
6	Graduate student dissertations are often developed into a PBL project	1	7%
6	Master thesis/doctoral dissertations are better researched	1	7%
6	Master thesis/doctoral dissertations are more comprehensive	1	7%

- Two of the results of PBL were selected by 73% of the respondents. Faculty reported that students are better able to apply the content of what they have learned and are able to better solve practical problems.
- Sixty percent of faculty responded that students become self-directed learners as a result of PBL.
- Nearly half of the respondents (47%) answered that students are better able to retain and recall information and that they show that they know how to work more cooperatively in teams.
- Two respondents (13%) reported that students perform better on their master and/or doctoral comprehensive or preliminary exams.
- Respondents did not see PBL as an enhancement to the quality or comprehensiveness of master thesis/doctoral dissertations; only one respondent selected this result from the list.
- Likewise, only one respondent selected that graduate student dissertations are often developed into a PBL project.

Q16. I have been disappointed with PBL because (select all that apply):

Faculty respondents could select as many as apply from a list of 11 possible ways they have been disappointed with using PBL. In addition, faculty could specify any other ways that they might have been disappointed with using PBL methodology. Two of the faculty respondents specified "other" disappointments with the PBL methodology. Those responses are:

- "Not all students participate."
- "Students whine when not spoon-fed or if collaboration becomes

problematic."

Three of the possible disappointments from the survey were not selected by any of the faculty respondents. They include:

- Too time consuming to implement.
- Too expensive to implement.
- Insufficient research and/or development on PBL.

In the following table, disappointments with PBL are presented in rank order.

Table 4-6. Rank Order of Disappointments Faculty Experienced With PBL

RANK	RESULT	NUMBER	PERCENT
1	Within the time constraints of a course, balancing the time needed for teaching & for problem solving is difficult	8	53%
2	Lack of colleague interest	2	13%
2	Finding assessment methods which match the learning outcomes sought in PBL	2	13%
3	Difficult to find time to balance teaching and research	1	7%
3	Lack of colleague commitment	1	7%
3	Lack of administrative interest	1	7%
3	Lack of administrative commitment	1	7%
3	Difficult to measure if PBL is more effective than traditional methods for graduate students in Higher Ed. Administration	1	7%

- Only one of the possible disappointments had more than two respondents select this choice. Fifty-three percent of respondents (N = 8) reported that within the time constraints of a course, balancing the time needed for teaching and for problem solving is difficult.
- Two respondents selected lack of colleague interest and finding an assessment method as a disappointment to using PBL.

- Only one respondent selected each of the five other possible disappointments provided in the list. Three of the listed choices were not selected at all.

Balancing the time constraints of teaching a PBL course as well as teaching theory, is a challenge to the faculty as reported with these results. It is interesting to note that the faculty in this study did not select one of the disappointments which stated that PBL is too time consuming to implement. Evidently, they are willing to spend the time to use it, however, still find it challenging to balance the time constraints within the curriculum. The other challenges listed were seldom selected and thus were seen as somewhat insignificant.

Other choices not selected were that PBL is too expensive to implement and that there is insufficient research and development on PBL.

Q17. I believe PBL is here to stay.[4]

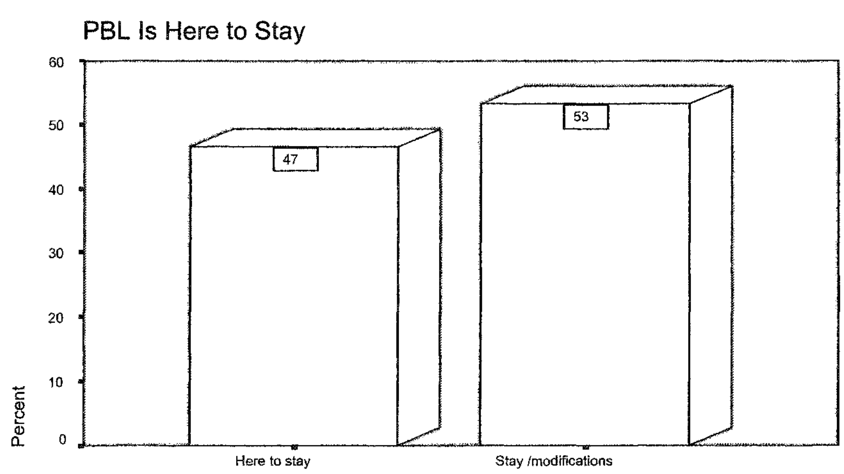

Figure 4.10. Percent of faculty who believe PBL is here to stay.

[4] One of the possible responses" will most likely fade from use over time" was not selected by any of the respondents.

- Forty-seven percent (N =7) of respondents think that PBL is here to stay.
- Fifty-three percent (N = 8) think that PBL is here to stay, but will be modified and improved over time.

First of all, the response "PBL will most likely fade from use over time" was not selected by any of the faculty. Therefore, it is enlightening to note that the faculty who did respond to this study believe that PBL is a methodology that can be used to teach and will not simply be a fad that is here today and gone tomorrow. PBL will likely be continued to be refined by faculty as they become more immersed in various problems and cases, as well as trying to meet the changing needs and demands of both students and the real world.

Q18. Please record your gender.

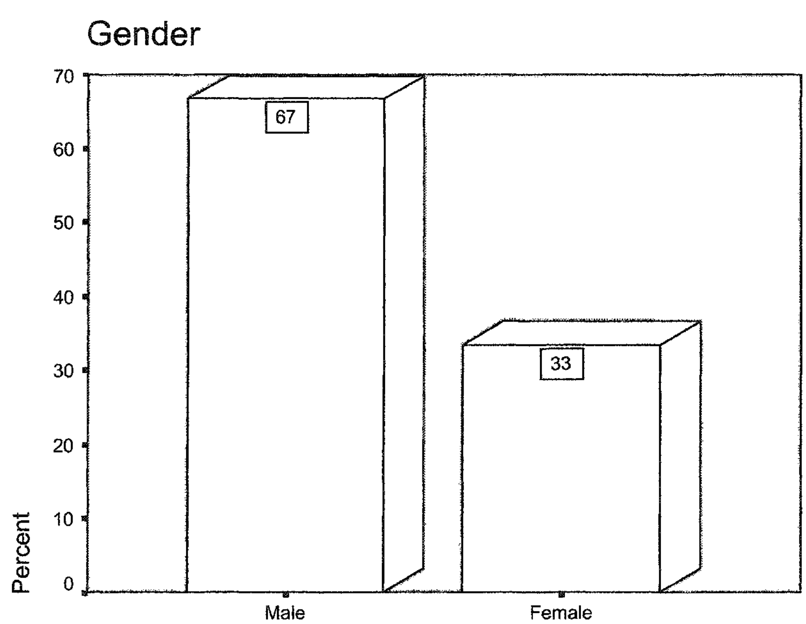

Figure 4.11. Percent of faculty based on gender who used PBL.

- Sixty-seven percent (N = 10) of the faculty that responded to the survey were male.
- Thirty three percent (N = 5) were female.

The reasons for this gender imbalance are beyond the parameters of this study. It may be due to various factors, i.e. amount of previous higher education experience which allow men to develop real-life problems/cases more readily or have more available time due to having achieved tenure, thus affording more time to implement PBL compared to a higher proportion of females who have not attained tenure.

Q19. Please indicate your age:

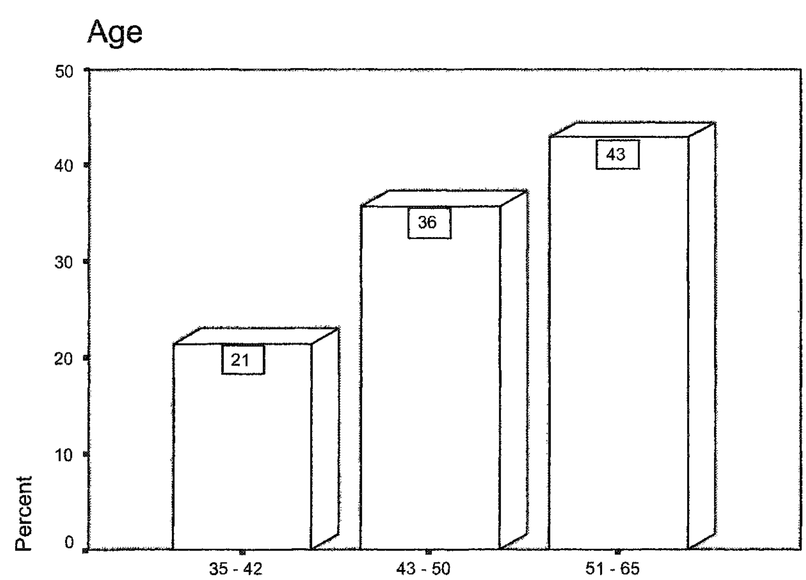

Figure 4.12. Percent of faculty based on age who used PBL.

- Twenty-one percent (N = 3) of faculty respondents are between the ages of 35 and 42.

- Thirty-six percent of the faculty (N = 5) are between the ages of 43 and 50.
- The largest percentage of faculty (43%, N = 6) are between the ages of 51 and 65.

It appears there is a relationship between age and use of PBL. This may be due to the fact that the older faculty who may be tenured have more time to construct and implement PBL methodology as well as time to commit to keep the PBL curriculum refreshed and current each year. As Professor A notably warned in the interview, it is not advisable for untenured faculty to spend their time using PBL but instead take time to focus on research and service in order to gain tenure. Once a professor has gained tenure, Professor A felt comfortable that they could try other teaching methodologies with their students because they could devote more time to teaching.

A Survey of Problem Based Learning (PBL)

in Higher Education Curriculum

Graduate Student Survey

A complete presentation from the data gleaned from graduate student responses n the survey instrument is presented below in both narrative and graphic form. Results are presented on an item-by-item basis in the same sequence in which the questions appeared on the survey instrument.

Of the 322 graduate student questionnaires distributed to departments of Higher Education, a total of 44 were completed and returned. Fifty of the surveys were returned due to the institution claiming that they did not use PBL. Thus, the overall return rate,

considering that there were 272 viable surveys that could be completed, was 16% percent.

Section 1: Demographic Information - The demographic data collected provide interesting results even though it was not critical to the purpose of this study. Forty-four graduate students from institutions that belong to the American Association of Higher Education (AAHE) returned surveys[5].

Q1. I am working towards a (degree):

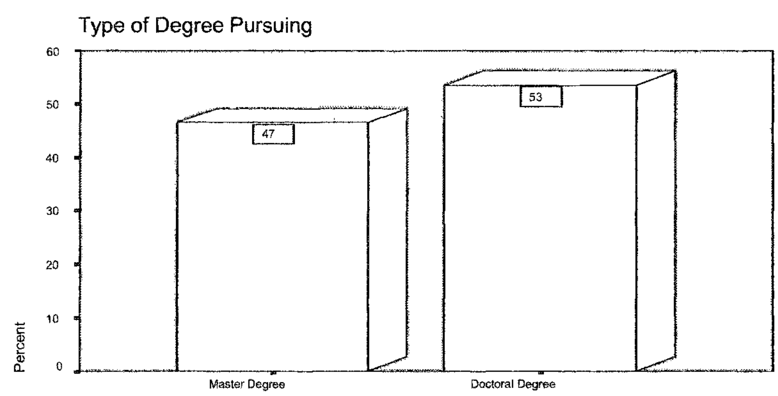

Figure 4.13. Percent of graduate students working towards a master or doctoral degree.

- The students are almost evenly split with 47% working towards a master's degree and 53% working on a Ph.D/Ed.D.

Of the 44 surveys that were completed, 47% (N=21) of the students were working towards a Master degree and 53% (N=23) were working towards a Ph.D. or Ed.D.

[5] All percentages reported on all tables, graphs, or charts are based on the valid percent (percentage of respondents that answered the question).

Q2. The degree specialty will be:

- The majority (53%) of students reported that they are working towards a degree in higher education administration.
- Seventeen percent are working towards a degree in student services.
- Thirty-percent (N = 12) are pursuing some "other" degree.

The "other" degrees that graduate students are pursuing are listed in the following table.

Table 4-7. Graduate Student Program Degrees in Higher Education

DEGREE
Adult Education
Curriculum and Instruction
Educational Leadership
Higher Education Curriculum
Higher Ed. Organization & Organizational Change (N = 2)
Human Resources Development
Instructional System Designs
K-12 Administration (N =2)
Secondary Administration (N = 2)
Student Personnel Administration in Higher Education
Teacher Education

When answering Question 2, which asked about their degree specialty, 53% (N=23) of the students responded that they are working towards a degree in Higher Education Administration; 17% (N=8) of the students reported that they are working towards a degree in Student Services; and 30% (N=13) of the students are pursuing another type of degree. The other degrees mentioned included Adult Education, Curriculum and Instruction, Educational Leadership, Higher Education Curriculum, Higher Education Organization and Organizational Change, Human Resources

Development, Instructional Systems Design, K-12 Administration, Secondary Administration, Student Personnel Administration in Higher Education, and Teacher Education.

Q3. Respondents Age

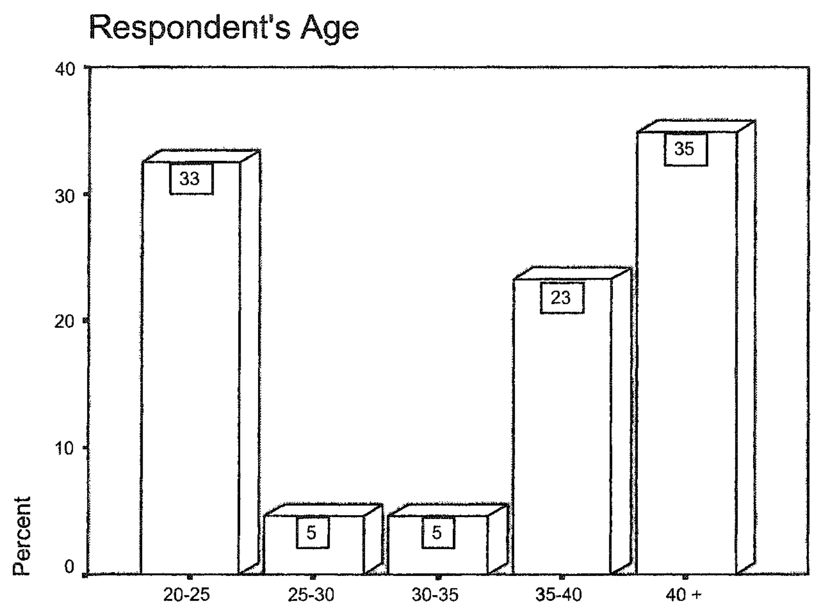

Figure 4.14. Age variations of graduate students.

- Fifty-eight percent of respondents are over 35 years old.
- Thirty-five percent of respondents (N = 15) are over 40 years old; by a margin this was the age category with the highest incidence.
- Thirty- three percent of the graduate students are between the ages of 20-25 while 23 percent are between the ages of 35-40.
- Only 4 respondents (10%) fall between the ages of 25-35.

The age variance of the students who responded to the survey as well as answering Question 3, showed that 33% of the students were between the ages of 20 and 25, 5% of the students were between the ages of 25 and 30, 5% of the students were between the ages of 30 and 35, 23% of the students were between the ages of 35 and 40, and 35% of the students were over the age of 40. Comparably, 58% of the students were over the age of 35 and 48% of the students were under the ages of 35 with the largest percentage between the ages of 20 and 25.

Q4. The number of courses taken that utilize PBL:

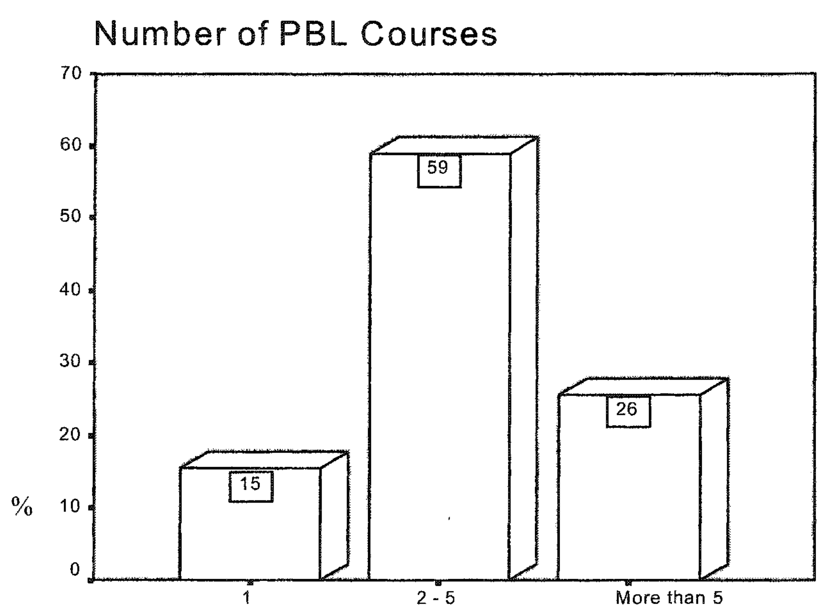

Figure 4.15. Percent of graduate students who took a specified number of PBL courses.

- Eighty-five percent of respondents reported taking 2 or more classes that utilized the PBL methods in class.

- Fifty-nine percent of students reported that they had taken between 2 and 5 classes that utilized PBL, making it the category with the highest incidence of response.
- Slightly more than a quarter (26%) of the students reported that they had taken more than five courses where PBL methodology was used.
- Only 15 percent (N = 6) reported that they have taken one PBL course.

In answer to Question 4, which asked about the number of courses students have taken that utilized PBL, 85% of the respondents (N=33) reported taking two or more classes, 39% reported that they had taken two or three classes, 21% reported that they had taken three to five courses, and 25% reported that they had taken five or more classes that used PBL.

Q5. The types of courses that I have taken that used PBL are (select all that apply):

Respondents could select from seven categories (law, finance, student services, organization/leadership, foundations, teaching methods, and administration) as well as select "other" and specify what that class is.

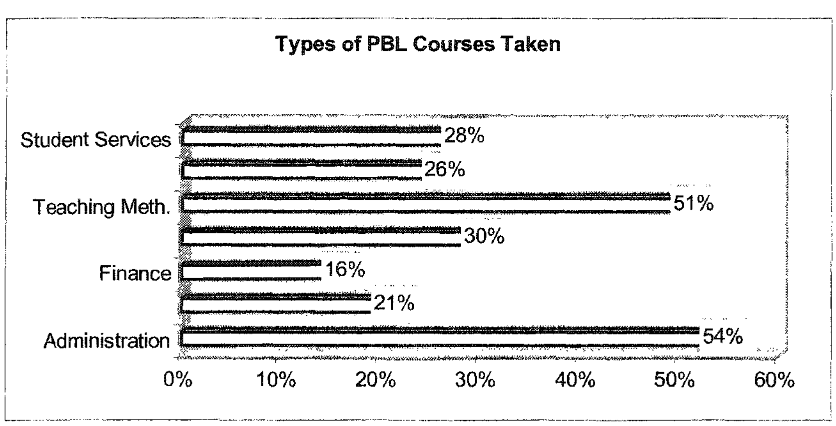

Figure 4.16. Percent of graduate students who have taken various PBL courses in graduate curriculums of higher education.

- More than half of the students reported that PBL methodology had been utilized in "administration" (54%) and "teaching methods" (51%) classes.
- Thirty percent of students were exposed to PBL in "law" classes.
- About a quarter of students took classes in "student services" (28%), "organizations/leadership" (26%), or "foundations" (21%), that utilized PBL.
- The response category with the lowest incidence of response was "finance" where 16 percent of students reported taking a class that utilized PBL methodology.

The following table shows the "other" types of classes that utilize PBL methodology that students reported taking.

Table 4-8. Other Types of Graduate Degrees in Departments of Higher Education

CLASS
Advising Student Groups
Current Issues / Internship
Educational Research
Higher Education Curriculum
History (N = 2)
Sports courses
Statistics
Philosophy

As far as the type of courses that students had taken or were currently taking that used PBL in response to Question 5, 54% of the students answered that they had experienced the PBL methodology in courses that taught higher education administration, 51% had experienced PBL in courses that taught teaching methodologies, 30% had experienced the use of PBL in courses that taught higher education law, 25% had experienced PBL in courses that taught application of student services, 28% had experienced PBL in courses

that taught organization and leadership, 21% had experienced PBL in courses that taught the foundations of higher education, and 16% of the students had experienced PBL in courses that taught higher education finance. There were other courses in which students reported experiencing PBL methodology such as advising student groups, current issues internship, educational research, higher education curriculum, the history of higher education, sports courses, statistics, and philosophy.

Section 2: Problem Based Learning

Q6. The advantages I perceive from participating in courses that have employed PBL are (select all that apply):

Respondents could select as many responses as applied from a list of four perceived advantages from participating in PBL courses. Two of the respondents specified "other" perceived advantages of taking PBL courses. Those advantages include:

- "The ability to apply knowledge based on leadership theories, in day-to-day administrative practices."
- "Development of group/people skills."

In the following table, the perceived advantages from participating in courses that employ PBL are presented in rank order from the most selected method to the least selected method.

Table 4-9. Rank Order of Perceived Advantages to PBL Methodology by Graduate Students

RANK	ADVANTAGE	NUMBER	PERCENT
1	Ability to apply knowledge based on learned theories, in day-to-day administrative practices	32	74%
2	Development of general problem solving skills	23	54%
2	Appreciation of readiness to handle on-the-job responsibilities resulting from exposure to PBL	23	54%
3	Development of lifelong learning skills	19	44%

- By a large margin (74%), the "ability to apply knowledge based on learned theories, in day-to-day administrative practices" is the most reported advantage of PBL methodology.
- More than half of the students (54%) selected "development of general problem solving skills" and/or "appreciation of readiness to handle on-the-job responsibilities resulting from exposure to PBL", as an advantage to taking courses that employ PBL methodology.
- The advantage with the lowest incidence was "development of lifelong learning skills", selected by 19 percent of respondents.

Very clearly the results showed that 74% of the students felt that the paramount advantage to taking a course using PBL methodology gave the student the ability to apply knowledge based on learned theories in day-to-day administrative practices. The second most favorable reason chosen by graduate students was that PBL methodology allowed them to develop general problem solving skills. Another of the students' second most selected choice (54%) was that they appreciated that PBL gave them readiness to handle on-the-job responsibilities.

Q7. The training I received in how to use PBL in the classroom was:

Respondents were asked to quantify the PBL training that they received in the classroom using the following scale:

- None – had to guess as I went along.
- Minimal – brief introduction to PBL by the professor on the first day of the course.
- Moderate – some training during the first two or three classes.
- Extensive – Thoroughly grounded in the methods of PBL through a seminar or series of training sessions sponsored by my department.
- Other – please specify

Three students answered "other" and their responses included:

- "Prior development at undergraduate level, workplace experience."
- "Received lots of instruction on how to address problems but not told was PBL or PBL methodology."
- "Was a natural process as we progressed through classes but not formally explained."

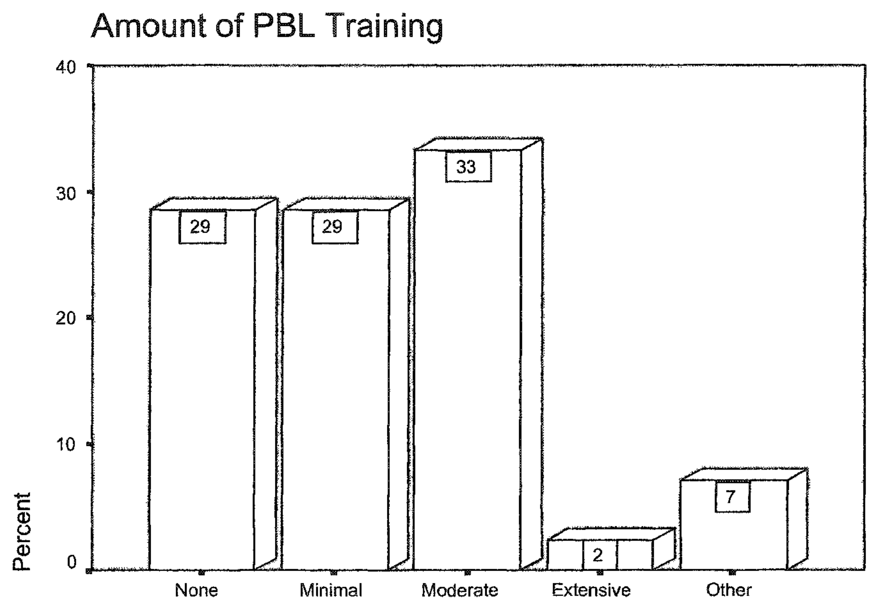

Figure 4.17. Percentage of PBL training graduate students received before taking a PBL course.

- Ninety-one percent of respondents felt the PBL training they received was moderate to none, with the highest incidence at moderate (33%).
- Twenty-nine percent reported they received no PBL training and the same amount believed their training was “minimal”.
- Only 2 percent (N = 1) of students felt their PBL training was “extensive”.

According to 58% of the students, the training they received in how to use and apply PBL methodology was none to minimal, with 33% of the students stating that the training was moderate, and only 2% of the students stating that it was extensive. Seven percent of the students explained that either they had received previous PBL experience in their undergraduate course work combined with their workplace experience or received lots of instruction on how to address problems but was not

told it was PBL or claimed it was a natural progress as they progressed through the class but PBL was not formally explained.

Q8. The type of PBL I experienced in my course(s) was:

In question 8, the respondents were given six definitions of PBL and asked to select the one that he/she has experienced in PBL courses. The five definitions of PBL used in this survey are:

a. Lecture-based cases – students are presented with information through lectures and then case material is used to demonstrate that information.

b. Case-based lectures – students are presented with case histories or vignettes before a lecture that then covers relevant materials.

c. Case-method – Students are given a complete case study that must be researched and prepared for discussion in the next class.

d. Modified case-based – Students are presented with some information and are asked to decide on the forms of action and decisions they make. Following their conclusions, they are provided with more information about the case.

e. Discovery – students are presented with a macro problem within which there are multiple smaller problems that must be addressed. Students construct their knowledge of education practices by working their way through the various problems.

f. Close-loop problem based – this is an extension of the discovery method where students are asked to consider the resources they used in the process of problem solving in order to evaluate how they may have reasoned through the problem more effectively.

In addition, students were able to select "other" and specify their own definition of PBL. Three respondents elected to do such. One student reported using a combination of methods without specifying any from the list. Following are "other" definitions of PBL supplied by the students.

- "Students identified several broad problems, or issues at the beginning of their course work. Then all subsequent coursework was related to the identified problems guided by professors".
- "Material just printed."

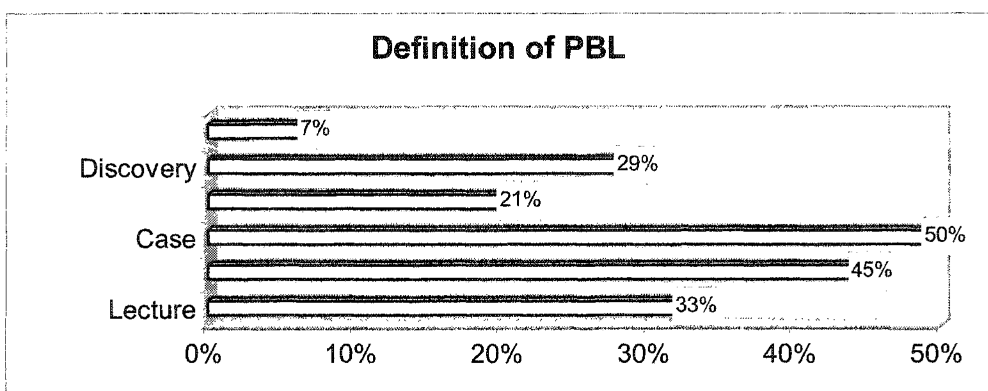

Figure 4.18 Percent of graduate students based on how they defined PBL.

- Half of the students reported having experience with the "case method" making it the response with the highest incidence of selection.
- Forty-five percent of respondents have experience with "case-based lecture", while a third of respondents selected "lecture-based cases".
- Twenty-nine percent of students experienced the "discovery" method of PBL and 21 percent were exposed to the modified case method of PBL.

- The PBL methodology with the lowest incidence was the "closed loop problem-based" method (7%).

Q9. While participating in a PBL course, as compared with courses using more traditional methods, I discovered (check all that apply):

Respondents could select as many as apply from a list of six "discoveries" found while participating in a PBL course. One of the respondents "discovered" another aspect of PBL methodology. That discovery was:

- "More confident in my own abilities."

In the following table, the "discoveries" found while participating in courses that employ PBL are presented in rank order from the most selected discovery to the least selected discovery.

Table 4-10. Rank Order of "Discoveries" Found From Graduate Students Who Participated in a PBL Course

RANK	DISCOVERY	NUMBER	PERCENT
1	That working as a team to solve problems is valuable	26	62%
2	I was able to apply what I learned to "real" problems	22	52%
3	I was/am more better prepared to handle problem situations	19	45%
4	I was/am more motivated	18	43%
5	I was/am a more self directed learner	13	31%
6	I was/am more capable of leadership responsibilities	9	21%

- A high percentage (63%) of graduate students discovered the value of working as a team to solve problems. This was the most selected discovery.

- More than half the students (52%) discovered that they are able to apply what they are learning to real problems, and forty-five percent are better prepared to handle problem situations.
- Forty-three percent of students discovered that they are more motivated and better prepared to handle problem situations as a result of PBL methodology.
- Thirty-one percent discovered that they are more directed self-learners.
- Only 22% (N = 9) reported that PBL made them more capable of leadership responsibilities.

Graduate students selected the value of working in teams as the preferred response when comparing PBL to traditional lecture-based learning.

Forty-four percent of the students found PBL motivating and past research has stated that this is a strength of PBL.

Finally, 44% of the students felt they were more prepared to handle problem situations as a result of participating in PBL classes compared to lecture-based classes. Only 22% of the students felt they were more capable of leadership responsibilities. This low response could be due to the type of career positions the graduate students had at this time. Once they move into actual leadership roles, they may find benefits from PBL that they do not see at this time.

Q10. I feel that lecture-based traditional learning when compared to PBL is:

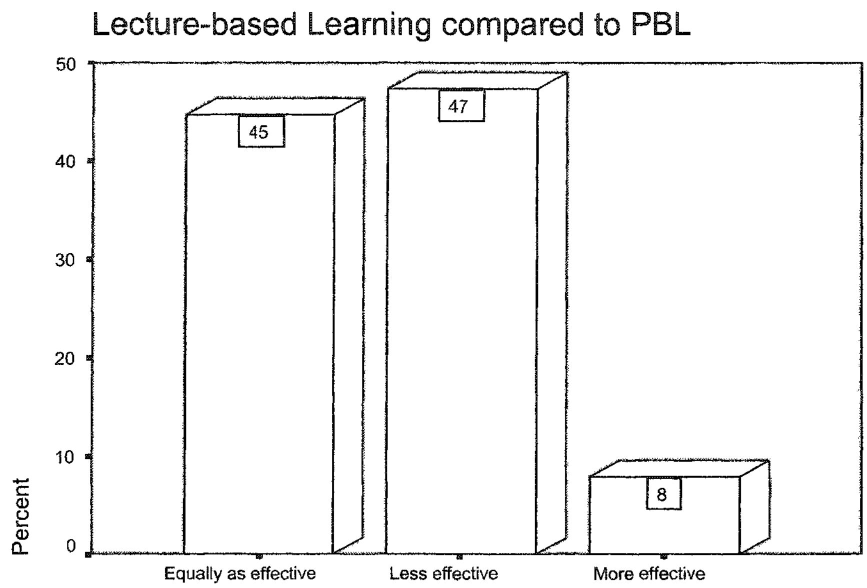

Figure 4.19. Comparison by graduate students of effectiveness of PBL to the effectiveness of traditional curriculums.

- Forty-seven percent of the graduate students reported that lecture based learning is "less effective" than PBL.
- A similar proportion of students (45%) reported that lecture based learning is "equally as effective" as PBL.
- Only 8 percent (N = 3) reported that lecture based learning is "more effective" than PBL methodology.

An equal proportion amount of graduate students reported that PBL was equally as effective as lecture-based learning and that PBL was less effective than lecture-based learning. Only 8% reported that they thought PBL was more effective than lecture-based learning. Yet in Question 16 in the survey, 51% of graduate students felt they learned more from a course using PBL versus 44% who felt they learned

about the same in a PBL course compared to a traditional lecture-based course.

Q11. When comparing PBL to more traditional methods of instruction, I have found that PBL (select all that apply):

Respondents could select as many as applied from a list of nine responses that compared PBL to more traditional methods.

In the following table, the responses are presented in rank order from the most selected response to the least selected response.

Table 4-11. Rank Order of Responses Comparing PBL to Traditional Teaching Methods According to Graduate Students

RANK	RESPONSE	NUMBER	PERCENT
1	Offers more critical thinking	27	64%
2	Was able to use my on-the-job experience when solving PBL models in class	22	52%
2	Provides more opportunities to solve real-life problems	22	52%
4	Provides more opportunity for in-depth thinking & understanding	15	46%
5	Was able to use previous knowledge in education when solving PBL models in class	17	41%
6	Reinforces self-directed learning	16	38%
7	Allows for more discovery of theories & knowledge and application of both	12	29%
8	Offers the same amount of critical thinking	3	7%
9	Offers a lesser amount of critical thinking	2	5%

- The response selected most often, (64%) was that PBL "offers more critical thinking".
- At the opposite end of the scale, only 5 percent reported that PBL offers a "lesser amount of critical thinking" and 7 percent think that PBL offers the "same amount of critical thinking".

- Slightly more than half (52%) of students reported that they were "able to use on-the job experience when solving PBL models in class" and that PBL "provides more opportunities to solve real-life problems".
- Forty-six percent agree that PBL "provides more opportunity for in-depth thinking and understanding".
- Thirty-eight percent think that PBL "reinforces self-directed learning", and 29% reported that PBL "allows for more discovery of theories and knowledge and application of both".

The most important element PBL seems to offer is the amount of critical thinking that students feel they use in this type of course. Sixty-five percent of the students responded that PBL provided more critical thinking than compared to a course where the professor uses more traditional methods of instruction. It is likely that PBL offers more "hands-on" involvement than traditional learning which lends itself to passive learning.

Forty-eight percent of the students felt they could actually apply their current experience to solving PBL models in class. Forty-five percent of the students felt that PBL provides more opportunities to solve real-life problems and more opportunity for in-depth thinking and understanding than traditional methods. Also, 40% of the students felt they were able to link their previous education to the PBL course than in traditional learning. PBL allows them to transfer concepts and theories and apply previously learned knowledge to current problems.

Twenty-eight percent of students felt that PBL provided opportunity for more discovery of theories and knowledge and application of both, compared to traditional learning, which signifies that students are more than likely being taught the same amount

of theory/knowledge with both types of learning methodologies based on the lower response rate in this category.

Q12. During the term, the amount of time that the professor lectured or employed other that PBL strategies was (percentage) and that it was (more) or (less).[6]

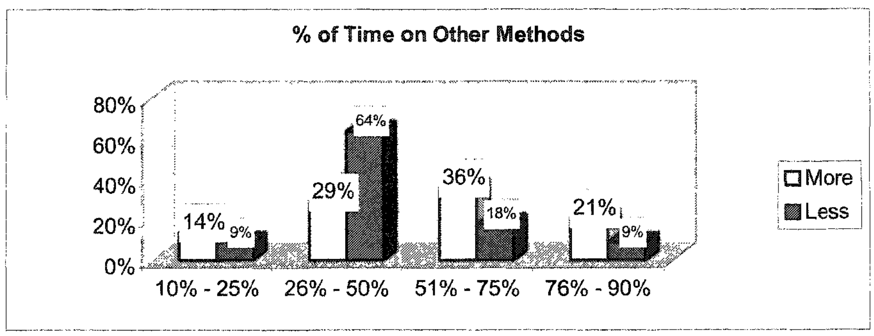

Figure 4.20. Percentage of time that graduate students felt faculty spent on lecture versus PBL methodology.

- Fifty-six of students reported that their professor lectured or used strategies other than PBL (X%) "more" of the time.
- Forty-four percent reported that their professor lectured or used strategies other than PBL (X%) "less" of the time.
- Fourteen percent of students reported that their professors used methods other than PBL between 10 and 25 percent "more" of the time, while 9 percent reported their professors used other methods between 10 and 25 percent "less" of the time.
- Twenty-nine percent of the students reported that methods other than PBL were used between 26 and 50 percent "more" of the time, while 64 percent reported that

[6] Forty-five percent of students (N = 20) did not complete the question by filling in "more" or "less". The data is only being reported on students that answered both parts of the question.

methods other then PBL were used between 26 and 50 percent "less" of the time.

- Thirty-six percent reported that methods other than PBL were used by professors between 51 end 75 percent more of the time, and 18 percent reported that methods other then PBL were used between 51 and 75 percent "less" of the time.
- Twenty-one percent responded that other methods were used between 76 and 90 percent[7] "more" of the time, and 9 percent responded that other methods were used between 76 and 90% less of the time.

Fifty-eight percent of the students responded that their professor used lecture or used strategies other than PBL more of the time, and 42% of the student reported that their professor used lecture or strategies other than PBL less of the time. However, 45% of the students who answered this question did not complete the question by filling in "more" or "less" which would not allow the answers to the question to be 100% valid.

Q13. Compared to other instructional approaches, expectations in PBL courses are:

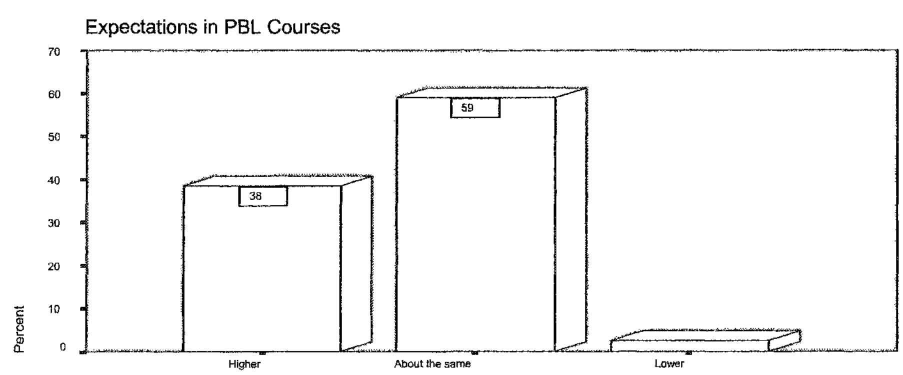

Figure 4.21. Expectations of graduate students when comparing PBL to other instructional approaches.

[7] No percentage was reported over 90 percent.

- Fifty-nine percent of the graduate students reported that the expectations in PBL courses are "about the same" as those employing other instructional approaches.
- Thirty-eight percent of the students think that the expectations in PBL courses are "higher" than those in other courses.
- Only one respondent (3%) reported that PBL courses had "lower" expectations than courses using other instructional approaches.

It seems safe to speculate that when faculty elect to use a creative (or non lecture) teaching methodology, such as PBL, they do not change their expectations and standards for student learning since 58% of the students responded that they experience the same course expectations in PBL courses as in traditional instructional courses.

Thirty-eight percent of the students did respond that they felt that the PBL course expectations were higher which could be attributed to more group work, more required time to work on class material outside of class time, different methods of assessment, i.e. group presentations, and more independent research which would be time consuming and more demanding. This may have lead to the reports by students of "more work" from student perception which could be interpreted as "higher class expectations."

Q14. Any frustration(s) I felt when working in a PBL class were due to (select all that apply):

Respondents could select from as many as applied from a list of 7 frustrations that might be apparent when working in a PBL class. In addition, the students could select "other" and define the frustration. Three of the students defined a frustration

that was not in the list. They included:

- "Stress greater when its real life vs. abstract scenarios."
- "Agreed norms for discussion-who holds the group accountable?"
- "Class discussions would go round and round. No consensus."

In the following table, the frustrations students felt when working in a PBL course are presented in rank order from the most selected frustration to the least selected frustration. As is indicated by the relatively low percentages, it appears that a large percentage of graduate students do not find PBL course work frustrating. Twenty-four percent of students (N = 10) reported that there "were no frustrations to speak of"[8].

Table 4-12. Rank Order of Frustrations Graduate Students Felt When Taking PBL Courses

RANK	FRUSTRATION	NUMBER	PERCENT
1	Confusion - was difficult to understand what the professor wanted because I was expected to find my own answers	11	27%
2	Poor group cohesion – when groups or cooperative learning occurred, the group I was in did not cooperate which was an unpleasant experience	8	20%
2	Stress – it was hard to work within limited time constraints or deadlines for completion	8	20%
3	Inappropriateness of assignment; the professor selected did not fit the course material	6	15%
3	Isolation – I had to discover learning on my own with little guidance or deadlines for completion	5	12%

[8] This response was the second most selected response.

- The frustration most students felt (28%) was "confusion".
- Twenty percent of the students think that "poor group cohesion" and "stress" are frustrations of working in a PBL class.
- Fifteen percent of students were frustrated by the "inappropriateness of the assignment".
- The least cited frustration of taking a PBL course was "isolation", selected by 12 percent of the students.

Twenty-nine percent of the students expressed that their greatest frustration with PBL was being confused and not knowing what the professor wanted due to being expected to find their own answers. Even though this could be looked at as a negative remark, using the PBL methodology correctly contributes to this type of remark most frequently voiced by students. Hence, this "confusion" was part of the PBL process as students are beginning to unravel their journey at the beginning of the course. This survey was distributed to students at the beginning of a semester, so this could have had some influence on this choice.

It was interesting to see that 24% of the students reported that there were "no frustrations to speak of", which was the second most selected response, even when students could have selected "other" and recorded their frustrations.

Twenty percent of the students did cite poor group cohesion as a frustration with PBL, and one comment was made by a student that "Class discussions would go round and round. No consensus." Another comment stated, "Agreed norms for discussion – who holds the group accountable?" was a frustration with the students. Twenty percent of the students also noted that it was hard to work within limited time constraints or deadlines for completion. This is going to be a valid complaint when students have to balance a

career, and/or a family, and additional course work.

This area should be closely monitored by faculty because when students are overwhelmed, they will tend to give up or just learn what "they think they should know" from a course compared to what faculty expect them to know.

Only fifteen percent of the students felt that the assignment was inappropriate for the course compared to 40% of faculty who felt that one of the challenges to using PBL was finding and implementing problems that are authentic, engaging and contemporary.

Finally, only 12% of the graduate students felt that they were isolated due to having to discover learning on their own with little guidance or deadlines for completion. Both of these areas can be adjusted by the faculty with curriculum redesign.

Q15. Comparing a PBL course to more traditional approaches, the professor spent:

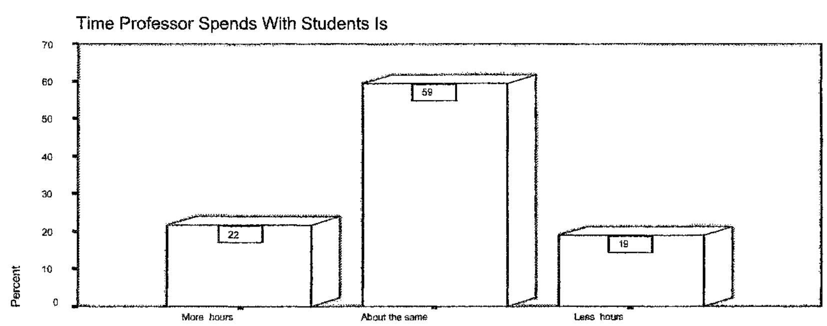

Figure 4.22. Amount of time graduate students reported that professors spent with students in PBL courses compared to traditional courses.

- The largest percentage of students (59%) reported that professors "spend about the same amount of contact hours with students" in a PBL course as compared to a more traditional course.

- Twenty-two percent of students reported that professors spend "more contact hours" with students in a PBL course.
- Nineteen percent think that professors spend "less contact hours" with students.

These results showed that 59% of the students felt the amount of time faculty spent with students when comparing a PBL course to more traditional courses was about the same. Only 22% of the students felt faculty spent more hours with them and 19% of the students felt faculty spent less contact hours with them.

Q16. When comparing learning about theories and models, as well as knowledge content, I:

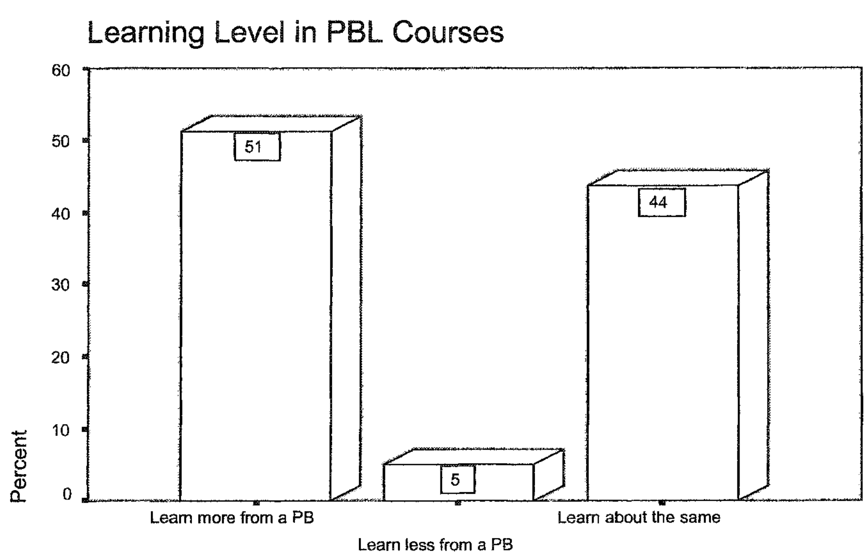

Figure 4.23. The amount of knowledge a graduate student feels they learn in a PBL course compared to a traditional course.

- More than half (51%) of students reported that they "learn more from a PBL course".

- Forty- four percent reported that they "learn about the same" from a PBL course.
- Only 5 percent (N = 2) reported that they "learn less from a PBL course".

It is interesting to see that PBL was given a slight advantage in gaining more knowledge content as 51% reflected they learned more from PBL courses.

Forty-four percent reported that they learn about the same when taking PBL courses. Only five percent of the students reported that they learn less from a PBL course.

Q17. Compared to more traditional courses, I discovered the advantages of PBL have been (select all that apply):

Respondents could select as many choices as applied from a list of five advantages of PBL courses compared to more traditional methods. Students had the option of selecting "other" and specifying their own advantage to taking a PBL course. No student selected "other". They could also select that they "experienced no difference at all when compared to more traditional course methodologies". Four students (10%) selected this response.

In the following table, the responses are presented in rank order from the most selected advantage to the least selected advantage of taking a PBL course.

Table 4-13. Rank Order of Advantages Graduate Students Perceive When Taking PBL Courses

RANK	ADVANTAGE	NUMBER	PERCENT
1	Better problem solving skills	23	56%
2	More involvement with my own learning	22	54%
3	Better knowledge retention skills	13	33%
4	Better mastery of course material and theories	12	30%
5	Became a self directed learner	10	24%

- Fifty-six percent of students reported that an advantage to PBL is "better problem solving skills"; this was the most cited advantage to taking PBL courses.
- Fifty-four percent of the students think that "more involvement with my own learning" is an advantage of taking a PBL course.
- Thirty-three percent reported that "better knowledge and retention skills" was an advantage of PBL methodology and a similar group of students (30%) cited "better mastery of course material and theories" as an advantage of PBL.
- About a quarter (24%) of the students reported that they "became a self directed learner" and saw this as an advantage to PBL methodology.

PBL purports to be focused on training students to learn problem-solving skills. Fifty-six percent of the students in this study ranked this as their first choice as an advantage to a PBL course. Fifty-four percent of the students selected more involvement with their own learning as their second choice.

Thirty-three percent of the students selected better knowledge retention skills. This was revealing since there is an ongoing debate about whether or not PBL contributes to better retention of knowledge over time when compared to traditional learning methods.

Finally, 24% of the students reported that they felt they became a self-directed learner, again one of the purported goals of PBL courses.

Students also had the opportunity of selecting "other" to reflect their own ways of describing the advantages of PBL when compared to traditional courses, however, none of the students selected "other". They could also select that they "experienced no difference at all when compared to more traditional course methodologies" and only four students or 10% selected this response.

Q18. Compared to more traditional courses, the disadvantages of PBL courses have been (select all that apply):

Respondents could select as many choices as applied from a list of six disadvantages of PBL courses compared to more traditional methodologies. Students had the option of selecting "other" and specifying their own disadvantage to taking a PBL course. No student selected "other".

In the following table, the disadvantages of taking a PBL course are presented in rank order from the most selected disadvantage to the least selected disadvantage.

Table 4-14. Rank Order of Disadvantages Graduate Students Perceive When Taking PBL Courses

RANK	DISADVANTAGE	NUMBER	PERCENT
1	More time consuming – takes more student time and dedication	25	61%
2	Less structured and thus more ambiguous objectives	12	29%
3	Students are forced to think on their own and so cannot simple memorize and regurgitate as in other courses	9	22%
4	Less choice in working independently or in groups	5	12%
5	Less adaptable as to strict time constraints and thus not amenable to time management schedules	4	10%
6	More difficulty in applying concepts globally – to see where everything fits and connects	3	7%

- Sixty-one percent of the students reported that a disadvantage to taking PBL courses is that they are "more time consuming – take more student time and dedication". This was the most cited disadvantage to PBL.
- Twenty-nine percent reported PBL is "less structured and thus has more ambiguous objectives".
- Twenty-two percent reported that "students are forced to think on their own and so cannot simple memorize and regurgitate as in other courses".
- Twelve percent (N = 5) of the students think that PBL is disadvantageous because there is "less choice in working independently or in groups", a similar amount of students (10%) think that PBL is "less adaptable as to strict time constraints and thus not amenable to time management schedules".
- The least cited disadvantage to PBL is "more difficulty in applying concepts globally – to see where everything fits and connects" which was only selected by seven percent of the students (N =3).

These responses seemed to underscore requirements of time and intense dedication to the subject matter as disadvantages.

Another disadvantage according to 29% of the students was that PBL was less structured and had more ambiguous objectives, and 22% of the students claimed another disadvantage was that they had to think on their own and could not memorize and regurgitate as in other courses.

Only 12% of the students saw a disadvantage to having less choice to working independently or in groups.

Ten percent of the students claimed that PBL is less adaptable as to strict time constraints and thus not amenable to time management schedules. It could be noted that

PBL originated in medical schools and medical students are immersed in these studies often times without any other obligations such as family, part-time work, or careers. Whereas students in other professional fields, are trying to balance graduate work with other responsibilities and PBL forces the student to give up more time in an already overloaded schedule.

Seven percent of the students responded that a disadvantage of PBL was that is it more difficult to apply concepts globally and to see where everything fits and connects.

Students had the option of selecting "other" and adding their own disadvantages to taking a PBL course, however, none of the students selected this area.

Q19. If offered the opportunity to take a future PBL course I will:

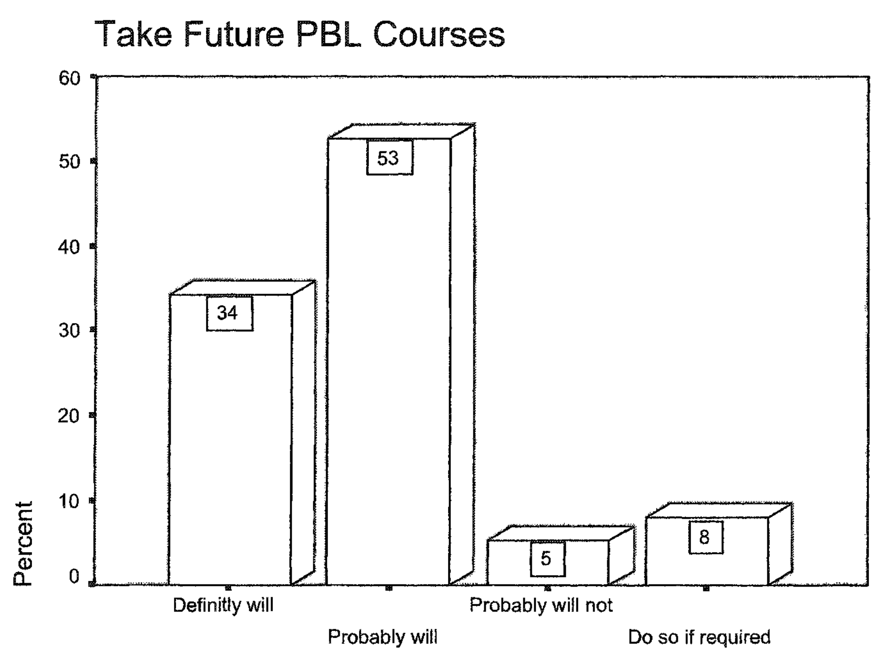

Figure 4.24. Percent of graduate students who would or who would not take PBL courses in the future.

- A very large percentage of students (87%) plan on taking a PBL course (if offered) in the future. Of these, 53 percent "probably" will take PBL courses in the future, and 34 percent "definitely" will take additional PBL courses.
- Eight percent (N =3) reported that they will only take future PBL courses "if required to do so", while 5 percent (N = 2) "probably will not" take PBL courses in the future.

At the conclusion of the survey, it was revealing to see that 87% of the students either definitely or probably would take another PBL course in the future. Only 13% replied that they probably will not or will do so only if required. Evidently, the students seem to find PBL interesting and challenging, and find their own intrinsic motivating factors to want to continue to take more PBL courses. They also appear willing to work through the challenges and disadvantages they mentioned, and most likely find the advantages outweigh the disadvantages/challenges.

Case Study Analysis of Qualitative Data

To further understand what PBL looks like, the advantages, disadvantages, and challenges PBL presents to faculty, and the advantages, disadvantages, and challenges PBL provides for graduate students, three case studies were conducted from a cross-sectional analysis based on geographical representation in the United States. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 1994, p. 13). A qualitative case study is an intensive, holistic description and analysis of a single instance, phenomenon, or social unit (Merriam,

1988, p. 21). The three participants were also selected to further understand the use of PBL based on years of experience implementing PBL, the training each professor received pertaining to the implementation of PBL, and the motivation underlying each professor's decision to use PBL in the classroom.

Once these interviews were conducted and concluded, two stages of analysis took place – the within-case analysis and the cross-case analysis (Merriam, 1998). For the within-case analysis, each case was first treated as a comprehensive case in and out of itself. Data were gathered so that the researcher could learn as much about the contextual variables as possible that might have a bearing on each case. The data of each single qualitative case were analyzed.

The main two categories that were gleaned from the data were "Implementation of PBL" and "The Results of Implementing PBL." Under the first category, "Implementation of PBL," there were subcategories that included the role of the professor and the role of the students, the grouping structures in the classroom, the course design, content knowledge, and assessment. Under the second category, "The Results of Implementing PBL," the subcategories included time management when using PBL, advantages of PBL, disadvantages of PBL, and challenges of PBL. Time management was placed in the category, "The Results of Implementing PBL," instead of the first category, because time management was seen by faculty as more of a disadvantage and a challenge when using PBL instead of being included in a discussion about implementation.

The results of the first stage in the analysis, the within-case analysis were as follows:

Professor A

Professor A is a tenured full professor and teaches at a doctoral/research university that is classified as a research-extensive university according to the Carnegie Classification System. It is located in the southeastern region of the United States. Professor A works in the Department of Leadership, Foundations, and Human Resource Education, which is located in the College of Education and Human Development. Professor A specifically teaches graduate courses in educational law and a doctoral seminar. Professor A is a Graduate Faculty member and supervises interns and matches students with other faculty. Professor A has been teaching for over twenty years and was a lawyer before becoming a professor. Professor A's research interests include law, general administration, and the politics of education.

Professor A received minimal training on how to use PBL and has only used PBL for the last three years. Professor A was first introduced to PBL by a colleague who had read literature that discussed PBL and shared this information with Professor A. Because Professor A was asked by his department to implement web-based instruction to supplement the current curriculum, Professor A decided that PBL would fit this need.

Implementation of PBL

Professor A uses a modified form of PBL that has been formatted to meet the needs of the curriculum and the students. The role of the professor is that of a facilitator and one who initiates dialogue and engages students. The role of the student is to participate in class discussions, work in groups, and take responsibility for learning and preparing. When implementing PBL, students are grouped in groups of 4 to 5. Faculty should be expected to know the course material in depth and be experts on the subject matter in

order to present the material accurately to the students, answer their questions correctly, and guide the students in the right directions for research. Students, on the other hand, need to learn the foundations of the course and make connections between the principles of the course and real-life problems. Assessments of course material include short written exams given four to five times per semester, group presentations, and end-of-semester faculty assessments.

The Results of Implementing PBL

According to Professor A, PBL fits the educational philosophy and teaching style Professor A embraces, and provides faculty enrichment. In regards to student learning, faculty receive better answers from students because students are digesting material instead of reiterating material back to the professor. Students think more critically, pay more attention in class, take ownership for their learning, understand the meaning of the course, and develop knowledge and skills to apply in the real world. PBL also builds community among faculty, students, and other departments. A disadvantage to PBL is the lack of rewards for faculty for exceptional teaching and additional time spent with students. A challenge to using PBL, compared to traditional methodology, is the increased amount of time that is needed to design the curriculum, handle the curricular workload, and interact more often with students.

Interview With Professor A

I teach Education Law each semester, and want the students to know the foundation of law. It is not about politics or what they read in the newspaper. Therefore, I do not use a textbook but instead I supplement my course with edited court opinions. I have been teaching for over twenty years, and am both a lawyer and a professor. For the last three years, or last six semesters, I have changed my way of instructing. Part of the

reason was that three years ago I was also asked to implement web-based instruction to supplement my teaching.

Looking back now, it seems that more than one thing prompted my change in my teaching methodology. Besides the web-based initiative, I also wanted to change the way I assessed students. In the past I had been giving healthy exams that were three to four pages long, and this was too lengthy. I began to think of everything holistically to the point that I wanted to change how I taught law to the students. I was also challenged in the aspect that students were not effectively internalizing the principles of law and in particular, were not able to relate these principles to current cases and legal situations. I needed a new format of teaching that would compel them to think more critically, and at the same time allow them to apply the concepts and principals I was teaching.

Today, I consider the way I am teaching is like PBL. I give the students ten cases per week to read and then divide the students into groups of four or five. Each group will "host" a particular case during the next class meeting and help the class understand the case more in depth. All students, however, are required to read all of the cases so that they can participate in the ongoing dialogue. The guidelines that I set require the students to read the cases and understand how each case is related to other cases they have read. I do not lecture about law during the entire class period, however, I am the main facilitator to initiate the dialogue when the class meets and respond to their questions. One of my fears with the use of PBL is that the professor is not an expert on the material and therefore, cannot ensure that students are learning the material versus sharing ignorance in their groups. If the professor is not an expert on the material, then allowing students to discuss problems in groups may lead to false assumptions and irrelevance of the concepts that are to be learned. Also, the professor really has to know the material they are giving students in order to get the groups to respond.

This semester I have 28 students and during a two and a half hour class I will lecture for twenty to thirty minutes commenting on the questions or postings via e-mails that the students have sent, and then spend the remainder of the time allowing each group to ask "what if" questions about the case they are hosting while I respond. At the end of the class, the students receive new material to read and discuss in their groups. They then have to e-mail their "what if" questions to me by Sunday night, so I can prepare for my Tuesday night class. I then type up their "what if" questions and keep their name anonymous, and give this print out to them at the beginning of the next class. I select "what if" questions that focus on the lesson, tend to provide more enrichment and cover the course material/principles of law. The "what if" questions are critical to the success of this methodology because they promote learning in a more critical style and at the same time, continue to focus on the principles for the course. Each student who submits a "what if" question gets a point. Currently only one-half to one-third of the students submit "what if" questions and they are enough to keep the class involved for the entire time. By not asking "what if" questions, those students do not get to participate with me or receive bonus points attached to their quiz. I do e-mail those who do not ask "what if" questions before class each week, to remind them to submit their questions. During this last quiz, I did find a small correlation that showed those students who did not write "what if" questions and who did not participate in class, received lower scores on their quiz. It is the first time I seriously looked at this and saw this and I may monitor this from now on.

Compared to traditional teaching, it would normally take me 45 minutes to organize my lesson plans and now it takes me up to ten hours per week. This includes reading their questions and preparing answers/materials, in order to respond to them and being able to generate group discussions; responding to other concerns and questions they might have had during the week; and finding relevant cases and information to present for the next assignment.

During the semester, I evaluate the students more frequently to get a "Polaroid snapshot" of their learning curve. Over one semester I give five quizzes and each one takes 35 minutes on the average. The students seem to do well on the quizzes because they have been practicing how to answer "what if" questions in class, and already know the format for answering the questions on the quizzes.

I personally feel the students are getting a much better education this way and I have noticed improvements in their learning and the way they think and pay attention to legal issues today. In fact, students from last semester are still staying in contact with me and showing me current legal news. Another noticeable difference with using PBL is that the more you interact with students, it seems they strive for even more contact from you. Therefore, besides planning lessons, responding to students and interacting with them can be extremely time consuming.

At the end of the course, the department evaluation and an evaluation I designed, are given to the students. I have received positive feedback on both evaluations based on implementing this teaching methodology. I designed my own survey to gather additional feedback about my teaching effectiveness and it addresses accessibility to the professor, responsiveness of the professor, and knowledge of the professor. This way of teaching is a wonderful way to build a community among faculty, students, and other departments. I thoroughly enjoy it because it is an enriching way to teach and I get better results from the students. I know they are learning versus regurgitating material and that they are making connections between principles of law and current legal cases. It is time consuming, however, and research universities do not reward professors based on teaching capabilities or time spent with students. Consequently, it is better for an untenured professor to focus on scholarship and once tenured, can then work on teaching methodology. So it is ironic that it seems like only tenured professors can spend time becoming better at teaching. My next initiative is to teach a course on-line using this same methodology.

This concluded the interview with Professor A.

Professor B

Professor B is an assistant professor at a doctoral/research university that has been classified as research-extensive by the Carnegie Classification System. The university is located in the southern United States. Professor B works in the Department of Educational Leadership, Policy and Technology Studies which is located in the College

of Education. Professor B teaches courses entitled, "The Community College and Junior College," "Academic Program Development and Evaluation," and "Problems in Higher Education." Professor B's research interest is problem-based learning. Professor B took several courses in pedagogy in a doctoral program and spent time working on faculty development. After graduating from the doctoral program, Professor B took a job as Director of PBL for a grant-funded project. The job required research and learning about PBL, and helping faculty learn about PBL, as well as speaking and writing about it. Professor B learned extensively about the benefits of PBL, and began using it in courses at the University of Delaware, which is one of the primary universities in the United States that developed the use of PBL in undergraduate curriculums. Professor B has used PBL for many years and chooses to use it because it offers more of a facilitative style versus a lecture-based methodology. Since PBL is conducive to Professor B's style of teaching in the classroom, Professor B continues to use it.

Implementation of PBL

Professor B uses both the traditional form of PBL and a modified case-based form of PBL. The role of the professor is a facilitative role and the role of the students, while working in groups, is to take responsibility for learning the course material and preparing for each class. Faculty should be expected to know the course material in-depth and be experts on the subject matter to help students make connections between the principles of the course and real-life problems. The basic structure of each course depends on the educational level of each class. Undergraduate courses have more structure because students have less professional experience and need more guidance on how to use PBL. Graduate courses are less structured because students usually have prior

professional experience and have been exposed to solving problems. Before using PBL, information concerning how to use PBL correctly should be reviewed with students. Ideas should be exchanged with colleagues to help each other implement PBL more productively and more creatively. Faculty can also draw from the expanding literature base describing PBL to help facilitate PBL in the classroom. Assessment should be authentic and the methods of assessment need to match the problems that the students have been asked to work on during the semester. Other methods of assessment can include group presentations, including presenting to a panel of expert practitioners, and formal research papers.

The Results of Implementing PBL

An important advantage to PBL, according to Professor B, is that it fits a constructivist educational philosophy and "hands on" teaching style. Other advantages of using PBL include the ability to procure deeper critical thinking from students and therefore, students understand the meaning of a course more fully, it teaches students to take ownership of their learning, and PBL helps students develop knowledge and skills to apply in the real world. A disadvantage for students when using PBL is the increased workload they may struggle with. Faculty often face a major challenge when switching from using traditional methodology to PBL methodology mainly due to issues related to time management. These challenges include the increased time it takes to design the curriculum, the additional amount of time to handle the curricular workload, and the

extra time to develop and write good problems. Because students lack experience with complex problem solving, it also takes time to help them learn how to solve problems which can be classified as a disadvantage due to the time constraints of a course.

Interview With Professor B

I learned about PBL a long time before I actually started using it herself. I took several courses in pedagogy in my doctoral program and spent time doing faculty development as well. Immediately after my graduate program, I took a job as Director of PBL for a grant funded project. The job required that I research and learn about PBL and that I help faculty learn about PBL, as well as speak and write about it. I learned so much about the benefits of PBL that I wanted to use it in the courses I taught as well. This occurred at the University of Delaware.

I use several models of PBL depending on the course, the students, and my goals. The ones I have used most often are modified case-based, problem-based learning, and close-looped problem-based learning.

In answer to the question about the main differences between PBL and constructivist learning, I think that problem-based learning fits in with the experiential learning tradition, starting as early as Protagoras and later, Aristotle, and going up to Dewey and his notion of experiential learning. I am not sure that considering differences is as important in considering connections between the two. PBL is an educational approach that can enable learners to reconstruct experience and make meaning of it. PBL enables students to assume some responsibility for their learning, to develop knowledge and skills that they can take beyond the classroom, and to make meaning of the course. It takes the experience of the learners into account and also nicely fits with my teaching style.

PBL is really challenging, probably much more so than lecturing. You have to really deeply know what you are teaching and think about it more deeply and more broadly so that you can think about where students might go with it. Another aspect is that a lot of times students don't have much experience with complex problem solving and it takes them a while to learn the skills and to get used to the approach. This may be a negative, or it may just be how it is. The primary thing was that students weren't initially familiar with the method and that it took some time getting used to. For me, it initially took a long time to get prepared and to come up with a good problem.

Switching from traditional instruction to PBL methodology can be very difficult for faculty. Perhaps easing the transition would be providing sufficient information about PBL such as having the time to dig into the research and literature to learn about it. Another thing that would help would be having good colleagues who were already using it and who you could exchange ideas and information with. Any time you redesign a course, it's a good thing to have the time to do it such a summer pay or release time, but this goes with redesigning a course of any kind and not just PBL.

The strategies I use to successfully implement PBL depend on what class I have. When I have worked with undergraduates, I've been more structured about it. For example, I have provided sample resources so that they could see what kinds of

resources were good. With graduate students, I've been able to be less structured because they already have a sense of what good and usable information is, for example.

If faculty want to use PBL, they have to do their homework and learn the method before trying it. Draw from an already existing and ever expanding knowledge base. Talk with other people who have used the methods. Talk with your students about your goals for their learning and ask them about their goals for their own learning. Be prepared.

When assessing a class using PBL, it depends on the problem. I try to use methods that are in keeping with the problem assigned. In one instance, students presented to a panel of experts I the field, who evaluated their solutions. In another, students wrote up formal research papers and exchanged them with a group of peers at a different institution. It just depends. I try to use authentic assessment.

I enjoy using PBL, but that's likely greatly because of my teaching style, which is not at all authoritarian but is rather facilitator/delegator. I'm currently teaching doctoral level students, who are all professionals, and they would not be pleased with a primarily lecture-based course at all. They are a very intelligent group, and they have great experience and great ideas to bring to the table. More than that, they want to bring their experiences and ideas to the table. They are much happier than they would be if I lectured to them all the time.

You would have to ask the students what they cite as the strengths of PBL. I think they learn more deeply but that the cost is increased and there is a more difficult workload, but you would have to talk with them to be sure. As far as how faculty would be able to measure the success of PBL, comparative analysis seems the simple answer, but coming from the qualitative/interpretive paradigm as a researcher as I do, I'd say that you'd have to ask them about the success and the effect.

This concluded the interview with Professor B.

Professor C

Professor C is an assistant professor and works at a doctoral/research university that is classified as research-intensive by the Carnegie Classification System. The university is located in the northwestern part of the United States. Professor C works in the Department of Education and teaches courses in higher education, particularly Student Services. Courses that Professor C teach include, "History and Philosophy of Higher Education," "College Teaching," and "Introduction to Student Services."

Professor C was trained by Professor B on the use of PBL when they worked together at the same university. Professor C has used it for several years and continues

to use it. Professor C was involved with training how to use PBL, and designed a summer leadership institute for a research-intensive university in the south and trained the College of Engineering at a research-intensive university in the northeastern United States. Professor C enjoys the teaching style PBL provides and Professor C actually moved from one university, whose faculty did not completely support the use of PBL, to a university that has embraced the use of PBL.

Implementation of PBL

Professor C uses both the traditional model of PBL and modified models of PBL when teaching courses, depending on the structure of the course being taught. At the graduate level, Professor C provides less course structure due to graduate students having had more professional experience and having been exposed to real-life problems. The role of the professor is that of facilitator or coach and the role of the students includes working in groups and being responsible for learning and preparing for each class. One of the major factors involved with implementing PBL successfully, is finding problems that are authentic and engaging. Methods of assessment should be authentic and can include ongoing peer assessments during the course, group presentations to the class, group presentations to panels of expert practitioners, formal research papers, and even video teleconferencing.

The Results of Implementing PBL

PBL fosters a constructivist learning environment and is a better representation of the real world, which are advantages according to Professor C. Professor C enjoys the role of facilitator compared to the traditional faculty role of lecturer. The advantages of PBL

for students include the way PBL takes their previous experience into account. PBL, therefore, provides more intrinsic motivation because PBL helps them transition from passive recipients of knowledge to active knowledge construction. PBL also assists students with critical thinking, teaches them to take ownership for their learning, allows students to develop knowledge and skills to apply in the real world, and shows them how to learn to create multiple answers to complex questions. A disadvantage to PBL can be dissension among groups, which can be exhausting because Professor C has to continually monitor the groups during each class session to prevent this from arising. Another disadvantage concerns time management, which includes the time it takes to design the curriculum, the additional time to manage the curricular workload and the time it takes for students to learn to use PBL skills, which can affect the time constraints of a course. Challenges to using PBL, according to Professor C, include switching from traditional teaching to PBL, helping students who lack experience with complex problem-solving skills, writing complex problems for each class, having to continually monitor classes, and the lack of support, at times, from colleagues. The challenges for students using PBL include the inability to handle the disorganization of PBL because it is not neatly written into a notebook and struggling with its ambiguity.

Interview With Professor C

I have used traditional PBL when teaching at three different institutions. I first used PBL in a master level course on applying student development theory to practice at a research university in the south . The following year I used PBL in a Student Services course at a comprehensive university in the Midwest and I am currently teaching an Introduction to Student Services course at the current university where I am working and am using PBL.

I have used a modification of PBL when I taught History and Philosophy of Higher Education this past fall, 2002 and again when I taught a class on College Teaching this current semester, 2003. I also helped design a summer leadership institute in the south, which incorporated PBL as the main "pedagogy" for the week-

long experience.

I have been a student of active learning pedagogies while working as an academic advisor without teaching responsibilities and as a doctoral student. At a research university in the north eastern part of the United States, I worked with the College of Engineering and sat in on discussions of teaching that included discussions of PBL. I took my first faculty position at a research university in the south where I met Professor B and learned about the Samford University PBL initiative and began to seriously think of using PBL for my own course.

I use traditional PBL methods where the course is designed around a problem with content feeding into that problem for the three student services courses she has taught. I have also used modified PBL, which requires a fairly major problem, as part of the requirements of the course but still using some traditional pedagogy for the other two courses she mentioned previously.

I see constructivist learning and PBL to be related but not the same. I think of constructivism as an educational philosophy. I believe that you can use all sorts of pedagogies and adapt them to facilitate constructivist learning. PBL, done well, is a great pedagogy for fostering a constructivist learning environment. But, like all skill sets, an instructor could do the mechanics of PBL and not foster a constructivist learning environment if they did not really believe that students aren't blank slates that the professor "writes" knowledge on.

The positive aspects of PBL are that it is a better representation of the "real world" and creates a learning environment that is less divorced from reality. I believe that the students become active learners and really engage in their learning; they are intrinsically motivated and they have ownership over what they've learned. I dislike lecturing, so I am relieved that I am not asked to do that much. Students get to practice some great skills like group problem solving, public presentation, writing, and research. I like that PBL reinforces the idea that there are multiple answers to complex questions instead of one right answer.

The negative aspects and challenges of using PBL are that sometimes the students can't get a handle on what they've learned because it's less organized and not neatly written into a notebook. A big challenge is to help students learn how to learn this way – they need lots of coaching and reassurance the first time, though, because it is so unlike other academic learning environments.

The biggest challenge overall, is that PBL does not fit well with our current methods of teaching evaluation. For example, there was a lack of support and understanding by my colleagues when I used this pedagogy in Iowa. The department I taught in wanted to use a traditional teaching evaluation when doing peer observations in my class. Well, if a colleague walked into the middle of many of my classes when I used PBL, I would be sitting on the side of the classroom, listening in on student groups, or perhaps answering one or two direct questions, but the place would look chaotic and unorganized and I would appear to have poor classroom management skills. As a PBL instructor, I would look at the same mess and think "now the students are really learning!", but I don't think an outside observer would get the same impression. They would also have difficulty evaluating my syllabus by traditional measures.

Transitioning from traditional teaching methods to PBL methodology involved work at the beginning that was tremendous. Writing a problem that was complex enough to

get all the learning I wanted them to do was a challenge. Then, during the first few weeks, sitting on my hands and not jumping in when they were struggling with the ambiguity was more difficult than I thought it would be. PBL fits with my educational philosophies, so in some ways, it was easy for me to adopt it.

Having a really good problem that engaged the students was the most essential element as a strategy to implement PBL in the classroom. Also, authentic assessment was important and I had outside experts come and evaluate final products so the students were very motivated to impress the panel.

If faculty want to try and use PBL, they should jump in. They should also coach their students in the beginning – tell students that their feelings of being overwhelmed are natural and that as they work through the problem it will become clear. Also, keep an eye on group dynamics issues and don't let them fester.

For assessment methods for PBL, I ask students to present their solutions to a panel of experts and they must also turn in a written product. In one of my more shining moments, I had my students present to a group of experts via interactive video teleconferencing which was appropriate since their PBL problem asked them to create a student services model for an internet based college. So, the modality of the assessment (presenting at a distance) fit with the problem. I have also had students complete rather rigorous peer evaluations (two times in a term) so that they can hold each other responsible for doing the required work. It cuts down on the resentment towards slackers and gives me a window into which students really put in the effort to make the group solution work. Finally, I always include a few individually generated requirements in the term so that those students who are uncomfortable with being evaluated on group measures can show me what they can do as individuals.

I love using PBL but I can't see using it for every course, mainly because of outside restrictions with the curriculum and other colleagues. Also, it can be exhausting because I don't have control over the process and I am constantly monitoring.

The students like the real world feel of PBL and they are very proud of their work when they are finished. They continue to have trouble with being evaluated for group work, however.

PBL is fabulous for graduate students. It really helps them make the shift from passive recipient of knowledge to active knowledge construction. Those that get this shift love it; those that want to remain passive don't think they learned much.

In my experience, the PBL pedagogy worked best with non-traditional, older graduate students – they had been working and already had developed some problem-solving skills. It worked less well with graduate students coming straight our of undergraduate school, even though by traditional measures such as grades and test scores, the younger students were more "talented".

This concluded the interview with Professor C.

Once the analysis of each case was completed, cross-case analysis began (Merriam, 1998). The researcher attempted to build a general explanation that fit each of the individual cases, even though the cases varied in their details (Yin, 1994, p. 112). The

researcher attempted to see processes and outcomes that occurred across the cases, to understand how they were qualified by local conditions, and thus developed more sophisticated descriptions and more powerful explanations (Miles and Huberman, 1994, p. 172).

In order to guide the researcher in this cross-case analysis, coding was used to prepare categories that reflected the purpose of the research (Merriam, 1998). These categories were created based on the answers to the research questions, which were: 1.) What does PBL look like?; 2.) What do professors who profess to use PBL report as the advantages, disadvantages, and challenges of using PBL; and 3.) What do graduate students who have experienced PBL report as the advantages, disadvantages, and challenges of PBL?

The results of this cross-case analysis can be seen in Table 4.15 and in the narrative summary that follows.

Table 4.15 Cross-Case Analysis of PBL from Case Studies of Professor A, Professor B and Professor C

CROSS-CASE ANALYSIS OF PBL

PROFESSOR A, PROFESSOR B, AND PROFESSOR C

Category	*Professor A*	*Professor B*	*Professor C*
A. Implementation of PBL			
1. Role of Professor			
Facilitator	X	X	X
Initiates Dialogue	X		
Engages Students	X		

CROSS CASE ANALYSIS OF PBL

PROFESSOR A, PROFESSOR B, AND PROFESSOR C

Category	*Professor A*	*Professor B*	*Professor C*
2. Role of Students			
Participate in class discussions	X		
Work in groups	X	X	X
Responsible for learning/preparing	X	X	X
3. Group Formation			
Groups of 4-5	X		
Unknown groups sizes		X	X
4. Course Design			
Structured at undergraduate level		X	X
Less structured at graduate level		X	X
Traditional PBL		X	X
Modified PBL	X	X	X
Review information describing PBL		X	
Exchange ideas with colleagues		X	
Draw from expanding knowledge base		X	
Need authentic and engaging problems			X
5. Content Knowledge			
Faculty			
Know material in depth	X	X	X
Expert on subject matter	X	X	

CROSS CASE ANALYSIS OF PBL

PROFESSOR A, PROFESSOR B, AND PROFESSOR C

Category	*Professor A*	*Professor B*	*Professor C*
5. Content Knowledge			
Students			
Learn foundations of course	X		
Make connections between principles of course and real-life problems	X	X	
6. Methods of Assessment			
Authentic		X	X
Methods match problems		X	
Short written exams	X		
Group presentations	X	X	X
Present to expert panel		X	X
Video Teleconferencing			
Formal research papers		X	X
Peer evaluations			X
Faculty evaluations	X		
B. Results of Implementing PBL			
1. Time Management			
Curricular workload increases/designing curriculum takes additional time	X	X	X
Interaction with students increases			
Need extra time to formulate problems		X	
Takes time to teach students PBL skills		X	X

CROSS CASE ANALYSIS OF PBL

PROFESSOR A, PROFESSOR B, AND PROFESSOR C

Category	*Professor A*	*Professor B*	*Professor C*
2. Advantages of Using PBL			
Faculty enrichment	X		
Fits educational philosophy/ teaching style	X	X	X
Students			
Think critically	X	X	X
Pay attention more often	X		
Digest material versus didactic learning	X		
PBL takes experience of learner into account			X
Take ownership of learning	X	X	X
More in-depth understanding of meaning of course	X	X	
Develop knowledge/ skills to apply to real world	X	X	X
Reinforces answering to complex questions			X
Community			
Builds community among faculty, students, and other departments	X		
3. Disadvantages to Using PBL			
Faculty			
Lack of rewards from university for exceptional teaching/time spent with students	X		
Students			
Difficult workloads		X	
Group dissension			X

CROSS CASE ANALYSIS OF PBL

PROFESSOR A, PROFESSOR B, AND PROFESSOR C

Category	*Professor A*	*Professor B*	*Professor C*
4. Challenges to Using PBL			
Faculty			
Switching from traditional teaching to PBL		X	X
Students lack experience with complex problem-solving skills		X	X
Writing complex problems			X
Lack of control/time spent monitoring class			X
Limited support from colleagues			X
Students			
Less organized			X
Struggle with ambiguity of course			X

Summary of Cross-Case Analysis

All three professors provided common themes during the case studies, as well as their own themes. First, all three professed to using modified forms of PBL based on the type of course they were teaching. In regards to the implementation of PBL, a common theme was the role of the professor, which is facilitative compared to the traditional role of lecturer. They all agreed that an advantage to PBL was that the methodology fits their educational philosophy and teaching style. Each of the professors used small groups of students to work together on projects during a course, and stated that the student role included responsibility for their own learning and their own preparation

for each class. They agreed that the advantages to using PBL in regard to student learning are that students learn to think critically, students take ownership of their learning, and students develop knowledge and skills to apply in the real world. All three professors used group presentations as their common method of assessment. One of the common themes and a major challenge when using PBL, was the time it takes to design a PBL curriculum and manage the curricular workload.

Within each case study, each professor had an underlying theme that justified their use of PBL. Throughout Professor A's case study, Professor A stated the importance of using PBL as a methodology to promote critical thinking. Professor B expressed that the importance of using PBL was to promote student understanding of course material. Professor C's concern was that PBL had many challenges, but in the end, was worthwhile for both the professor and the student learner.

According to the review of literature, each of the themes listed above are the same compelling reasons that other authors cite as reasons to use the PBL methodology in the classroom. The recurrent themes in each case study that Professor A, Professor B, and Professor C described are also consistently found in the review of literature of PBL. These themes are in harmony with the qualitative findings of this study that were presented earlier in this chapter.

CHAPTER 5

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

This study was predicated on the need to identify and explore how PBL was used as a teaching methodology by faculty who taught graduate courses in higher education, as well as explore the effectiveness of PBL when compared to traditional lecture-based teaching methodologies from the perception of graduate students who took PBL courses in graduate departments of higher education. The intent of this study was to gather background information on PBL, its image, its nature, the advantages, disadvantages, and challenges of using PBL, and the ways it might be employed in a curriculum in higher education.

In order to address the problem, three research questions served as organizing guides: 1.) What does PBL look like?; 2.) What do professors who profess to use PBL report as the advantages, disadvantages, and challenges of PBL?; and 3.) What do graduate students who have experienced PBL report as the advantages, disadvantages, and challenges of PBL?

Conclusions

What Does PBL Look Like?

Due to the paucity of investigations of PBL in higher education, an exhaustive review of literature on the theoretical aspects of PBL in general and of research and case study applications, especially in medical education and K-12 education was done (please refer to Chapter Two), and is used to address this question as well.

According to the review of literature, PBL is a learner-centered educational method and learning is based on the messy, complex problems encountered in the real world as a stimulus for learning and for integrating and organizing learned information in ways that will ensure its recall and application to future problems. The problems used in PBL are designed to challenge learners to develop effective problem-solving and critical thinking skills. PBL is seen as a motivating way to learn as learners are involved in active learning, working with their real problems and what they have to learn in their study is seen as important and relevant to their own lives. The objectives of PBL are to provide learners who will:

1.) engage the problems they face in life and career with initiative and enthusiasm; 2.) problem-solve effectively using an integrated, flexible, and usable knowledge base; 3.) employ effective self-directed learning skills to continue learning as a lifetime habit; 4.) continuously monitor and assess the adequacy of their knowledge, problem-solving, and self-directed learning skills; and 5.) collaborate effectively as a member of a group. (http://www.pbli.org/pbl.htm)

In this study, academic responses to PBL, at least from a categorical standpoint, evidence a high degree of similarities when responding to the questions about PBL.

Survey results indicated that most faculty who teach PBL courses make concerted attempts to use discovery PBL whereby students are presented with a macro problem within which there are multiple smaller problems that must be addressed and students construct their knowledge of education practices by working through the various problems. Also used by some faculty is a modified case-based approach whereby students are presented with some information and are asked to decide on the forms of action and decisions they make and following their conclusions, they are provided with more information about the case.

There is an obvious discrepancy between what graduate students perceive they are experiencing in their course work and the type of PBL faculty are claiming to use as a teaching methodology. According to 40% of the faculty, they are using discovery (or PBL) as a teaching methodology while only 7% claim they use a case-based PBL methodology. On the other hand, 50% of the graduate students claim that they are being exposed to a case-based methodology and only 29% state that they are being exposed to discovery PBL. There is obviously a different perception of PBL held by faculty and students or perhaps confusion as to the definitions of PBL or perhaps miscommunication as to the type of methodology being used. Faculty may have one mind set as to the type of curriculum they wish to implement, however, when it is presented to the students, it may look like something else to them. This discrepancy would likely be averted if a clear clarification as to what type of PBL is going to be used in a course at its outset so that students understand this clearly from the beginning of the course. Faculty (20%) and students (21%) gave similar responses in regards to having implemented/been exposed to modified case based PBL, and both groups (7%) had implemented/been exposed to close-looped PBL.

There were notable discrepancies between faculty responses to using case-base lectures (0%) and student responses to being exposed to using case-base lectures (45%) and faculty using lecture-based cases (7%) and students claiming to being taught with the case-based lecture methodology (45%). It is hard to determine why there were such large discrepancies unless faculty and students simply interpreted the definitions differently. According to the review of literature, the type of PBL that is going to be presented to a class should be clearly defined to avoid confusion or misconception concerning the particular methodology being employed. Unless this is done, students will find the course frustrating and confusing because they do not know what the professor wants them to learn. The review of literature stated the importance of fully training faculty how to implement PBL as well as providing additional training for students such as offering a semester course on how to properly use the PBL methodology.

Advantages, Disadvantages, and Challenges of PBL According to Faculty

Turning to the second of the research questions, it was found that faculty spend large amounts of time constructing PBL courses, more time than they allot to traditional instruction. Because they spend a considerable amount of time formatting PBL, this was also the main challenge they pinpointed when using PBL. In the qualitative interviews, both Professor A and Professor B remarked about the additional amount of time it takes to design a PBL curriculum. Professor A even went so far to add that it would not be advisable for untenured faculty to use PBL because it is time consuming and faculty need time to be able to balance teaching, service, and scholarship in order to earn tenure. PBL would possibly tip this balance and jeopardize their opportunity for promotion.

One of the main challenges mentioned by Professor A was trying to balance spending more time with students while trying to keep a current PBL curriculum updated and running. Professor A even mentioned that often times students from previous semesters took up extra time by sharing articles they had read.

Based on research and the qualitative interview with Professor A, it is hard to determine why a small percentage of students in the survey said they spend more contact hours with their professor while the majority of students said they spend the same amount of time as in traditional classes. One feasible explanation might be that it depends on the type of PBL being used in the course that determines the amount of contact hours required. Or, perhaps faculty are so intent on having students use self-directed learning, that they are reluctant to spend much time with each student for fear that they would undermine this type of learning. There is also the possibility that since 66% of the faculty who responded to this survey work at research extensive, research intensive, and comprehensive doctoral institutions, that these faculty are trying to balance teaching, research, and service and this can result in limited availability to students.

Whether the amount of faculty time spent with students impacts student learning in a PBL curriculum, would have to be determined by future research. Certainly, more one on one time would logically be expected to positively influence the learning curve of students as well as continue to motivate their learning and help them to become life-long learners.

When implementing PBL, administrative and colleague support were generally found to remain strong, however, one-third of each of these groups were reported to be unconcerned with PBL. This could very well disrupt a unified departmental approach in support of using a PBL curriculum for all of the classes in a specialty area. Another

concern was raised in that one-fifth of colleagues were reported to be resistant to using PBL, although their reasons were not uncovered in this study.

Faculty made it clear that their decision to use PBL was not because students were not responding or learning with the traditional lecture methodology, or because students were not successful in applying educational theories in their coursework or exams. Therefore, it did not appear that PBL is driven because of low academic grades or lack of understanding, but instead, faculty seem to want students to think deeper and produce results that parody real life in order to be thoroughly prepared for professional positions. Faculty respondents professed to be interested in developing critical thinkers who can work together as a team and find innovative and workable solutions to problems in the workplace. These were the main reasons they elected to use the PBL methodology. Faculty, who use PBL, also reported enjoying the "hands-on" approach that PBL offers.

Based on the interviews of two professors who use PBL, the same message was found to be consistent as was given in the survey responses. Both professors wanted their students to be able to use critical thinking skills in their classes to be better prepared as professionals. Both professors also enjoyed using the PBL methodology because it was more interesting to teach and did offer more "hands on" opportunities compared to traditional lecture based instruction. PBL was acknowledged to allow them to operate in the role of "facilitator" versus "instructor". This was illustrated by the survey results with 67% of faculty stating that they prefer using a constructive or a "hands on" approach and that is why they are using PBL. Professor C, one of the interviewees, in particular, wanted the graduate students to feel more motivated and be able to use their current experience, expertise and education in the classroom so they would find the class material more interesting and applicable. Professor A mentioned that it was frustrating when

students who were taking law classes could not respond appropriately to the material being presented. Students were reading about law in newspapers and other media and did not clearly understand the origins of law. This propelled Professor A to begin searching for another way to teach to be able to help students connect case law with today's legal rulings.

From the learners' point of view, PBL can be used as a motivation tool. In the graduate student survey in Question 4, students were asked what they discovered while participating in a PBL course as compared to courses using traditional methods. Forty-four percent of the graduate students chose motivation making it their third most cited choice. This answer followed their first choice, which was working as a team to solve problems (63% of graduate students chose this answer), and their second choice which was the ability to apply what they learned to "real" problems (51% of the graduate students chose this answer). Clearly, motivation is important when designing a curriculum and PBL can provide ongoing and consistent motivation for learning because of the way it is implemented and the strategies faculty can choose to use. PBL allows students to become actively involved versus passive participants.

From the professional literature, it is clear that attendance can also be tied to motivation. According to White (2001), who taught Introduction to Biochemistry, a PBL course for sophomore majors, attendance which always was near or above 90%, improved even further to 94%. Coincident with the increase in attendance was a greater than 20% increase in the number of hours students reported they spent on the class. According to Hans (2001) who taught the use of technology in an undergraduate course on the criminal courts, absenteeism was lower and was also easier to spot. Lieux (2001), who taught a course for junior-level dietetics majors, found there were significantly more

students coming to class in the PBL section in 1994 than those who attended the lecture-based section. In order to help monitor attendance, one advantage to using PBL is that faculty can use undergraduate peer tutors who receive training in PBL and are assigned to one group or a small number of groups during a semester. The peer tutor approach allows the instructor in a large class using PBL to keep apprised of each group's progress and to intervene when necessary, such as managing attendance or providing additional direction for groups. (Allen & White, 1999)

Based on the present investigations, the faculty answers in response to how they find appropriate PBL problems are in line with how faculty members who teach in other disciplines find their PBL problems. Eighty-seven percent of the faculty responded that they use practicing practitioners' real-life problems. The literature search revealed that Bridges and Hallinger (1995) developed their own department programs based on PBL, as well as designed problems based on practitioner experiences. Both professors have also had graduate students write PBL problems for future classes. Duch (2001a, 2001b) gives specific advice on how to write effective PBL problems. Hafler (2001) wrote a chapter on "Case Writing: Case Writers' Perspectives" where she described how to write an effective case study for students. In the faculty survey, 73% of the respondents claimed that they wrote their own problems based on their previous experience. Hafler said that case writers offered a variety of reasons for agreeing to develop a case, but they all said that students' education was of concern and interest to them, as was knowing the importance of applying theory to practicing PBL. Fifty-three percent of the faculty reported that they used outside resources to find PBL problems, although they did not state which particular outside resources they utilized. Twenty-two percent of faculty

used other methods to write problems such as students, from case books that "I" edited, and computer simulation. Twenty percent did report that they used problems from other university programs. Finally, 6% reported that they purchased a PBL program but did not mention or cite the source. (For further information on "How to Write a PBL Problem" refer to Appendix C).

Faculty in this study also selected the challenge of finding and implementing problems that are authentic, engaging, and contemporary as their second most cited challenge when using PBL. According to the review of literature, faculty frequently mention this area of concern as a challenge to using PBL.

It is surprising that none of the faculty mentioned that PBL was "cost prohibitive" as research has claimed. Cost may be a deterrent for institutions to implement PBL because it is labor intensive and involves additional training costs. However, PBL can either be generated by a collaborative effort within a department or by an individual faculty member. If it is generated by a department, the additional costs for training and supplies, as well as the additional hours required for faculty to design PBL curriculums can be defrayed. Further research needs to be conducted involving department chairs to determine the relative cost of PBL when done collaboratively. This could reveal if individual faculty are paying for PBL and are absorbing the cost, however minimal or exorbitant it may be, or if departments more often finance the attending curricular changes. Evidently, cost is not a barrier to implementing PBL in the classroom according to the faculty who answered this survey.

Faculty varied on their responses to how they present PBL to students at the beginning of the course. Two-fifths of the faculty said they verbally described it or presented a PBL scenario and worked through it as an in-class experience. This issue is of concern

because according to the student responses to Question 7 on their survey, PBL training varied according to the quantity of exposure they received. A total of 91% of the respondents felt that the PBL training they received was moderate to none, with the highest incidence reporting moderate or 33%. Twenty-nine percent of the students reported that they received no PBL training and the same amount believed their training was minimal. Whether this has bearing on how much the instructor thinks the student needs to know about PBL and on the other hand, what the student thinks they need to know about PBL, could not be determined at this time. However, it seems important that faculty members should be well-versed in how to implement PBL in order to have students meet with success when using this methodology during the course. Usually, when first being introduced to PBL, students are uncomfortable in not knowing exactly what the teacher expects from them so they can produce the necessary results to procure a good grade. PBL does not allow students the ease of knowing every detail for the entire course and instead, prompts students to adjust his or her learning curve as the course develops over time. It would be important to ensure that students are familiar with the basic components of PBL before they proceed with the course in order for students to learn how to use the skills PBL provides.

Sixty-seven percent of faculty stated that when using PBL they place their students in groups, 7% use a combination of independent study and groups, and 20% use independent study. Also, 47% of faculty responded that they felt that PBL students learn to work cooperatively in teams as an added benefit of using the PBL methodology (this was the fourth choice most often selected regarding the benefits of PBL). Interestingly enough, faculty (33%) also remarked that one of the ongoing challenges of using PBL was having to address teamwork issues or interpersonal conflicts among students. One

faculty respondent remarked that a challenge to using PBL was "Student resistance to taking an active role; student resistance to ambiguity." Another faculty member stated that "Not all students participate" and another faculty member wrote, "Students whine when not spoon-fed or if collaboration becomes problematic." Therefore, it is important that instructors who aspire to use PBL be fully aware of these expectations relative to group dynamics.

A small percentage (20%) of the faculty participants in this study felt that having less control over what students have internalized regarding learning objectives and knowledge is a challenge. Research has shown that when students are working in groups, some students tend to want to avoid responsibility while other students prefer to work independently. It seems safe to assume that students who first confront PBL feel lost. They are not getting the help they feel they need from the instructor. It is not until later on in the course that they finally grasp what a PBL exercise is like and how to cope with taking an active role in their own learning. Until they realize this, however, they may often feel frustrated, ignored, and helpless with the course and the instructor. Again, this is a common challenge with PBL. It takes experience and practice to use PBL effectively, as well as design effective assessments that can help the instructor assess what is being learned and what is being either forgotten, ignored, or left out.

When assessing PBL, over two-thirds of the faculty reported using oral group presentations. It was not clear if they supplement these presentations with other forms of assessment, but it is assumed that they do since 15 faculty checked this item, yet there were 33 total responses in this category and only 15 faculty participants in the survey. Following oral presentations, the same number of faculty (7) also reported using self and peer assessments by students, a final written report by students, or a combination

of a final written report and a group oral presentation. Only two faculty respondents reported using a comprehensive final exam over each problem area. It seems that faculty are using more authentic assessment in which to assess students rather than multiple-choice exams and other forms of summative assessment.

It should be noted from the interview that Professor A mentioned that changing the assessment process from using lengthy examinations that were often three to four pages long, to short answer essay exams that take part of a class period (35 minutes) to complete increased efficiency. Instead of giving lengthy exams, Professor A now gives five short assessments sprinkled throughout the course. This allows Professor A to more closely monitor how students are learning which in turn allows the course material and lesson plans to be adjusted based on students' needs.

It can be speculated that exposure to these types of assessment or authentic assessments, likely influenced the responses from the graduate students. In their survey they reported that PBL emphasizes more critical thinking and the value of teamwork. (see Appendix D for Methods of Assessment for PBL).

As a result of these assessment strategies, almost three-fourths (73%) of faculty feel confident that students are more able to effectively apply the content of what they have learned using PBL. The same percentage also perceives that students are better able to demonstrate that they can solve practical problems, and 60% feel that students become self-directed learners.

Students appear to agree with the faculty results as three-fourths of them stated that they have the ability to apply knowledge based on learned theories in day-to-day administrative practices. Fifty-four percent replied that they developed general problem solving skills as an advantage of a PBL course and have an appreciation of readiness to

handle on-the-job responsibilities resulting from exposure to PBL. Forty-four percent of students also felt that they had developed lifelong learning skills. The remainder of the data concerning the results from using PBL, did not appear to reveal other similarities between faculty responses and student responses.

An examination of the professional literature exposed one area that has the potential for future development is using PBL for graduate student dissertations as the Department of Educational Leadership at Stanford University has done under the direction of Dr. Edwin Bridges (Bridges & Hallinger, 1995). Yet, only 7% of faculty in the present study responded that they are currently using PBL problems for dissertation work. According to Bridges and Hallinger, using PBL problems for this purpose can often times be effective because then the solutions to the problems can be implemented in programs that are being researched. PBL was the focus of a dissertation research study at Vanderbilt University and the program that was developed has now been implemented in universities across the nation. Using PBL helps to institute new programs and development, as well as bring recognition to the university.

Also, the low response of two faculty (13%) reported that students performed better on their master and/or doctoral comprehensive or preliminary exams gives pause to thought that PBL problems are probably not being used on these types of exams. If PBL problems were used in this way, it is likely that PBL would be infused more frequently in the curriculum.

Finally, all of the faculty who participated in this study stated that PBL was here to stay or here to stay with modifications. None of the faculty opined that PBL will most likely fade over time.

Advantages, Disadvantages, and Challenges

of PBL According to Graduate Students

Graduate students expressed similar opinions as those of faculty regarding the benefits of PBL such as the ability to solve problems, ability to apply what have learned on the job, using more critical thinking skills, and developing skills for lifelong learning. Contrasted to faculty, however, students had to deal with some challenges that are unique to being a student such as confusion and not knowing exactly what the professor wanted and poor group cohesion when groups did not cooperate. They also reported it was difficult to work within the time limits given for the course to meet deadlines for completion, as well as stating that PBL takes more student time and dedication as the primary disadvantage to PBL.

It is not surprising then that 61% of the students selected “more time consuming” as the most glaring disadvantage to a PBL course. In similar fashion, 80% of faculty responded that a challenge to using PBL is that it is time consuming. Along the same lines, 55% of faculty said that a disappointment with using PBL was that within the time constraints of a course, it was difficult to balance the time needed for preparation for teaching and for developing problem solving scenarios. Even though PBL can be an effective methodology, whoever chooses to use it must take into consideration the time element, which unfortunately appears to be its main drawback. Consequently, one resounding reason that many faculty are against implementing PBL as a department objective or in individual courses is because of the time it requires. PBL is not a methodology that often parallels the type of class they are already teaching. Students, however, would be more likely to adapt to and embrace a PBL curriculum if an entire department structured its curriculum around PBL and if the courses were also

interdisciplinary. Having one course with PBL and other courses using the traditional teaching methodology, could be more conflicting for students and create more resentment for PBL classes because of the time factor and thus they would not see the other intrinsic values it offers.

Fifty-one percent of student respondents replied that an advantage of PBL versus traditional learning was the ability to apply what they learned to "real" problems. This is portrayed in the literature as an element of constructivist learning. According to Ryan (1997), who quotes Jerome Bruner, a constructivist, "learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge" (Kearsley, 1996: Constructivist Theory). Cognitive structures are utilized (and in the process, changed) to provide personal meaning and organization to experiences. This survey question also allowed to students to again confirm that they are able to apply what they learn to real problems, as their second choice in comparing the differences of PBL methodology to traditional lecture-based methodology.

The amount of exposure to PBL, as mentioned above in the faculty survey, was also brought forth in Question 7 of the student survey. When asked about the amount of training they received on how to use PBL in the classroom, a total of 91% of the graduate students felt that the PBL training they received was moderate to none. This would be a critical area for further study, due to the increasing implementation of PBL. The way it is introduced and implemented may very well affect the achievement of results. Having nearly all of the students state that their training was none to minimal, raised a critical concern. To explore this area, additional research should be addressed to allow those who wish to purse the use of PBL to access additional resources to help with its implementation. Of course, again, it is not known if individual faculty are implementing

this type of methodology on their own or with colleagues with departmental support or through an established curriculum committee. Effective PBL implementation requires a cohesive body of people willing to develop and use it together which will provide more success and impetus than on a sporadic individual level. Further information and literature review on this important topic may be found in Appendix B for those readers who have an interest in it.

As to the number of hours faculty commit with students during a PBL course, over fifty percent of the students stated that it was the same amount of hours as traditional courses and only twenty-two percent of the students felt faculty spent more contact hours with them. Again, this could be a result of the role demands placed on faculty from research and doctoral institutions who responded to this survey. While all institutions have faculty who have to balance teaching, research, and service, in research and doctoral institutions the balance is acknowledged to be heavily weighted towards research.

When comparing learning about theories and models, as well as knowledge content in PBL as compared with traditional courses, 7% more students felt that they learned more from a PBL course. However, an equal proportion of students felt that lecture based learning was as effective as PBL. Relative to concern with course expectations, 59% of the student respondents felt the level to be about the same in a PBL course as in a traditional course, while 38% of the students felt that the expectations were higher in a PBL course.

A common complaint of students, according to the professional literature, is that once they exit a PBL course they sometimes feel they were missing something or did not get exposure to all of the important theories in the course. Also, some students cannot adapt to a PBL format and spend the entire course feeling lost because they are used to

traditional learning and want to know exactly what the professor expects from them so that they can attain a good grade. Because PBL is purposely less structured, this can be a barrier to student learning for those who choose not to participate or want a traditional method of learning. Also, if a professor finds it difficult to utilize PBL for this purpose in a course, the student may exit the course with less knowledge than was intended by the professor. This can result in feelings of dismay or confusion by the student. This potential disadvantage can be overcome by an instructor who employs continual feedback by students and is consciously aware of the need to adjust course objectives and learning goals to this feedback.

Finally, eighty-seven percent of the students stated that they would definitely or probably take a PBL course in the future. Since faculty feel that PBL is here to stay, it is highly likely that these students will indeed find themselves in another course utilizing a form of PBL.

Discussion of Results

This study was initiated because there has been limited data on how PBL is utilized in graduate departments of higher education and the study was exploratory in nature. It was also designed to compare results with previous reports in the professional literature of PBL applications in other disciplines and circumstances. This allowed the identification of variations or consistencies in the advantages, disadvantages, and challenges of PBL. Both faculty and student responses held no surprises and were consistent with other findings by previous researchers and literature reports, especially in regard as to what skills the faculty want the students to learn and what skills the students are finding that they are using and learning.

One issue that is of concern that was identified is how to define PBL. This was a major discrepancy in the surveys between how faculty viewed definitions of PBL and how students viewed definitions of PBL. When faculty at all AAHE institutions were first contacted regarding their use of PBL, the majority of them reported they had never heard PBL by its given name and were more familiar with such things as the case study method developed by Harvard University. Determining a common, acceptable definition of PBL is a task that needs to be addressed promptly and effectively.

Unfortunately, in response to a request made early on in this study, only one professor sent a copy of their course syllabus to illustrate how they describe PBL in their course outline and how they implement PBL successfully in the class. Therefore, it was impossible to discern how PBL is being functionally implemented. However it was possible to determine from the survey responses that the typical learning objectives of using critical thinking, learning how to solve problems, working together as a team, applying knowledge and theory to real-world problems, using previous knowledge from education and on-the-job to solve problems, and self-directed learning skills are clearly the main focus of PBL courses as developed by faculty and are being readily learned by PBL students.

As revealed by the faculty survey results, the majority of the faculty respondents are writing their own problems and cases. Obviously there is no cumulative resource guide or institutional repository to go for problems or cases. This would be highly desirable. From the review of literature, it is known that Harvard University has published three books on using cases in higher education (Honan, Rule, & Kenyon, 2002) and there are a few available websites that display problem scenarios and case studies.

The status of faculty and administrator support patterns were evident from the

faculty survey, with 47% of faculty claiming that they had strong administrative support while 46% of faculty claimed that administrative support was ambivalent or unconcerned. Only 7% of the faculty claimed that there was no administrative support. In regards to colleague support, 40% of the faculty claimed they had discernable colleague support and 40% reported that their colleague support was either ambivalent or unconcerned. Twenty percent of faculty reported they had no colleague support compared to only 7% reporting no administrative support. This overall profile of support for PBL is unfortunate if PBL is to flourish, because a combination of both administrative and faculty support is important to effectively infuse PBL into the department's curriculum. As it stands, according to this survey, less than 50% of faculty have the support they need when using PBL and are more or less only surviving in the use of PBL as a methodology on their own motivation. All of the research that was inspected overwhelming stated the need for strong support of faculty who choose to use PBL due to its heavy time demands. Of course, if there are no rewards or incentives connected to the use of PBL, that will result in a low probability of success in its use. Impediments to implementing PBL will only serve to slow it down or make it dysfunctional because they will limit the level of innovation permissible in the program and will restrict the time staff can spend working on it (Little & Sauer, 1997).

Various graduate programs across the country have chosen to offer two to three different paths for students to follow in their graduate work. Students are allowed to select the traditional method of learning, the PBL method of learning, or even independent studies. Departments of higher education need to recognize that if there is an interest in using PBL, it can be initiated by offering two different pathways such as was done at Harvard University in 1984 with its New Pathway curriculum (Moore,

1997). This seems preferable to remaining ambivalent or unconcerned about PBL which is in essence ignoring an alternative that may be an effective teaching methodology. Faculty can then choose which approach to pursue rather then feel pressured toward one teaching methodology or another. This would at least legitimize the adoption and implementation of the PBL methodology by those faculty who aspire to use it.

Intrinsically, faculty can benefit from a PBL curriculum that responds to a desire to help students use critical thinking and become better prepared to apply theory and knowledge to real-life situations. Extrinsically, faculty who favor “hands-on” learning, find an added benefit in a PBL curriculum. During one of the interviews, Professor B stated that this was a primary reason for using PBL because it provided more of a “hands on” methodology and embraced a facilitative approach . Professor B also reported that students responded positively as to their satisfaction rate with PBL in various ways from enjoying the teamwork to using more critical thinking to being able to apply what they learned in class to what they do on the job. They also enjoyed being more involved in their own learning and self-directing their learning. The primary dissatisfaction with PBL stemmed from being too time consuming.

This latter statement by Professor B warrants further attention as to how to manage balancing the time to teach the course material while implementing a PBL course of study. While this will most likely vary based on the level of demand student learners place on the professor in each class and the pace at which the students can comfortably learn, it will remain an ongoing PBL challenge. It does not seem as though there is a simple solution to this challenge of time availability since PBL is supposed to allow time to think more critically while concurrently allowing more time to find and explore a wide array of resources that are available.

Even though students replied that PBL gave them the added benefits as mentioned above, only 30% of students responded that they felt PBL gave them a greater advantage in the mastery of course material and theories. This paralleled a concern expressed by faculty as 20% of them mentioned that they felt in PBL that they had less control over what students internalized regarding learning objectives and knowledge. It is clear from this study, that a follow-up study should be done to determine why mastery of course material was only selected by a small group of students even though the majority of students claimed that an advantage of PBL was being able to apply knowledge based on learned theories in day-to-day administrative practices (74%) and offered the opportunity for more critical thinking (65%). Only 28% of the students, however, responded that PBL allows for more discovery of theories and knowledge and application of both than do traditional approaches. Clearly there are serious discrepancies and concerns as to how much of the course content material PBL students are able to master by the time they exit the course. Appropriate assessment devices could help measure understanding and application of theories. However, if authentic assessment is already being used as the primary approach to assess PBL, then these may be more difficult to discern.

Unfortunately, it was difficult to pinpoint how faculty believe they will be able to determine the success of PBL in fostering the future success of students in their professional careers. In an interview, Professor B stated that the students themselves would have to be asked how successful they found PBL compared to traditional courses in regards to the comparative impact that PBL and traditional learning methodologies had on later success on the job. This would be an interesting future follow-up. In question 15 on the faculty survey, 53% of faculty did respond that former students, who are practitioners, report having the ability to resolve real problems in their profession as a

result of being exposed to PBL. Also, students going through PBL courses, who were employed at the same time, clearly stated that they find PBL useful in helping them apply theories to their job, general problem solving skills, and readiness to handle on-the-job responsibilities.

After much speculation about the effectiveness of PBL as a teaching methodology, based on the review of literature and the results of the present surveys, PBL is another teaching methodology that has unique characteristics and values. It is not, however, a panacea to teaching methodologies in the classroom nor is it the one solution to produce student learners who will meet every educational challenge. PBL is a constructivist type of methodology that offers flexibility and creativity in the classroom, as well as opportunities to address complex real-world-like problems. It appears to be more adaptable for students who have had previous work-experience and can bring their own real-life experience into the classroom. There is still much more work and research to be conducted regarding the use of PBL, especially in regard to the phenomena of critical thinking and long-term retention. While PBL claims it can better prepare people in these areas than can more traditional methods of teaching, this needs to be established through formal, rigorous investigations.

PBL can be used and modified as an alternative form of teaching in the classroom, depending on the objectives of the instructor and the constructs of the course. One of the most promising characteristics PBL can claim is motivation, since students are required to participate fully in their own learning and facilitate their own results. Assessing PBL and its true impact, however, is still a challenge. Developing valid and appropriate assessments that can truly measure the results of using PBL in the classroom is crucial to the future of PBL.

Recommendations

There is still an unlimited amount of research that can be conducted on the use of PBL as a teaching methodology. Again, since this study was only exploratory in nature, there are a multitude of smaller studies that can result from the findings reported here.

A follow-up survey could be sent out that lists the key elements of PBL and asks respondents to report the extent to which they use each of the elements in their teaching methodology since there is confusion and differences between what faculty label PBL and what students discern as PBL.

Another study could be conducted to identify the range of strategies used by faculty in training students how to use PBL and thus develop a compendium on how to train both faculty and students to effectively implement PBL in courses of higher education administration. It was hoped that examples of syllabi, problems, and case studies could be collected by this study.

Further research could be conducted to understand why faculty are resistant to using PBL, even though the amount of time it takes to implement PBL seems to be a challenge, there could be other factors that would need to be discerned from this research.

Various methods of assessment are currently used to assess PBL courses, however, it was thought that perhaps PBL problems are not being offered on comprehensive exams and this is an area that needs further study. When looking at master and doctoral comprehensive examinations, or periodic course exams, and using PBL as the applied methodology, it would be instrumental to investigate if problems discussed in the course are integrated with the exam questions, if the entire exam is based on problems, or if problems are used at all. At the same time, further research could be conducted on the use of PBL in doctoral dissertations.

Case studies could be used to follow graduate students over time from the beginning of their graduate studies, to completion of their graduate studies, to their entry into their profession and a few years into their profession in order to fathom the long-term effects of PBL. These case studies might be compared to case studies of graduate students who follow a traditional curriculum.

There is a need for more qualitative research to be conducted with faculty who are immersed in PBL and have had the opportunity to reflect on PBL as a teaching and learning methodology over time versus traditional course instruction. Similarly, it would be useful to study the relative effectiveness of student learning relative to course knowledge and theories and the degree to which they are able to accurately apply theories to appropriate problems in the real world between PBL students and those taught through a traditional curriculum. Also, it is suggested that a study be conducted as to whether or not PBL works better as a teaching methodology for clinical and business based courses in comparison to more holistic social science and humanities courses.

Due to the amount of time allotted for this study, only two populations could be included – faculty and graduate students. It would be important to do a follow-up study with deans and/or department heads to determine their interest in PBL and support for PBL – do they endorse the use of PBL and if so, to what degree, and if not, what are their reasons?

Finally, a follow-up study to further identify why faculty and their colleagues do not appear to support PBL, or why they are ambivalent or uninterested in using PBL would be useful.

To close on a positive note, it is a substantial advantage to select educators and students as the study population. Participants in this study were generally cooperative

and thoroughly responsive so that the insights and benefits of this study are truly owed to them.

APPENDIX A

Additional Conceptual Framework

Models Underlying the

Theory of PBL

Metacognition

Findings from cognitive psychology provide a theoretical basis for improving instruction in general and PBL in particular. A basic premise in cognitive psychology is that learning is a process of constructing new knowledge on the basis of current knowledge. According to Glaser (1991), it is generally assumed that learning is a constructive and not a receptive process; that cognitive processes called metacognition affect the use of knowledge; and that social and contextual factors influence learning.

Modern cognitive psychology tells us that the most important feature of memory is associative structure (Bruer, 1993; Bruning, Schraw, and Ronning, 1995). Knowledge is structured in networks of related concepts, referred to as "semantic networks". As learning occurs, new information is coupled to existing networks. Depending on how this is done by learners, new information may be effortlessly retrieved and used to solve problems, recognize situations, or recall factual knowledge.

Bruer states that learning is quicker when students possess self-monitoring skills

generally referred to as "metacognition". He continues writing that metacognition is viewed as an essential element of skilled learning: goal setting (What am I going to do?), strategy selection (How am I doing it?), and goal evaluation (Did it work?). Successful problem solving is not only dependent on the possession of an extensive body of knowledge, but also on the use of problem-solving methods to accomplish goals.

According to Glaser, metacognitive skills typically include the ability to monitor one's own learning behavior, that is, being aware of how problems are analyzed and whether problem-solving results make sense. Studies of expert performance have shown that experts, in contrast with novices, constantly judge the difficulty of problems and assess their progress in resolving them.

Some evidence exists that metacognition has to be developed in education because monitoring of the learning process is usually late in developing. Unfortunately, studies have shown that students experience serious difficulties in using scientific knowledge (Bruner et al.). According to Boshuizen (1995), numerous studies indicate that problems regarding the use of knowledge pervade higher education.

Social Learning

Social factors also influence individual learning. Glaser argues that in small group work, the learner's exposure to alternative points of view is a real challenge to initial understanding. In small group work, students evoke their problem-solving methods and conceptual knowledge. They express their ideas and share responsibility for managing problem situations. Different views on a problem are observed, leading students to ask new questions. Bruning et al. argue that science instruction is more effective when the social nature of learning is recognized and used to help students acquire scientific understanding.

Albert Bandura (1977) stressed that social learning theory emphasizes the prominent roles played by vicarious, symbolic and self-regulatory processes in psychological functioning. Bandura accepts that, as a social process, learning involves functionalism, interactionism, and significant symbolism. But he also stresses how far individuals are capable of self-regulation and self-direction. He states:

> Social learning theory approaches the explanation of human behaviour in terms of a continuous reciprocal interaction between cognitive, behavioural, and environmental determinants. Within the process of reciprocal determinism, lies the opportunity for people to influence their destiny as well as the limits of self-direction. This conception of human functioning then neither casts people into the role of powerless objects controlled by environmental forces nor free agents who can become whatever they choose. Both people and their environments are reciprocal determinants of each other. (p. vii)

Bandura continues by stating that the theory of reciprocal determination means that individual and environmental influences are interdependent. "To take one example, people's expectations influence how they behave, and the outcomes of their behaviour change their expectations" (p. 195).

According to Jarvis et al., the implications for education are clear. Motivation to learn rises, or fails in a social context of mutual expectation by teachers and learners (p. 43). Learning, therefore, can only be social, because mind and self are themselves constructed through the social process of habit and response (p. 41). According to Miller (1973):

Learning consists in the modification of impulses and the transference of modified behavior to various particulars "belonging to the same class". Thus learning means acquiring habitual ways of acting or habitual response applicable to an indefinite number of situations and particulars. Intelligence, learning, and habit formation apply only to organisms having needs that can be fulfilled by behaving in certain ways toward, and acting on, objects in their respective environments. (p. 10)

But, according to Jarvis et al., the environment of learning is social and we can only get evidence of learning through communication – by way of "significant symbols" or language. In other words, we can only be said to learn in so far as we can share and communicate with others. (p. 42)

Self-Directed Learning

Jarvis et al. write that adult education has always embraced the principle of individualized learning. Adult education has never been compulsory or universal, and has never been organized according to traditional curriculum principles, but rather as individualized learning programs. It also implies that teachers must accept that adults can and do learn without the help of teachers. A role of adult educators is to facilitate self-directed, reflective, and critical learning on the part of individual learners. (p. 77)

Adult educators' concerns with self-directed learning originated in the writings of several North American scholars in the 1960's. Perhaps the most influential was Cyril Houle's book The Inquiring Mind (1961). Houle identified three broad categories of learner "orientations" to study:

1. Goal-oriented. For these learners, motivation was instrumental, the means to some end, such as their career.

2. Activity-oriented. For these learners, motivation was the social activities and interaction which learning may offer.

3. Learning-oriented. For these learners, motivation was intrinsic and learning was simply undertaken for its own sake. (pp.15-16)

Another researcher, Allen Tough (1979), conducted extensive research and surveys trying to find out how much of adult learning was self-directed. Tough drew attention for the first time and in a systematic way, to how much people engage in purposeful study, and their range of reasons. He found that learning for credit formed only a small portion of adult learning, and that adults have a strong determination to succeed and persevere, despite difficulties. (p. 19) In 1993, considering the implications of his own theory of self-planned learning and major personal change, Tough offered five answers to the question of how this might be facilitated:

1. The first is, in effect, staff development. "I think probably the largest change in our institutions will come from learning how to facilitate the learning of the staff of those institutions." In other words, it is only possible to facilitate the learning of others if you know how to facilitate your own.

2. "Major personal change" needs to be integrated into the curriculum itself. Instead of being merely an indirect intention of the education process, it needs to be incorporated as an actual aim.

3. The formal education system needs to be supplemented by informal networks of learning, such as "skill exchanges", "peer matching services", and "directories of freelancers".

4. The range of choice and support for students in formal systems needs to be increased, especially in terms of teaching methods and the content of learning.

5. The emphasis on credit needs to be decreased. Tough's own research demonstrated that only a small number of adults want to undertake learning projects for accreditation purposes. (pp. 39-41)

Malcolm Knowles (1975) theory of self-directed learning embraced learning in the context of personal growth, social change, and lifelong learning. His theory embraces three central concepts:

1. Self-directed learners are better learners: people who take the initiative in learning and learn more things, and learn better, than do people who sit at the feet of teachers passively waiting to be taught.

2. Adults do not need teachers, in the sense that they are perfectly capable of taking charge of their own learning. Therefore, "self-directed learning is more in tune with our natural processes of psychological development".

3. The de-institutionalization of education, in the form of open and independent learning systems, is creating a need for learners to develop appropriate skills. "Students entering into these programs without having learned the skills of self-directed inquiry will experience anxiety, frustration and often failure, and so will their teachers." (pp. 14-15)

Jarvis et al. comment that apart from these immediate reasons for adopting self-directed learning, there are other reasons which Knowles described in terms not unlike those used more recently to describe the passing of the "modern" era (p. 81). The three radical implications which Knowles drew are as follows:

1. The growth of knowledge itself means that we need to learn in very different ways because it is no longer realistic to define the purpose of education as transmitting what is known. The skills of self-directed learning are therefore necessary for everyone to develop throughout their lifetime.

2. Learning must be experiential. Instead of thinking about learning as what is taught, we must learn from everything we do and we must exploit every experience as a "learning experience". Every institution in our community becomes a resource for learning. Learning means making use of every resource – in or out of educational institutions – for our personal growth and development.

3. Learning can no longer be identified with schooling or initial education and it is no longer appropriate to equate education with youth. Education – or, even better learning – must now be defined as a lifelong process. (pp. 15-16) Knowles (1975) defined self-directed learning by writing:

> In its broadest meaning, "self-directed learning" describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Self-directed learning was usually a cooperative exercise. This led Knowles to a brief description of his idea of andragogy, which is the art and science of helping adults learn, which he contrasts with pedagogy, the art and science of teaching children.

Brockett and Hiemstra (1985) write that these implications for the role of facilitator

of self-directed learning can be related to the general theories of learning as outlined above. The same authors had earlier developed their account of bridging the theory-practice gap in four areas:

1. Learners' self-directedness needs to be viewed as a continuum, and not an "all-or-nothing" concept. Diversity of learning styles means that attention must be paid to the fact that "individuals vary in their readiness for self-direction".

2. The role of facilitation: developing teaching strategies, reconceptualizing the role of instructor and devising "tools for self-directed learning", such as learning contracts and written learning materials.

3. The development of policies for learners, educators and institutions, in order to promote self-directed learning.

4. There are ethical issues to address, such as the relationship between the learner and the facilitator, and institutional issues such as quality and standards of academic achievement.

Andragogy

Jarvis et al. write that andragogy allows learners the freedom to use their own experience and learn from the situations within which they find themselves. Pedagogy, on the other hand, involves helping learners learn what they are being taught by their teachers (p. 62). According to Knowles (1990), the andragogical model is based on several assumptions that are different from those of the pedagogical model:

1. The need to know. Adults need to know why they need to learn something before undertaking to learn it. Tough (1979) found that when adults undertake to learn something on their own they will invest considerable energy in probing into the

benefits they will gain from learning it and the negative consequences of not learning it. Consequently, one of the new aphorisms in adult education is that the first task of the facilitator of learning is to help the learners become aware of the "need to know." But even more potent tools for raising the level of awareness of the need to know are real or simulated experiences in which the learners discover for themselves the gaps between where they are now and where they want to be.

2. The learner's self-concept. Adults have a self-concept of being responsible for their own decisions, for their own lives. Once they have arrived at that self-concept they develop a deep psychological need to be seen by others and treated by others as being capable of self-direction. They resent and resist situations in which they feel others are imposing their wills on them.

3. The role of the learner's experience. Adults come into an educational activity with both a greater volume and a different quality of experience from youths. This assures that there will be a wide range of individual differences. It means that the richest resources for learning reside in the adult learners themselves. Adults tend to derive their sense of identity from their experiences.

4. Readiness to learn. Adults become ready to learn those things they need to know and be able to do in order to cope effectively with their real-life situations. An especially rich source of "readiness to learn" is the developmental tasks associated with moving from one developmental stage to the next.

5. Orientation to learning. Adults are life-centered (or task-centered or problem-centered) in their orientation to learning. Adults are motivated to devote energy to learn something to the extent that they perceive that it will help them perform tasks or deal with problems that they confront in their life situations. Furthermore, they learn

new knowledge, understandings, skills, values, and attitudes most effectively when they are presented in the context of application to real-life situations.

6. Motivation. While adults are responsive to some external motivators (better jobs, promotions, higher salaries, and the like), the most potent motivators are internal pressures (the desire for increased job satisfaction, self-esteem, quality of life, and the like). Tough (1979) found in his research that all normal adults are motivated to keep growing and developing, but that this motivation is frequently blocked by such barriers as negative self-concept as a student, inaccessibility of opportunities or resources, time constraints, and programs that violate principles of adult learning.

Experiential Learning

Kolb and Fry (1975) and Kolb (1981, 1984) developed an approach to classifying learning styles. Learning is conceived as a four-stage cycle comprising an immediate concrete experience, observation and reflection on that experience, the formulation of an hypothesis or some kind of theory, and finally the testing of that theory through practical action. They argue that in any learning there is a conflict or tension between the polarities of at least two dimensions. The first of these dimensions has the concrete here-and-now experience at one pole, and abstract conceptualization at the other. The second dimension has practical action and experimentation at one pole and detached reflective observation at the other. The ideal learner has the capacity to operate at either pole of both dimensions. Kolb and Fry explain that learners, if they are to be effective, need four different kinds of abilities: concrete experience abilities, reflective observation abilities, abstract conceptualization abilities, and active experimentation abilities. (pp. 35 – 36) That is, they must be able to involve themselves fully, openly and without bias in new experiences; they must be able to reflect on and observe these experiences

from many perspectives; they must be able to create concepts that integrate their observations into logically sound theories; and they must be able use these theories to make decisions and solve problems (Tennant, 1997, p. 91). Kolb and Fry argue that becoming a complete learner entails integrating the bipolar dimensions of each learning style, and operating comfortably in any learning style. They state that the complete learner "is marked by increasing complexity and relativism in dealing with the world and one's experiences and by higher level integrations of the dialectical conflicts between the four primary adaptive modes – Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation" (p. 41).

Miller and Boud (1996) neatly summarize the underlying tenants of experiential learning as follows:

1. Experience is the foundation of, and stimulus for, learning.
2. Learners actively construct their own experience.
3. Learning is holistic.
4. Learning is socially and culturally constructed.
5. Learning is influenced by the socio-economic context within which it occurs.

(pp. 8 – 10)

Jarvis et al. state that experiential learning may be defined as the process of creating and transforming experience into knowledge, skills, attitudes, values, emotions, beliefs and senses. It is the process through which individuals become themselves. (p. 46)

Action Learning

Revans (1983) suggests that verbal explanations cannot convey the nature of action learning for those who have not tried it in practice. His central thesis is that "responsible

action is our greatest disciplinarian as well as our most sympathetic helper" (p. 20). Revon states for example, "It is recognized ignorance and programmed knowledge that is the key to action learning; men start to learn with and from each other only when they discover that no one knows the answer but all are obliged to find it" (p. 11). Revan's (1982) theories emphasize the importance of asking questions and are expressed as L = P + Q, where L = learning, P = programmed instruction, and Q = questioning insight. According to Meizrow et al., this emphasis on the interplay among received knowledge through learning and questioning insight raises problem setting as equal in importance to problem solving. Through striving for questioning insight, group reflection is emergent and tends to be on the content of the project. (p. 259)

Meizrow et al. write that action learning is interpreted in many ways, but in all cases it involves learning in small groups through taking action on meaningful problems. Based on an analysis of the various ways action learning is practiced, O'Neil (1999) has identified four theoretical schools of action learning: the Tacit School, the Scientific School, the Experiential School, and the Critical Reflection School. Meizrow uses the imagery of a pyramid to capture an inverse Guttman-type ordering of schools in terms of the kinds of learning that are most likely to be produced in an action learning program.

At the base of the pyramid is the Tacit School, which seems to assume that significant learning will take place so long as participants are placed together, some team building is done, and information is provided by experts. Learning typically involves the elaboration of existing frames of reference – learning to further differentiate and elaborate previously acquired points of view that are taken for granted or learning within previously acquired habits of mind.

The Scientific School occupies the second level of the pyramid. Like the Tacit School, the Scientific School is essentially concerned with solving the problem facing the participants. In addition, however, it infuses participants with a strong, rationalistic approach to problem solving coupled with an emphasis on problem resetting through periodic questioning insight into available data. The learning that is most likely to take place in the program involves both learning through existing points of view and learning new points of view – creating new meanings through questioning insight that are sufficiently consistent with existing ones to complement them by extending their scope.

At the third level of the pyramid is the Experiential School. Practitioners in this tradition emphasize the role of explicit reflection throughout the process. Goals encompass both problem solving around the project and the development of various interpersonal and managerial competencies.

The Critical Reflection School's place at the top of the pyramid reflects the accumulation of the learning goals of the earlier three levels along with a strong emphasis on reflecting on the premises that underlie the thinking of managers and provide the basis for their habits of mind. (pp. 256 – 261)

Perhaps the most extensive treatment of action learning is by McGill and Beaty (1995, p. 21). They do not give a formal definition but their opening description of action learning approximates to one (Kember, 2000, p. 35) which states, "Action learning is a continuous process of learning and reflection, supported by colleagues, with an intention of getting things done. Through action learning individuals learn with and from each other by working on real problems and reflecting on their own experiences."

Problem Solving

According to Gagne (1985), the learning of rules and of domains of verbal information sets the state for problem solving. In a sense, the activity of problem solving is a natural extension of both rule learning and schema learning. The solving of a problem is guided by the stored verbal knowledge possessed by the learner, which makes possible the interpretation of the problem.

Gagne continues to write that the contents of memory that make problem solving possible are the rules that have previously been learned. Problem solving may be viewed as a process by which the learner discovers a combination of previously learned rules and plans their application so as to achieve a solution for a novel problem situation. Problem solving is not simply a matter of applying previously learned rules, however, according to Gagne. It is also a process that yields new learning. Learners are placed (or find themselves) in a problem situation. They recall previously acquired rules in the attempt to find a "solution". In carrying out such a thinking process, learners may try a number of hypotheses and test their applicability. When they find a particular combination of rules that fit the situation, they have not only "solved the problem" but have also learned something new. One newly learned entity is a "higher-order rule" which enables individuals to solve other problems of a similar type. The other aspect of new learning may be ways of solving problems in general – in other words, cognitive strategies that can guide learners' subsequent thinking behavior.

The sequence of events involved in problem solving is often referred to in the writings of Dewey (1910). The initial event is the presentation of the problem, which may be done by a verbal statement or some other means. The learner then defines the

problem, or distinguishes the essential features of the situation. As a third step, the learner formulates hypotheses that may be applicable to the solution. Finally, verification of the hypothesis or successive ones is attempted until the learner finds one that achieves the solution. The hypothesis that are formed are often new rules; the successful one will be learned when its application has been tested and confirmed (see Gagne, 1964). In addition, in carrying out the steps learners practice using some cognitive strategies that govern their own thinking behavior (Gagne, 1985, p. 178).

According to Gagne, research studies of problem solving have shown the importance of three kinds of learner capabilities in problem solving:

1. Intellectual skills, the rules, principles, and concepts that must be known in order for the problem to be solved.

2. Organized verbal information in the form of schemata that make possible understanding of the problem and assessment of the adequacy of solution.

3. Cognitive strategies that enable the learner to select appropriate information and skills to decide when and how to apply them in attempting to solve the problem. (p. 188)

According to Gagne, some notion of the range and variety of views of cognitive scientists may be gained from a discussion by Newell (1980). Among the ideas about how problem solving occurs are the following:

1. Big switch. The problem solver has a very large number of highly specific procedures. These are intellectual skills and task-specific cognitive strategies, and they number in the tens of thousands. The problem solver also has a "discrimination net" (the big switch) used to gain access to these procedures. By rapid searching, the ones that fit the problem are selected.

2. Big memory. The problem solver has a large web of facts, that is, verbal information in the form of schemata. These sets of organized information enable the problem solver to quickly have access to many ideas, some of which are relevant to the problem at hand.

3. Weak method. This is Newell's name for the kind of cognitive strategies that have broad generalizability. These are such general strategies as "means-end analysis", "hill climbing", "subgoal decomposition", and "hypothesize and match". Newell calls them weak, because even though generally applicable, they do not have much power.

4. Mapping. The problem solver maps the problem situation into something that they know. The situation, for example, may be turned into a symbolic form in which an analogy or metaphor is used. Or, general ideas ("treat it like a heat-loss problem") can be mapped onto the concrete situation of the problem.

5. Planning. The problem solver first constructs a plan in terms of abstract but simple concepts, then uses the plan (one kind of cognitive strategy) as a guide in solving the problem. By using a simplified, familiar situation, the problem solver is able to arrive at a solution by relatively simple means.

Besides ways in which problem solving occurs, there are conditions necessary for problem solving:

1. Conditions within the learner. In order to solve a problem, the learner must be able to recall relevant rules that have been previously learned. Another important requirement for problem solving is the possession of verbal information organized in appropriate ways. Sets of knowledge relevant to particular kinds of problems are usually viewed as schemata. When the problem situation or problem statement

provides a cue that links with some element of schema, the entire set of knowledge within the schema becomes readily accessible in the learner's working memory. As a consequence, the learner can construct a problem space that gives essential help in "thinking out" the problem.

2. The other important internal set of conditions is the activation and use of the cognitive strategies the learner possesses and may previously have learned.

3. Conditions in the learning situation. The external conditions that support processes of problem solving often consist of verbal instructions. One function of such instructions is to ask questions that stimulate recall of relevant rules. Verbal instructions that are externally provided may be used to "guide" or "channel" thinking in certain directions. As a minimum, guidance of thinking informs the learner of the goal of the activity, the general form of the solution; this amount of guidance appears to be required if learning is to occur at all. Greater amounts have the effect of limiting the range of hypotheses entertained by the learner in achieving the solution. (Gagne, 1985, pp. 190-191)

Dialogic Learning

According to Savin-Baden (2000), Mezirow (1981) described dialogic learning as occurring when insights and understandings emerge through dialogue in a learning environment. It is a form of learning where students draw upon their own experience to explain the concepts and ideas with which they are presented, and then use that experience to make sense for themselves and also to explore further issues. The promotion of such forms of learning can encourage students to critique and challenge the structures and boundaries within higher education and industry, whether virtual or terrestrial. This is because learning through dialogue brings to the fore, for students

and tutors, the value of prior experience to current learning and thus can engage them in explorations and (re)construction of learner identity. (p. 33)

APPENDIX B

The Implementation of PBL

When implementing a PBL curriculum, (Boud & Feletti, 1997, p. 50) provide a checklist of elements:

1. A clear purpose and philosophy outlined to students and faculty.
2. Acquisition of sufficient resources: funds, teachers, equipment, clerical and educational support, teaching space.
3. Dean's support or leadership.
4. Nominal support (at least) from departmental heads.
5. Faculty genuinely committed to its trial and further improvement.
6. Students willing to accept greater responsibility for their learning.
7. A curriculum committee with clear communication to faculty.
8. A suitable project leader with acceptable autonomy to proceed.
9. An explicit commitment to specific project deadlines.
10. Facilities for appropriate staff-student contact and self-directed studies.
11. Plans for the recognition of teaching effort and excellence (rewards not just for research achievements).
12. Regular planning and review meetings involving faculty, support staff and students.

13. Adequate support networks and encouragement for both faculty and students.

14. Opportunities for faculty to reflect, expound, benefit from their experiences with the approach.

15. Political support for innovators when facing strong faculty "resistance".

16. Observation of problem-based learning in action, access to consultants.

According to Schwartz (1997), when the Otago Medical School (in Dunedin, New Zealand) decided to implement PBL, during 1986 and 1987, large numbers of staff and students took part in activities that ranged from two highly concentrated single-day exercises (which they called case-based learning days – Schwartz, Fiddes, and Dempster, 1987) through a 50-hour program where Barrows' (1985) problem-based learning modules were used, to a week-long trial where a prototype integrated problem, which they had designed for themselves for possible use in their proposed course, was used with a group of incoming medical students. This latter exercise was recorded in its entirety on videotape and extracts were shown to staff members in interested departments.

Moore (1997), writes that procedural guidelines shaped the expectations of students and faculty (the New Pathway Curriculum at Harvard Medical School). They developed a program guide that described the reasons for the new curriculum, the theory underpinning the educational approaches used, the general objectives and a detailed description of the problem-based tutorial methodology. A fourth-year student, on leave to work as a fellow with the project, developed a student-guide to problem-based learning. He continues with writing that in the curriculum development process, for example, a specified set of case materials was designated for each problem. The educational staff and faculty chairmen for each block were expected to develop a course

book consisting of a description of the curriculum, general course objectives, and the set of problems for that block.

What happens, however, when there are course-related factors that can undermine the potential of "reiterative PBL". According to Ryan (1997), he outlined some ways in which reiterative PBL (the skills and knowledge acquired by PBL are applied back to the problem, to evaluate the effectiveness of learning and to reinforce learning – the reiterative loop – Barrows, 1986; Barrows and Tamblyn, 1980), with the use of small group activity, has the potential to greatly enhance students' development of adequate and well-structured knowledge, through the application of sound educational principles. This is being discussed in this section of the survey study because of the same concern that 58% of the students claiming that they are receiving none to minimal PBL training and this information will show the adverse effects of limited training or guidance.

According to Ryan, if this form of PBL offers such potential, why then are we seeing the kind of results reported in the meta-analysis of studies which have compared the knowledge performance of students in PBL with students in more traditional courses which indicate that PBL students may not be developing adequate knowledge structures (Albanese and Mitchell, 1993; Berkson, 1993; Norman and Schmidt, 1992; Vernon and Blake, 1993). While these studies provide considerable insights into the problem, a recent intensive case study of PBL tutorial processes (Ryan in press), sheds a clearer light on some of the factors which can interfere with this process.

The study, using both quantitative and qualitative research methods, looked at the experiences of 120 students and their six tutors throughout the first semester of a three-year undergraduate degree course in nursing. The course was well-established (it originated in 1984), and implemented totally integrated, reiterative, small-group PBL;

and provided, in its overall structure and organization, an opportunity to apply the educational principles of PBL.

The course gave considerable emphasis to the importance of tutorial process, with problem-based tutorials accounting for approximately 60 percent of total student "contact" (or "class") time..."Resource sessions", which included traditional approaches such as lectures and laboratories, were designed to help students to further explore the concepts and issues which arose out of the problem packages being explored during tutorials, and during self-directed learning.

The study's findings were consistent with a number of those of Albanese and Mitchell (1993), namely well-developed study behaviors by student: studying for understanding and assuming considerable control over their learning; positive views about the learning environment, particularly the emphasis on self-directed learning; high levels of satisfaction with PBL, from both students and teachers; and enjoyment of small-group interactions.

In terms of the objectives of PBL; there was also clear evidence of increased motivation for learning, and well-developed problem-solving ability which transferred successfully out into the students' clinical practice in a hospital setting. By the end of the semester, the students were also demonstrating highly developed self-directed learning – successfully monitoring and self-correcting their construction and use of knowledge.

However, from tutorial observations, from interviews conducted with both the students and the tutors, and from the results of an individual (as opposed to group) problem-solving exercise, it was evident at times there was not a sufficiently deep understanding by students of knowledge issues. Several reasons for these findings were

evident: excessive workload, lack of time to explore issues in adequate depth and non-availability of resources. (These factors, of course, are not unique to PBL courses.) There was clearly a problem with the number of concepts and issues which students were required to explore in any one problem package. Time constraints often meant that important "core" concepts were either overlooked, or received only cursory attention – a danger also noted in Albanese and Mitchell's (1993) findings.

Data from tutor interviews indicated that the primary focus of the first semester was to develop in students a process of inquiry, particularly the use of a particular problem-solving heuristic; and discuss of the process during tutorials was often at the expense of in-depth discussion of the knowledge issues. It was pointed out by the tutors that during subsequent semesters, when the "process" was much more automatic, more time would be devoted to discussion of learning issues. These findings highlight the difficulties that teachers face when seeking a satisfactory balance between content and process, and indicate that if this balance tips continually in favor of process, problems may start to emerge with the quality of students' knowledge.

From their point of view, the students were critical of the role which the tutors had adopted – that is, to consistently reflect knowledge questions back to the student for exploration as self-directed learning. (The tutors had, over several years, established their role as a 'facilitator' of student self-directed learning.) It can be argued, according to Ryan, that this is a necessary strategy, particularly when the overt aim is to have students assume responsibility for learning. But it is of little benefit to the student at the time if:

(i) they are already feeling pressured by a heavy workload of learning issues;

(ii) there is insufficient time in which to adequately explore the issues; and

(iii) there are inadequate library resources.

As well as the issue of availability of resources, there again is the question of balance between the expectation that students will find the information for themselves, and the tutor acting as a resource person. Even with the relatively highly supportive learning environments such as this, when both the curriculum and the tutors provide a high level of structure and direction in the early weeks of the course, it can be difficult to get the balance "right".

Albanese and Mitchell (1993), in their conclusions about teacher directiveness in PBL tutorials, canvass a number of models and ideas about how such a balance can be achieved. The areas of agreement lie in what Brookfield (1987) would refer to as "critically responsive teaching" – that is, the kind of "micro" decisions that are made by the teacher in response to a particular classroom situation, and takes into account both the identified needs of the student in relation to their immediate learning goals, and the broader course-related goals; as well as tutor-related factors such as the ability to answer knowledge-related questions. The result can be a gradual progression toward independence for the students, with the tutor perhaps being more directive and "telling" initially, but becoming increasingly more "participatory" or "delegative"(Albanese and Mitchell, 1993, p. 74) as the course proceeds.

Thus, according to Ryan, there may be times when the tutor needs to act as a resource person. Or, there may be occasions when the students have developed misconceptions about material explored – for example, during self-directed learning – and the tutor intervenes to "correct" these misconceptions. While expert tutors tend to be more directive, "they appear to better enable students to identify relevant learning

issues and correct gaps in knowledge and errors in processing" (Albanese and Mitchell, 1993, p. 75). On the other hand, while non-expert tutors may be "more facilitative of student-centered, self-directed learning, it could be at the expense of perpetuating misconceptions arising during self-directed learning" (Albanese and Mitchell, 1993, p. 75). The latter was the finding, at times, in the Ryan (in press) study.

Dr. Hallinger from Vanderbilt University, provides an outline to follow when developing a PBL project. His example has been broken down into useful steps when designing a PBL curriculum:

Introduction

The purpose of the *introduction* is to clarify and highlight the salience of the problem around which the project is organized. Recently, at the conclusion of a project, Hallinger spent some time discussing the relevance of the problem that the students had addressed to the real world of a practicing manager. After this discussion, one of his students commented that he should have initiated that discussion at the outset of the project rather than the conclusion. He said, "if I had really understood the relevance of the problem at the beginning of the project, I would have worked harder on it, I mean I would have put in 110% instead of 100% effort". The point is that to the extent possible, the introduction needs to really hone in on to clarify why this project has meaning for people who are practicing administrators; not easy to do, but a real challenge. Different techniques can be used to engage the reader at the outset. An interesting or controversial quote, or a story can help capture the reader's interest and lead them towards an understanding of why the problem to be addressed in the project is important. While not essential, Hallinger finds it

useful to conclude the introduction with a statement that tells the reader explicitly what he/she is going to learn through this project in relation to the problem described in the introduction. This is not mandatory, however.

Problem Scenario

The *problem scenario* ought to pose a swampy set of problems. An important skill to be obtained through problem-based learning is problem-finding. If the problems presented are too clearly defined, two things happen. First, students lose the opportunity to engage in problem-finding. Second, the *problem* loses some of the flavor of reality. Remember that a large portion of the problems that administrators face are messy, ill-defined and difficult to untangle. Therefore, even if there is a set of technical skills that you want students to acquire within a given project, it is likely that those skills will be practiced in an organizational setting that is rife with cultural norms, ethical conflicts and corporate politics. Students need to have the experience of applying technical skills with due consideration of the often problematic contextual issues that tend to complicate organizational life. The implication is that the scenario should be rich in its presentation of problems so that students have the opportunity to identify and address a variety of issues. Generally, Hallinger begins with more structured problems and works towards increasingly swampy ones over time as students acquire the problem-solving and group skills to succeed. In addition, he recommends abandoning the third person, passive voice, academic style of writing in the projects. The description of problem scenario (as opposed to the introduction) should engage the reader and create interest. This is difficult

if the problem is being described from a distance. Bring the reader into the context in which the problem is occurring; let the reader experience the problem as you or someone else in the situation would experience it. This can be done more effectively by writing the problem scenario in the either the first or second person, though it is possible in the third person -- only it's more difficult.

Learning Objectives

In writing the learning objectives, it is important to distinguish between the product that the learners will produce and what the learning outcomes. It is useful to try and capture a variety of knowledge outcomes at different taxonomic levels (e.g., knowledge, comprehension, application etc.). Also, it is important to consider addressing attitudinal/affective as well as cognitive domains in the learning objectives. Remember, PBL is supposed to encourage the affective development as well as cognitive development. A critical piece of the project is the nature of the performance expectation. This is described in the "product specifications". It is important to try as much as possible to emulate the nature of the performance expectation in the workplace when conceiving the product for projects. For example, if the project entails having students learn how to conduct an interview or select a new employee, use an interview or selection process as the product. (www.vanderbilt.edu/lead/PBL/Class/Development/Initial-Considerations.html)

APPENDIX C

Writing a PBL Problem

According to Duch (2001a), many practitioners of problem-based instruction will probably identify the following as important characteristics of a good PBL problem:

1. An effective problem must first engage students' interests and motivate them to probe for deeper understanding of the concepts being introduced. It should relate the subject matter to the real world as much as possible. If the problem is placed in a context in which the students are familiar, they will feel that they have a stake in solving a problem.

2. Problems that work well sometimes require students to make decisions or judgments based on facts, information, logic and/or rationalization. In this kind of problem, students will be asked to justify their decisions and reasoning based on the principles being learned. Problems may require students to decide what assumptions are needed (and why), what information is relevant, and/or what steps or procedures are required in order to solve the problem. Not all the information given in the problem needs to be relevant to a solution, as in the case in "messy" real-world situations, and not all the information needed for a solution will be given to the student right away. For this reason, many PBL problems are designed with multiple stages, to be given to student

groups one at a time, as they give additional information to students related to issues raised in the first stage of the problem.

3. The problem should be complex enough that cooperation from all members of the student group will be necessary in order for them to effectively work toward a solution. The length and complexity of the problem or case must be such that students soon realize that a "divide and conquer" effort will not be an effective problem strategy. It may be necessary and, in fact desirable for groups to assign different learning issues to individuals to research. The power of problem-based learning, however, lies in the ability of the group to synthesize what they have learned and connect that new knowledge to the framework of understanding that they are building, based on the concepts in the course. This requires cooperative learning and group discussion as opposed to individual compartmentalized learning. For example, a problem that consists of a series of straightforward "end of chapter" questions will be divided by the group and assigned to individuals and then reassembled for the assignment submission. In this case, students end up learning less not more.

4. The initial questions in the first stage of a problem should be open-ended, based on previously learned knowledge, and/or be controversial so that all students in the groups are initially drawn into a discussion of the topic. This strategy keeps the students functioning as a group, rather than encouraging them to work individually at the outset of the problem. Again, the initial discussions will help students remember what they already know and help them build connections to previously learned concepts and material.

5. The content objectives of the course should be incorporated into the problems, connecting previous knowledge to new concepts, and connecting new knowledge to concepts in other courses and/or disciplines. Many faculty share the content objectives of the problem with students after they finish the problem to ensure that all groups researched each objective, and if not, they still have an opportunity to do so. Instructors usually prefer to wait until students are through so that they will not limit the scope of their investigations, but they do want to give students the benefit of seeing the instructor's objectives so as to check their learning. PBL practitioners may also choose to share the broader objectives of the problem at the beginning of the problem to focus students before they identify learning issues. The problem's questions should challenge students to develop higher-order thinking skills, moving them beyond Bloom's (1956) lower cognitive levels of knowledge and comprehension to the higher Bloom levels, where they analyze, synthesize, and evaluate. These are the skills that are so important for students to develop in order to succeed in any profession. (pp. 48-49)

When writing PBL problems, Duch (2001b) suggests the following steps can help instructors write problems for any course:

Step 1. Choose a central idea, concept, or principle that is always taught in a given course, and then think of a typical end-of-chapter problem, assignment, or homework that is usually assigned to students to help them learn that concept. List the learning objectives that students should meet when they work through the problem.

Step 2. Think of a real-world context for the concept under consideration. Develop

a storytelling aspect to an end-of-chapter problem, or research an actual case that can be adapted, adding some motivation for students to solve the problem. A complex, ill-structured problem will challenge students to go beyond simple plug-and-chug to solve it. Look at magazines, newspapers, and articles for ideas on the story line. Some PBL practitioners talk to professionals in the field, searching for ideas of realistic applications of the concept being taught.

Step 3. The problem needs to be introduced and staged so that students will be able to identify learning issues that will lead them to research the targeted concepts. Some questions that may help guide this process follow:

1. What will the first page (or stage) look like? What open-ended questions can be asked? What learning issues should be identified?
2. How will the problem be structured?
3. How long will the problem be? How many class periods will it take to complete?
4. Will students be given information in subsequent pages (or stages) as they work through the problem?
5. What resources will the students need?
6. What end product will students produce at the completion of the problem?

Many times, PBL problems are designed as multistage or multi-page and may take student groups a week or more to complete. Not all the information needed to solve theproblem is given in the problem, or chapter, or perhaps even in the textbook. Students will need to do some research, discover new material, and arrive at judgments and decisions based on the information learned. The problem may have more than one acceptable answer, based on the assumptions the students make.

Step 4. Write a teacher guide detailing the instructional plans on using the problem in the course. If the course is a medium- to large-size class, a combination of mini-lectures, whole-class discussion, and small group work with groups regularly reporting may be necessary. The teacher guide can indicate plans or options of cycling through the pages of the problem interspersing the various modes of learning.

Step 5. The final step is to identify the resources for students. Students need to learn to identify and utilize learning resources on their own, but it can be helpful if the instructor indicates a few good sources to get them started. Many students today will want to limit their research to the Internet, so it will be important to guide them toward the library as well. (pp. 50-54)

Hallinger from Vanderbilt University sets guidelines for developing a problem-based learning (PBL) project that will afford an opportunity to work on a problem that current and potential administrators are apt to face as students and professors can use this problem as a starting point for learning new knowledge and skills:

Preparation

Prior to completing the prospectus for a PBL project, faculty may find it helpful to read the following sections of *Problem-Based Learning for Administrators* by Bridges & Hallinger (1992):

- Background and rationale for PBL (Chapter 1)
- Features of a PBL project (pp. 20-23)
- Examples of PBL projects (pp. 134-159)
- Developing PBL projects (pp. 93-105)

Project Components

The PBL project should contain the following features or parts:

- Introduction
- Problem
- Learning objectives
- Resources
- Product specifications
- Guiding questions
- Assessment exercises
- Time constraints

Project Development

The starting point for developing a PBL project is a focal problem; the problem comes first, then the learning. In selecting a problem, attempt to choose one that is representative of the kinds of problems students are likely to encounter in the roles and contexts for which they are being prepared. Moreover, the problem should be one with a high potential impact, that is, it affects large numbers of people for an extended period. Examples of such problems are the hiring of a new teacher, coping with the array of challenges inherent in a school undergoing transition from a homogeneous to a heterogeneous population, and implementing a controversial curricular change. Once the problem is selected, represent it through the format (e.g., written case, case incident, or computer simulation) that is chosen, and the next task will be to specify the nature of the product or the performance that constitutes a resolution to the problem. Ideally, this product or performance should be similar to the one that an administrator would actually

create or engage in when resolving the problem. For example, if the problem involves the selection of a teacher, students should design a selection procedure, implement it with a group of applicants, choose the person who performs best during the selection process, and prepare a memo to the superintendent detailing their selection process and the person whom they are recommending. Professors may find it helpful to enlist the assistance of practicing administrators in crafting the product or performance that represents a reasonable, real-life resolution to the problem. Having chosen the focal problem and specified the culminating product or performance, identify the learning issues that are inherent in solving this problem. They can be identified by the professor, thereby obtaining a more comprehensive list especially when inviting others to review the problem and to brainstorm the learning issues they see. As all interested parties consider what these learning issues are, ask these two questions:

(1) What skills and knowledge is it assumed the students will bring to this project?
(2) Which of these assumed skills and what presumed knowledge are these students likely to lack?

Once the problematic situation is described, the product or performance specified, and the relevant learning issues identified, the groundwork has been laid for choosing the major learning objectives and for identifying the key resources that students may draw on as they work to accomplish the learning objectives and to solve the problem. Wherever possible, these resources should expose students to relevant theory and research and provide examples of how this theory and research have been translated into school policy and practice. The next step in the process of developing a PBL project involves stating a set of "guiding questions." In framing these questions, faculty may direct students to key

concepts and/or assist them in thinking through the problem. Deciding on what questions to include in a PBL project is more an art than a craft or a science. Having fleshed out the problem, the product specifications, the learning objectives, the resources, and the guiding questions, the next step is to think about the assessment exercises. Since the PBL project hasn't been pilot tested, students should be invited to provide feedback about the project and how it can be improved (Bridges and Hallinger, pp. 102-105). In addition, gauge what students have learned through this experience. In determining what students have learned, strive to gauge how they intend to use their knowledge in the future (promotes transfer) and how they actually use this knowledge in job-related tasks and activities. If the knowledge seems technical, design a knowledge-review exercise and provide the answer key after students complete the exercise. *Classroom Assessment Techniques*, by Angelo and Cross (San Francisco: Jossey-Bass, 1993), contains useful techniques for assessing student knowledge. (http://www.vanderbilt.edu/lead/PBL/Class/Development/Guidelines.html)

APPENDIX D

Methods of Assessment for PBL

According to Swanson, Case, and van der Vleuten (2001), problem-based curricula generally emphasize communication skills in tutorial groups, acceptance of responsibility for learning, learning to learn, appropriate selection and use of a wide range of resources, and development of problem-solving skills. Consequently, process-oriented assessment methods generally focus on one or more of these.

One category of assessment, according to the authors, is tutor, peer, and self-ratings that are commonly used to assess a broad range of skills, including effort, self-directed learning, group cooperation, and communication skills. Use of ratings from tutors and peers is based upon the belief that co-workers are in a good position to evaluate each other. Use of self-ratings is nicely congruent with PBL's emphasis on judging the state of your own knowledge as an essential element of the learning process. There are well-known psychometric and practical problems that use such ratings.

The authors mention an example of the problems that may occur. When peer ratings were used formatively by the School of Health Sciences at the University of Maastricht, students either did not take them seriously or refused to complete them. When they were used summatively, ratings were uniformly high and not useful. Steps to force some variation into ratings (eg.by forced ranking) elicited so much resistance from

students that they had to be discontinued. The School of Medicine at the same university has never used tutor or peer ratings because of a belief that the teacher and assessor roles are incompatible; interpersonal relationships take on a different meaning when teachers are involved in assessment, and it is difficult for co-workers to be objective.

The authors further write that these results are consistent with research that has found that peer and tutor ratings (especially when focused on process) carry little measurement information and have poor validity (Boud, 1989; Rezler, 1989). Generally, inter-item correlations are very high, suggesting that raters can only provide an overall impression, without much differentiation of distinct skills. In addition, raters commonly vary in stringency, so that variation in ratings across students may simply reflect differences in rater standards. Similar problems exist for self-ratings.

The same authors go on to suggest that it is reasonable to expect that differences in students' self-directed learning skills and motivation to learn, coupled with differences in general ability will result in marked variation in learning outcomes. Given similar educational goals and opportunities to learn, better students (brighter, more highly motivated, more self-directed) will learn more than poorer students and, as time goes on, this effect will increase in size. Use of outcome-oriented assessment procedures capitalizes on this trend: the quality of the learning process is measured indirectly by testing the results of that process after it has been in operation for some time.

Development of problem-solving skills is a major focus of PBL, so assessment of these skills seems like a natural choice. However, research has shown that medical problem-solving should not be thought of as a unitary, consistent, content-independent skill that increases over time (Elstein et al, 1978; Norman, 1988). The effectiveness of

the process depends upon details of the structure and organization of knowledge and skills that support the problem-solving process, not in gross characteristics of the process itself. Possession of factual knowledge of an area does not guarantee successful application of that knowledge in solution of problems. This is, in fact, a major element in the rational for PBL: knowledge is better remembered in the context in which it is originally learned (Norman, 1988).

Type of assessments that can be used and are effective for PBL, are written and computer-based clinical simulations; essay exams because the format can provide an in-depth assessment of problem-solving skills, however, it is recommended that in order to insure that students understand the broad domain, it is better to include a larger number of short essays, rather than a small number of longer ones (eg, twelve ten-minute essays, instead of two 60-minute essays); multiple-choice exam questions (MSQ) – even though they are often rejected for use in PBL programs because they focus purely on recall of isolated facts, it is quite possible to prepare MCQs that require examinees to apply their knowledge in problem-solving situations; and short-answer tests. (Swanson, Case, & van der Vleuton, 2001)

These same authors conclude with the advice that as long as tests focus on application of knowledge in problem-solving situations, and undesirable influences on student-learning are avoided, these techniques can play an important role in problem-based programs.

According to Donham, Schmieg, and Allen (2001), one of the surest ways to disappointment as an instructor is to fail to link instruction to assessment; if problems do not support content objectives and the learning required for success on exams, students

learn to quickly disdain the significance of the problems. Furthermore, if students are expected to collaborate in the development of understanding, then assessment of group products should be part of the grade (but not to the extent that individual accountability is compromised).

According to Duch and Groh (2001), decisions concerning the assessment of student learning in a PBL course should begin with an examination of the course's learning objectives. This is true for any type of course, but the learning objectives in a PBL course generally go beyond simple content mastery, so the connection between these and assessment bears further examination. Learning objectives should focus on broad concepts and skills rather than on the details of the course content, since listing them is not intended to limit student research and self-guided learning. The first step in thinking about assessing students' learning begins with two questions (Uno, 1999) that will guide one to find appropriate assessment tools:

1. What should students know, value, and be able to do by the end of the course?
2. What evidence will indicate that they have reached these goals?

An example by Allen and Hans (2001) is presented below:

Learning Objective	*Assessment Method*
Explain how CO2 is used in photosynthesis.	Exam-multiple choice, short answer, or homework assignment.
Analyze and critically evaluate claims made in public policy debates about the court.	Group assignment, question on exam, or homework assignment.

Identify, find, and analyze information.	Take-home group or individual exam, problem write-up or summary, and/or evaluation of individual effort within the group.
Express confidence in ability to work with others.	End-of-course rating form.

Duch and Groh continue to write that group learning is a central aspect of the learning experience in a PBL class, and instructors may want to think of ways to factor it into the total grade given to students. Some methods used by other faculty including the following:

1. Give students one group problem on an exam, followed by the individual portion of a test. The group question may be given in class or as a take-home assignment. This in one method of planning an authentic PBL assessment by assigning a PBL problem similar to one that students have worked through in class.
2. Grade group problem summaries.
3. Use the ratings by group members of individual contributions to the group as part of a participation grade.
4. Grade group presentations. (Duch and Groh, 2001)

APPENDIX E

Effective Institutional

Models of PBL

McMaster University Medical School

According to Hmelo and Evensen (2000), PBL can be used to refer to many contextualized approaches to instruction (Bruer, 1993; Williams, 1993). What all of these methods have in common is that they anchor much of the learning and instruction in concrete problems. There are five objectives that PBL is most likely to address for medical students (Barrows, 1986): 1) construction of clinically useful knowledge; 2) development of clinical reasoning strategies; 3) development of effective self-directed learning strategies; 4) increased motivation for learning, and; 5) becoming effective collaborators. Barrows (1986) has identified two factors that affect the probability that any of these objectives might be achieved: the nature of the case: whether it is a complete case, a vignette, or a full problem simulation; and the locus of control of learning: whether it is teacher-centered , student-centered, or mixed.

Continuing, Hmelo and Evensen write that what has become known as the classic version of PBL is described by Barrows (1985, 1988). This model has two key features: a rich problem is used that affords free inquiry by students, and learning is student-centered. (p. 2)

In this approach, according to Hmelo and Evensen, a group of five to seven medical students and a facilitator meet to discuss a problem (Barrows, 1986). The facilitator provides the students with a small amount of information about a patient's case, and then the group's task is to evaluate and define different aspects of the problem and to gain insight into the underlying causes of the disease process. This is accomplished by extracting key information from the case, generating and evaluating hypotheses, and formulating learning issues. Learning issues are topics that the group deems relevant and in need of further explanation. The group members divide up the learning issues among themselves and research them. They then share their information and use it to explain the patient's disease process. At the completion of the cycle, the students reflect on what they learned from the problem. The facilitator's role is to help the students' learning processes by modeling hypothesis-driven reasoning for the students and by encouraging them to be reflective. (p. 2)

At the heart of PBL is the tutorial group, report Hmelo and Evensen. The PBL tutorial consists of several phases: introductions and climate setting, starting a problem, problem follow-up, and post-problem reflection (Barrows, 1988). Before beginning to grapple with a problem as a group, students must get to know each other, establish ground rules, and establish a comfortable climate for collaborative learning. Meeting in a small group for the first time, students introduce themselves, stressing their academic backgrounds to allow facilitators and each other to understand what expertise might potentially be distributed in the group. The other important function of this preproblem-solving phase is to establish a nonjudgmental climate in which students recognize and articulate what they know and what they do not know (Barrows, 1988). (p. 2)

The actual problem-based episode begins by presenting a group of students with minimal information about a patient's case, write Hmelo and Evensen. The students then query the case materials to determine what information is available and what they still need to know and to learn to solve the problem. During this phase students typically take on particular roles. (p. 2)

Hmelo and Evensen continue to describe that first, one student takes on the role of scribe. The scribe records the groups' problem solving on whiteboards or on easel paper where they list the facts known about the problem, students' ideas or hypotheses, additional questions about the case, and the learning issues generated throughout ensuing discussion. This written record (which usually remains visible during the entire discussion around the case) helps the students keep track of their problem-solving and provides a focus for negotiation and reflection. At several points in the case, students reiterate this process: pausing to reflect on the data collected so far, generating additional questions about that data, and hypothesizing about the problem and about possible solutions. In addition, the facilitator models metacognitive questions to encourage reflective thinking by asking students to explain why they consider a particular solution to be good, or why they need a particular piece of information about the problem. (p. 3)

As the students work on the problem, continue Hmelo and Evensen, they identify concepts they do not sufficiently understand and so need to learn more about to solve the problem (the "learning issues"). Early in the PBL process, the facilitator may question students to help them realize what the don't understand. For example, he or she may ask puzzled students whether or not a particular issue should be added to a growing list

of learning issues posted on the board. As students become more experienced with the PBL method and take on more of the responsibility for identifying learning issues, the facilitator is able to fade this type of support, or scaffolding. After the group has developed its initial understanding of the problem, the students divide up and independently research the learning issues they have identified. The learning issues define the group's learning goals and help group members work toward a set of shared objectives. These objectives can also help the facilitator to monitor the group's progress and to remind members when they are getting off course, or alternately, to ask if they need to revise their goals (Barrows, 1988). (p. 3)

In the problem follow-up phase, the students reconvene to share what they have learned, to reconsider their hypotheses, or to generate new hypotheses in light of their new learning, note Hmelo and Evensen. These further analyses, and accompanying ideas about solutions, allow students to apply their newly acquired knowledge to the problem. Students share what they have learned with their group as they coconstruct the problem through the lens of their newly accessed information. At this point, it is important for the students to evaluate their own information and that of the others in their group. In the traditional classroom, information is often accepted at face value. In the PBL tutorial, the students discuss how they acquired their information and critique their resources. This process is an important means of helping the students become self-directed learners. (p. 6)

The emphasis in PBL is not necessarily on having students solve the problem; rather it is on having them understand the cause of the problem. During postproblem reflection, students deliberately reflect on the problem to abstract the lessons learned. They consider the connections between the current problem and previous problems,

considering how this problem is similar to and different from other problems. This reflection allows them to make generalizations and to understand when this knowledge can be applied (Salomon & Perkins, 1989). Finally, as the students evaluate their own performance and that of their peers, they reflect on the effectiveness of their self-directed learning and their collaborative problem solving.

Both cognitive constructivist and sociocultural theories provide insights into the learning mechanisms of PBL (Greeno et al., 1996), write Hmelo and Evensen. In terms of individual learning, PBL situates learning within the context of medical practice. Problems give rise to epistemic curiosity (Schmidt, 1993) that will, in turn, trigger the cognitive process of accessing prior knowledge, establishing a problem space, searching for new information, and reconstructing information into knowledge that both fits into and shapes new mental models. At the same time, proceeding through the PBL process requires the learner's metacognitive awareness of the efficacy of the process. In this regard, PBL is self-regulated. Yet, PBL does not exist in a vacuum. Rather it is a social system within a larger cultural context. The knowledge that the learner seeks is embedded in and derives from social sources – in this case, the world of medical practice. From this perspective, the learner is seen as both transforming and as transformed as the processes of practice and their underlying symbol systems are internalized through dialectical activity (John-Steiner & Mahn, 1996). In this sense, learning is not an accumulation of information, but a transformation of the individual who is moving toward full membership in the professional community. This identity-marking is marked by observing the facility with which cultural tools, or the ways of thinking and using language, are invoked. The sociocultural context of PBL is the group meeting that simulates the social process of medical problem solving in a scaffolded way. (p. 4)

Barrows (1996) presents a list of educational objectives and each objective is followed by a description of curricular design elements needed to address this objective.

The Acquisition of an Integrated Knowledge Base. For this to happen, all medical school disciplines' basis to medical practice need to be incorporated into the problem-based learning curriculum. In a number of schools, some disciplines are taught outside the problem-based learning curriculum. Not only does this inhibit integration of those subjects in the students' understanding of a patient's problem, it also requires students to move in and out of different learning approaches, passive versus active, dependent versus independent. Many disciplines beyond the basic sciences, such as behavior, humanities, community health, ethics, and epidemiology need to be incorporated into the curriculum.

The Acquisition of a Knowledge Base Structured Around the Cues Presented by Patient Problems. By organizing their knowledge around patient cues, medical students enhance their ability to recall what they have learned and apply it in clinical work. This objective could be accomplished by any problem-based learning curriculum in which students analyze and resolve the problem as far as possible before acquiring any information needed for better understanding. This objective may represent the absolutely irreducible core of problem-based learning, if such a thing were to be articulated.

The Acquisition of a Knowledge Base Enmeshed with Problem-Solving Processes Used in Clinical Medicine. The Development of an Effective and Efficient Clinical Problem-Solving Process. These two objectives cannot be realized unless patient problems are presented in a format that allows students to use the problem-solving skills needed in practice. For example, the problem-based curriculum at Southern Illinois University stresses the use of patient formats such as the PBLM (Distlehorst and

Barrows, 1982) and standardized patients to allow students to inquire freely of the patient. By contrast, the problem-based curriculum at Maastricht presents students with patient problem protocols that contain most of the information needed to analyze and resolve the problem. Other schools use formats that only develop some skills in problem solving.

The Development of Effective Self-Directed Learning Skills. The Development of Team Skills. These goals require that the PBL approach be student-centered. Students must be able to determine on their own what to learn and from what resources, guided by the facilitator or tutor. This educational goal is easily weakened by tutors who are directive with students, by faculty statements about learning expectations with each problem, by reading assignments paired with problems, by resource faculty who tell the students what they should know as opposed to answering their questions, and by faculty-generated multiple choice questions to assess student progress. All these tend to make students dependent on the faculty telling them what to learn, as in conventional curricula, instead of being the independent learners that they must be in medical practice. (pp. 6-7)

According to Barrows (1996), most medical schools that have changed to problem-based learning share several characteristics. The dean either encourages PBL or provides visible support to a faculty group who wants to change to PBL. There is also a group of internally credible faculty members from both the clinical and basic sciences who want to change to PBL and are willing to spend the necessary time and effort. (p. 8)

Other factors, write Barrows (1996), that contribute to curricular change are visits by both enthusiastic and skeptical faculty members to schools using PBL and a demonstration of PBL at the school, using the school's own students. It also helps to have interested faculty members go through a PBL experience themselves to appreciate

the motivation and desire to learn that is produced despite their already established expertise in medicine. Presentations and lectures about problem-based learning are unconvincing – the listeners conjure up their own ideas as to what the method is like based on their past experiences. Demonstration and experience make all the difference. (p. 8)

Maastricht University

Medical School

According to Schmidt and Moust, in 1974, PBL was introduced in the Netherlands by faculty of the then new medical school of Maastricht University. The approach was adopted from the health sciences program of McMaster University. (p. 20)

All learning in a problem-based curriculum starts with a problem. Problems are the starting point of students' learning processes. A problem is presented to students for discussion in a small tutorial group generally made up of 8 to 10 students. Usually the students have to explain the phenomena or events presented to them in terms of their underlying mechanisms, principles, or processes. The students do not prepare themselves for the initial discussion of the problem. They come into the situation equipped with only their prior knowledge. (p. 21)

While discussing a problem, the group employs a specific procedure that all students are taught shortly after entering a problem-based curriculum. This procedure is called the "Seven Jump" (Schmidt, 1983b). The Seven Jump consists of seven steps to be completed by the tutorial group to take maximal learning advantage of a problem. The following steps explain the Seven Jump procedure:

1. Clarify the unknown terms and concepts in the problem description.
2. Define the problem; that is, list the phenomena to be explained.
3. Analyze the problem; "brainstorm"; try to produce as many different explanations for the phenomena as you can. Use prior knowledge and common sense.
4. Criticize the explanations proposed and try to produce a coherent description of the processes that, according to what you think, underlie the phenomena.
5. Formulate learning issues for student-directed learning (SDL).
6. Fill the gaps in your knowledge through self-study.
7. Share your findings with your group and try to integrate the knowledge acquired into a comprehensive explanation for the phenomena. Check whether you know enough now.

Schmidt and Moust continue to explain that the procedure guides the small-group members from the initial clarification of terms through a phase of problem definition to a phase of brainstorming in which they bring forward their initial ideas. Students then have to elaborate on their initial ideas and critically evaluate what they know and do not know. Finally, they have to formulate their learning issues for self-directed study. After about two days of SDL, the members of the tutorial group meet again to report and synthesize their findings in relation to the original problem. The goal here is to make sure that they have now gained a better, deeper, and more detailed understanding of the (causal) mechanisms or processes underlying the problem. The discussion in the tutorial process is chaired by a student. The chairperson ensures that the meeting proceeds in an orderly fashion through introducing new topics for discussion, summarizing the students' contribution, and making certain that the group achieves its goals. Thus the discussion of a problem is not a spontaneous ad hoc

process, but proceeds along prescribed lines. (pp. 21-22)

A tutorial group is supported by a staff member, known as a tutor. The role of the tutor is to facilitate the students' learning processes and to stimulate students to collaborate in effective ways. The contributions of a tutor are geared toward challenging the students to clarify their own ideas, inciting students to elaborate on the subject matter, questioning ideas, looking for inconsistencies, and considering alternatives. By doing so, he or she helps the students to organize their knowledge, to resolve their misconceptions, and to discover what is not well understood. (pp. 22-23)

Harvard Medical School

According to Moore, (2001), in 1984, after two years of extensive discussion and planning, Dean Daniel C. Tosteson presented the curriculum committee with his final plans for the radical reform of medical education at Harvard. The committee agreed that an experimental, fully redesigned curriculum called the New Pathway would start about one year later for a volunteer group of students and faculty. The New Pathway curriculum featured problem-based learning in tutorial groups as its central educational approach. (p. 73)

The two most important structural steps were to initiate the new curriculum as a separate, experimental track and to develop an organization that could manage the process of development. By using a separate track, they (dean and founding members) were able to approach the innovation as an experiment and encourage radical thinking and far-reaching alteration. They attracted the relatively small number of faculty who were dissatisfied with the traditional curriculum and excited about the prospect of change (Wilkerson and Maxwell, 1988) and enrolled students who voluntarily

welcomed a different kind of educational approach. An important benefit of the second track was the pioneering spirit, collegiality and enthusiasm generated by a small, tightly knit group of faculty and students. (pp. 75-76)

Led by a single broad-based faculty leader, scientists and clinicians from the relevant disciplines developed, designed and delivered each block. The block chairmen met regularly in an interlocking directorate called the Core Planning Group, which oversaw the development of the entire curriculum and discussed and adopted policies and procedures. This Core Group, which was also attended by the central educational staff, achieved important compromises regarding gaps and redundancies in the curriculum content and experiences, as well as trade-offs that were required in order to fit the entire curriculum within the allotted time. (p. 76)

Since their goal was faculty approval of the ideas of the new curriculum, the planners recognized the importance of communication in fostering understanding, and ultimately, support for the innovations. Many of the objections to the new curriculum would be overcome by clarifying the tutorial method through discussion, through citing the available literature and through direct contact with the pilot group. The project staff set up a variety of mechanisms to inform the faculty and persuade them of the value of the problem-based approach:

1. The new program reported frequently on its progress to the Curriculum Committee.

2. A special Steering Group, formed by the Dean, met monthly to review important decisions and monitor progress. This committee consisted of influential members of the faculty, including many who were skeptical about the new approach to education.

3. Department chairmen were asked to designate key faculty to lead and participate in the curriculum.

4. Each department was asked to designate a liaison to the new curriculum to serve as a channel of communication.

5. Faculty development programs brought interested faculty together and communicated reactions to the new curriculum and tips for teaching to each succeeding faculty group.

6. The project director met individually with important faculty leaders to address their concerns about problem-based learning. (pp. 76-77)

The curriculum committee created the first timetable by confirming a start date, specifying the number of students, and agreeing to a redesign of all four years. When they developed and brought options to faculty groups for discussion, they always pushed for closure on specific critical parameters. Among these were such important matters as the balance of time between electives and the required courses, the purpose and frequency of lectures (ultimately limited to one per day), and the goals and methods for student evaluation. (p. 78)

Procedural guidelines shaped the expectations of students and faculty. They developed a program guide that described the reasons for the new curriculum, the theory underpinning the educational approaches used, the general objectives and a detailed description of the problem-based tutorial methodology. A fourth-year student on leave to work as a fellow with the project, developed a student guide to problem-based learning. As mentioned, the Director of Faculty Development initiated a series of courses about the approach as well as offering to improve lecturing and other educational approaches that might be used in both the traditional and the new curriculum. (p. 78)

In the curriculum development process a specific set of case materials was designated for each problem. The educational staff and faculty chairmen for each block were expected to develop a course book consisting of a description of the curriculum, general course objectives, and the set of problems for that block. (p. 78)

A specific educational budget was developed to support the New Pathway project, using program budgeting to identify important milestones and the resources need to achieve them. A funding campaign identified potential outside sources of support for the new effort and resulted in a number of grants to develop designated aspects of the new program. (p. 78)

Perhaps the most important aspect of the approaches listed above was the goal-directed management of the entire process. Strong central management was needed to balance the heavy commitment to discussion and review by faculty and the decentralized organization used in the development of the curriculum blocks. (p. 79)

A handful of principles emerged from the experience of implementing problem-based learning at Harvard Medical School. These included:

1. Take a "do it and fix it" approach that limits discussion and moves towards action.

2. Develop a strategy to isolate and protect the initial development of an educational innovation if one expects significant change.

3. Find a means to counterbalance the centripetal force of strong, decentralized departments. Most successful schools have decentralized financial and operational organizations. This structure makes integration and collective action difficult. To achieve comprehensive curricular change, leaders must create a centralized,

interdisciplinary group to provide an overview and integration of the entire span of medical education.

4. Find and use the creative energy and commitment of the relatively small numbers of students and faculty interested in the early adoption of new approaches, without derailing their efforts by forcing them to work with nay-sayers. This principle can be achieved by segregating functions and authority among the faculty. The entire faculty need to gain agreement to the overarching goals and purposes of education, but operational implementation can be confined to a relatively small group of planners and workers. Balancing this tension between freedom to experiment while preserving faculty participation through the important functions of evaluation, review and comment is a critical dimension of success in educational innovation. (pp. 79-80)

According to Armstrong (2001), the New Pathway incorporates their (Harvard medical school faculty) assumptions that passive attendance at basic science lectures will not guarantee learning for every student; memorization of increasingly large numbers of facts will not necessarily provide the accessible knowledge required for clinical practice or research; and, finally, that presenting discrete bodies of information in totally separated courses during the first two years of medical school will not prepare every student to apply and integrate that information in solving clinical problems in the second two years of training. (p. 138) The New Pathway at Harvard Medical School is a broad-based attempt to create a four-year pedagogical structure within an organization that supports students to equip themselves with the skills, knowledge, and sensitivities they will need in a swiftly evolving professional environment (Tosteson, 1990).

A Core Faculty Planning Group, according to Armstrong, designed the framework

and goals for the first two years of basic science study with a set of interdisciplinary blocks. Each block includes small group case discussions (tutorials) led by instructors called tutors. Tutorial time varies from block to block. For each block, there is a smaller faculty planning unit called a Curriculum Design Group comprised of scientists and clinicians from each represented discipline and a curriculum coordinator providing expertise in education. The members of these groups continually re-evaluate, redesign and reimplement each block guided by the Masters of the five Academic Societies who share responsibility for the oversight of the curriculum and integration of content across the four years. The curriculum design groups are charged with establishing the goals of the course, integrating its disciplines, identifying the level of content appropriate to a general medical curriculum, and matching that content to the most effective pedagogy. (pp. 140-141).

Most Curriculum Design Groups for individual blocks, writes Armstrong, begin by pairing the course goals with a series of increasingly complex written cases, usually one per week. The cases are the primary vehicles for the students' tutorial discussions and self-directed study (Glick and Armstrong, 1996). As a supplement to the cases that organize each unit, regular lectures, labs, conferences and computer-aided instruction sessions offer a variety of perspectives on the major instructional theme of the week. (p. 141)

The curriculum coordinator plays an active role in facilitating the preparation and review of cases and all support materials for the block. The coordinator acts as an educational consultant to the planning group and is sometimes referred to as the producer of the block. The primary responsibility for facilitating communication

among numerous faculty and guiding the planning and implementation of the course rests with the coordinator. (p. 141)

The number of lectures was reduced below that of the traditional curriculum, and the remaining lectures were focused to emphasize key concepts, build a framework of ideas and relate to the case of the week. Lectures are used to present material that is new or more conceptually difficult and, therefore, less likely to be readily assimilated from the readings or tutorial study. In addition, lecturers are asked to make their presentations interactive – to permit interruptions and take more questions. Within the existing weekly schedule, lectures are presented as a multidisciplinary series whose theme relates to the teaching objectives of the particular week. Lecture material is integrated with labs and discipline-based conferences. All the approaches combine to prepare the student to grasp and apply what they are learning. To promote coherence, lecturers receive copies of the case(s) to which their lectures must correspond and they are requested to submit one- or two- page lecture outlines which, when reviewed and accepted, are published in student guidelines and distributed before the lectures. These outlines specify learning objectives and list one or two key references. Students report that these outlines enable them to prepare for lectures, organize their independent studies and learn actively during lectures. As a result of preparation and careful curricular integration, it is also common for students to bring up unresolved questions from tutorial discussion or independent study in the lecture hall. This approach has permitted lectures in the new curriculum to promote far more active learning than in the past. (pp. 142-143)

All of their paper cases include learning objectives, which they present either in behavioral terms or in the format of study questions that encourage students to evaluate their own progress. Tutors distribute the objectives or questions only after students

have had the opportunity to create and follow their own learning agendas. Each case includes a list of available audio-visual resources and suggested readings from course textbooks and/or collections of journal articles. Faculty resources (experts) who may be considered are also listed in each case. Tutors receive a written tutor guide or teaching note for each case. These guides detail the key features of the case and may include suggestions for pacing the case through the allotted tutorial time. Often, tutor guides are organized around information related to key concepts that underlie each objective or study question in the case. In addition, weekly tutor meetings provide tutors with a forum in which to review the tutorial process, discuss content issues related to the case under study, and prepare for the case of the following week. (pp. 144-145)

Christensen (1987) described several benefits of the case method teaching for both students and faculty at the Harvard Business School. He highlighted students' opportunities to discover in their own ways and build unique personal frameworks for the knowledge base they acquire. For faculty, case teaching and development provide opportunity for intellectual stimulation and pedagogical risk-taking. Faculty who shift from lecturing to case method teaching often report new learning and a refreshing sense of adventure. Christensen went on to note that, for some faculty members, case development rekindles research interests and faculty and students all benefit from the general culture of change that results:

The case method is supportive of a culture that places high value on review and innovation. Too often, faculties teach change – but practice the status quo. Individual course and overall curriculum reviews often depend on the personal initiative of an instructor or the work of faculty committees. But when faculty must prepare teaching cases, their continuing contact with the world of practice

provides the institution with an external force for change. Suggestions that a familiar framework be reviewed or new concepts developed are often received more sympathetically when they derive from the impersonal demand of practice rather than from colleagues or departments, with their personal agendas. The case method encourages an adaptive culture.

University of Hawaii, John A. Burns

School of Medicine

According to Anderson (2001), the John A. Burns School of Medicine at the University of Hawaii converted from its traditional curriculum to problem-based l earning for the entire incoming class of 56 students in 1989. The John A. Burns School of Medicine adopted the McMaster model of small group, self-directed, tutorial-based learning. That process of change was accomplished in 15 months. (p. 65)

In 1988, Christian L. Gunbrandsen, M.D. was appointed Acting Dean of the School of Medicine. After attending the Association of American Medical Colleges' Management Education Program in San Diego, where the emphasis was on managing institutional change and introduced problem-based learning, he appointed five faculty members as a Task Force on Problem-based Learning. That Task Force identified the problems in the traditional program, studied existing curricular models, and in September, 1988, presented a written proposal to the faculty for conversion to problem-based learning as a solution to these problems. In December, the Executive Committee of the School of Medicine directed the Task Force to proceed with the planning of that new curriculum.

In March 1989, the Planning Group presented the curricular outline with a plan for implementation. (pp. 65-66)

The school was authorized by the Executive Committee to begin the new program with the entire incoming class in September, 1989. This rapid change was accomplished by an early strategic decision to concentrate the school's resources on faculty development, specifically on tutor training. That decision acknowledged the tutorial process as the core experience in problem-based learning. The tactics employed were consultation, demonstration and broad interdepartmental participation. Persuasive and substantive consultation was obtained from McMaster University under the leadership of Dr. Bill Shragge, Chairman of the McMaster M.D. Program. Curricular materials (Health Care Problems) were purchased and adapted to the school's local needs. A two-day demonstration of the tutorial process by Dr. Shragge with six first-year students in front of 90 University of Hawaii faculty converted many skeptics. They saw that the students could perform impressively in a self-directed, participatory, problem-based format. Participation has been the most effective vehicle of change. Most faculty agreed that experiencing the tutorial process, like basic training in the military, created a sense of commitment to the new educational philosophy. (p. 66)

Anderson identifies the following factors as those which have been most influential:

1. Leadership of the Dean – Dr. Gulbrandsen pointed the way to PBL, but referred the decision to the faculty. He proposed that those who selected education as their career choice would be rewarded. He supported the change process by his enthusiasm and participation, and by fiscal measures which provided for consultation, faculty

development, curricular materials and learning resources. He approved the establishment of an Office of Medical Education for central development, coordination and ongoing assessment of the program. He even served as a tutor in Unit I of the new curriculum.

2. Successful choice of consultant – The relationship between the home team and the consultant, Dr. Shragge, gelled quickly. He provided a clear blueprint, but also knew when to step aside and let the faculty introduce their own ideas. Continuing consultations have provided review of interim progress, reassurance and the opportunity to address problems as they emerge.

3. Early decisions – a number of early decisions influenced the rate and direction of change. The Task Force studied and used the experience of others to make decisions, to anticipate problems, and to make choices when alternatives existed. The most available prototypes for them were the McMaster and University of New Mexico models (Newfeld et al, 1989; Kaufman et al, 1989). Total conversion to PBL was chosen rather than a dual-track system because they decided not to plan forever. Rather, they developed a critical mass of interested and key faculty, and began the new program. They purchased the McMaster curriculum, i.e. Health Care Problems, learning resources and evaluation instruments, and implemented these with minimal changes. They installed a mechanism to monitor the program and to gather information regarding omitted objectives, content areas and learning resources in order to modify or introduce new problems in the future. Effort and resources were invested in faculty development, and specifically, in tutor training. It effectively addressed the fear of the unknown, and the fear of becoming unskilled in an area of previous self-esteem.

4. Role of the major stakeholders – They identified the major stakeholders in the process of change, including those with most at risk from the loss of self-esteem, control or position (Grant and Gale, 1989). Dissemination of information about problem-based learning was a necessary and important first step. They found the use of demonstration of the tutorial process, participation in tutor training, and the experience of success to be the point of conversion for many. Changes in the social structure of the school – the social structure of the school was reorganized (see Bloom, 1989 for an in-depth discussion). The Task Force on Problem-Based Learning (five members) was enlarged

to become the Planning Group (10 members) for the new program. With augmentation, that group evolved into the M.D. Program Committee (15 members) and was charged by the Dean with the implementation and monitoring of the educational program. This evolution removed problem-based learning from the purview of the traditional curriculum committee which was organized to uphold departmental representation, control and autonomy.

By contrast, membership on the M.D. Program Committee was constructed to secure accountability for the integrated components of the program. These are the Unit Chairmen (curricular Units I-V), the chairpersons for student evaluation, learning resources, tutor training, the advisor program, discipline representation, community medicine, and clinical skills. This administrative system of chairpersons for functional rather than structural units has sub-committees for the implementation of each function. It provides for the interdepartmental team building and faculty development. It offers recognition and increasing administrative responsibility based on successful

performance, leadership, and commitment. It is a training program that supports the continuation of change. (pp. 66-69)

Southern Illinois University

School of Medicine

The Barrows model of PBL is implemented at the SIU School of Medicine, and the school's specific features are seen as directly contributing to the development of the proactive lifelong learner. According to Myers Kelson, these descriptions are followed by ensuing principles:

1. The discipline-oriented basic science years are replaced by a curriculum consisting entirely of patient problem encounters that are selected to achieve two ends: they are representative of the common and important problems physicians encounter in actual practice, and from this "universe" a problem set is selected that will afford the development of a foundation of basic knowledge and skills essential to the practice of medicine.

Principle #1: The acquisition of domain knowledge emerges from learning affordances of common and important problems of future practice.

2. Problems are developed from actual patient records and are presented just as patients present in real life cases. Cases are not scrubbed but present with all of the ambiguity and messiness that characterize actual patient encounters. Although the cases are simulations, they are presented in such a way that students must build the problem by inquiring for patient information, using the inquiry techniques of the profession:

taking a history, performing a physical examination, and ordering and interpreting laboratory tests and procedures. In other words, they are ill-structured problems (Barrows, 1990, 1992; Spiro et al., 1987).

Principle #2: The full complement of reasoning skills in which the practicing physician must engage is afforded by the process by which the problem is presented and unfolds.

3. Students engage the problems in small groups of five or six, together with a facilitator called a PBL tutor. The tutor coaches the group's collaborative reasoning by means of the Tutorial Process (Barrows, 1992). The tutorial process replicates within the group the hypothetical-deductive reasoning process used by most physicians when encountering a problem (Barrows & Feltovich, 1987; see also Kelson & Distlehorst, 2000).

Principle #3: Students practice the hypothetico-deductive reasoning process, developing procedural problem-solving knowledge.

4. Students are responsible for recognizing and addressing both the learning and problem-solving affordances of the problem, recording as "learning issues" any in which they feel deficient. Following each session in which the group encounters the problem, they research the learning issues and return to readdress the problem armed with new knowledge and skill. The process continues until the group arrives at a well-reasoned resolution and can articulate a systems explanation.

Principle #4: The onus for attuning to problem affordnesss as well as the responsibility for acquiring necessary knowledge and skills is entirely on the student. The tutor acts as a coach, taking care to protect this student responsibility.

5. The group recognizes that is has a dual responsibility: to arrive at a reasoned resolution of the problem and to fully understand the knowledge and skills it demands.

Each problem is finalized in two ways. The group compares its reasoning through the problem with that of the health care professionals who actually cared for the patient, and they are asked to articulate a systems explanation of the present patient problem and its management, incorporating biomechanical, biochemical, and psychosocial mechanisms. They are encouraged to compare and contrast with relevant elements from other cases and to verify their explanation with content experts from the faculty. The systems explanation typically takes the form of a flowchart or a concept map. This knowledge abstraction process serves to unbind knowledge from specific context, fostering its transfer to new problems (Collins et al., 1989). It also contributes to the building of a mental model, which incorporates reasoning from basic mechanisms.

Principle #5: Students see knowledge, problem solving, and knowledge acquisition as an integrated process. Problem solutions are validated by systems explanations.

6. At the end of every problem students systematically reflect on their own performance and progress and analyze that of their peers, giving them specific feedback as to strengths and weaknesses and identifying goals for improved future performance. The tutor joins the group in this self- and peer assessment.

Principle #6: Students practice self-reflection and the analysis and articulation of strengths and weaknesses in performances of others, a process that enhances both self-reflection and team building.

Taken together, these features are designed to precisely model the expected outcome of the curriculum. The entire curriculum consists of students practicing the features of proactive lifelong learning. (pp. 328 – 330)

Ohio University

MBA Program

According to Stinson and Milter (1996) the Ohio University MBA presently is an intense thirteen-month learning experience, starting in August of year one and concluding in September of year two. All programs use a PBL format with a theoretical base in cognitive constructivism, a format that places the learner in exactly the type of projects and work situations that he or she will face as a leader of the information age organizations of the twenty-first century. Students learn basic business concepts, but in the context of use, maximizing their ability to both recall and apply those concepts as they move back into the work world. Students develop the skills (communication, collaboration, teamwork) and the personal characteristics (initiative, creativity, personal responsibility) that are becoming necessary for success. Students develop a high level of comfort with information technology as they regularly access information through the resources of the Internet, collaborate electronically over time and space, and develop and make professional-level, computer-driven presentations. (p. 33)

Stinson and Milter continue by writing that the program centers around eight major projects. The projects tend to be large macro problems that address business holistically. There are, within any project, multiple smaller problems that students must address to manage the total learning problem. Students construct their knowledge of business practices by working their way through the problems. Student learning is aided by the ability to access appropriate content on a just-in-time basis. Students learn content at a time it will be most useful to them in their management of the learning problems. While some of the problems are designed to challenge individual separately, most of them are designed to be approached by collaborative learning groups. (pp. 33-34)

The authors explain that the PBL process employed is a derivative of Reiterative PBL, which was developed by Barrows (1985) and follows closely the concepts of cognitive constructivism (Savery and Duffy, 1994) and cognitive apprenticeship (Brown, Collins, and Duguid, 1989).

Ohio University's first movement into a more integrated curriculum using PBL was prompted by criticism of graduate business education. In the early eighties, business schools were chastised by the popular press for being too theoretical and out of touch with business realities, for producing narrow-minded technicians without interpersonal and communication skills, and for concentrating on esoteric research unrelated to the business world. (p. 34)

In response to those concerns, they performed a complete redesign of their curriculum. The redesign process was conducted by an interdisciplinary team who formed the central delivery team for the program. On this team were faculty from each major discipline in the College. The process began by attempting to establish desired student outcomes. To approach that issue, they asked themselves, "What is it we want our students to know, and know how to do, as they leave our program?" They attempted to answer each question from three different perspectives:

1. Each discipline-based participant was asked to draw upon his or her technical expertise and propose what were the minimum acceptable conceptual knowledge and skills that all MBA graduates (not discipline majors) should have from their area. Each participant then had to defend the resulting list to the other faculty representing other disciplines.

2. Businesspeople who might be expected to hire graduates of MBA programs were polled. They were asked what they expected incoming recent graduates to know and to know how to do.

3. A futures analysis was performed. Given that their job is to prepare people to assume leadership roles in business in the future, they wanted to make certain that they were helping students develop the types of knowledge and skills that provide a base for long-term, as well as short-term, success. (pp. 34-35)

They employed this process during their last major redesign in 1992 and have performed the same analysis in abbreviated form each year since. They reinvent the program each year; it is never conducted exactly the same way twice. Using this process, they have developed a dozen desired student outcomes. Under each of these outcomes, called *meta-outcomes*, they have developed a more specific set of learning outcomes (approximately 150) that drive the structure of the program. (p. 35)

The meta-outcomes are much broader than those traditionally identified for MBA programs. In addition to knowledge and the ability to apply the knowledge, they incorporate a number of skills and personal characteristics. Because of the breadth and the interrelatedness of those outcomes, they concluded some time ago that a typical discipline-based and course-structured curriculum would not produce the desired outcomes. (p. 35)

Furthermore, according to Stinson and Milter, as constructivist research shows (Duffy and Jonassen, 1991), positivist pedagogues encourage the development of personal characteristics counter to those they needed to develop. For example, in the more positivist-based pedagogy, students are encouraged to be passive. Their outcomes, on the other hand, call for them to become active initiators. Traditionally,

the faculty took responsibility for providing clarity for students. Their outcomes called for students to clarify their own roles in ambiguous situations. Thus they concluded that a pedagogy based on a constructivist philosophy of learning, PBL was more appropriate given their desired learning outcomes. (p. 35)

Stinson and Milter continue to explain that they have now had over a decade of experience implementing PBL. While some may still have concerns about the effectiveness of the process, they do not. Rather, their concerns center on the implementation of PBL. Inappropriately used, PBL will not lead to the potential robust learning. It is their experience that the critical implementation issues, those that may actually limit learning, include incomplete or inappropriate use of the process, faculty capabilities and attitudes, and issues of student transition. (pp. 35-36)

They offer four guidelines to effectively implement PBL. The first guideline refers to the design and implementation of appropriate problems as central to effective PBL. Effective problem design begins with a set of clearly identified learning outcomes. It is the learning outcomes that should drive problem design, and not the other way around. Designing a problem includes a number of principles:

1. Learning outcomes should be holistic, not divided by narrow disciplinary boundaries. Focusing on content only within narrow disciplinary boundaries limits potential learning. Further, disciplinary boundaries are largely a construct of academic convenience. In practice, there is no such thing as a "marketing problem". Any action taken in the marketing area of the firm impinges on the operational area and the financial area.

2. Problems should mirror professional practice. This meets the criteria of authenticity. Problems should be similar in nature to the problems we find in professional practice or at least call forth the same types of skills and activities. Thus, content will be learned in the context of practice so that, when needed for practice, the content can be more readily recalled and used. More and more over time, as the student confronts and manages authentic situations, the process of learning and doing becomes intertwined and indivisible. The learner manager develops the ability and the responsibility for managing his or her own learning. The manager in practice approaches each situation as a learning experience and has the ability to reflect upon experience and extract knowledge that will lead to continual growth in capability. The learner manager will evolve into the learning manager.

3. Problems should be ill-structured. In practice, managers are seldom confronted with neat, well-structured problems. Rather, they most frequently face what Ackoff (1979) has characterized as "managerial messes". Students need to develop the ability to confront ambiguous, ill-defined situations and make sense of them. They need to be able to recall concepts and techniques and apply them in this sense-making process. Further, they need to engage in and develop an effective inquiry process. There is no textbook or written case study for this process.

Once again, this is authentic. The information needed to analyze a situation is not prepackaged, preanalyzed, and provided for the manager. By repeatedly confronting and managing ill-structured problems, students develop the ability to ask the right questions and to determine what information is needed to frame the situation. Further, they learn where and how to obtain the needed information. They develop the truly requisite business research skills. Stinson and Miller state:

Problems should be contemporary. While authenticity is emphasized in all these principles, engagement is implied. In their experience, authentic problems are engaging. Students see such problems as real and find them stimulating to attack. But these stimulating real problems should also be contemporary. Students are not engaged by a challenge to determine what a company should have done ten years ago. This is a typical problem of Harvard-type cases. Students do not accept the authenticity of a case set several years in the past and thus are not engaged. An additional problem with a historic case is a search for the right answer. This gives students an impression that complex business problems are simply puzzles requiring selection of the correct responses. (pp. 36-37)

The second guideline for a successful PBL curriculum is the actual implementation of PBL. In particular, students must learn from their experience and be able to generalize from the specific situation to more robust knowledge and understanding. (p. 37)

Albanese and Mitchell (1993) noted that graduates of problem-based medical programs sometimes reported a lack of confidence that they had learned as much content as have those who went through a traditional program. They further noted research that sought to measure the extent of content learning. They concluded that research suggested somewhat less knowledge among PBL graduates. According to Stinson and Milter, however, this conclusion reflects a measurement bias. It is based on measurement of learning via standardized objective tests. Measure more directly related to professional activity, that is, data from evaluations of clinical performance were discounted – because "clinical evaluation represents a complex mix of personal and secondary observation of residents" (p. 77). This bias causes Stinson and Milter to question the validity of the

conclusion. Rather than suggesting a weakness in the concept of PBL as was implied, these reviews may suggest a weakness in the implementation of the learning process.

In their early use of PBL, they experienced similar concerns. Students would learn, but would exit the program not fully comprehending how much they had learned. Further, they could not effectively access their learning in nonassociated recall and thus could not demonstrate the extent of their learning on traditional tests. (p. 38)

A review of their use of PBL revealed that they were not effectively helping students to make their learning explicit. They were assuming that the students would, as a natural part of the learning process, reflect on their experience and extract abstract knowledge. At most, they would conduct a debriefing that focused on how the students felt about their experience. (p. 38)

Stinson and Milter write that Collins (1990) notes three problems in simply learning by doing: a flexibility problem (students learn to do things in only one way), a learning problem (students do not learn a global framework to organize their learning), and a transfer problem (students do not learn how to apply what they have learned in new situations). He proposed that, to construct robust understanding from situated experience, learners must articulate a global framework that can be used to integrate all the bits and pieces of knowledge gained from specific situations, reflect on situated experiences and relate them to the global framework, and explore and elaborate connections between situated experiences and the global framework. According to Stinson and Milter, influenced by Collins as well as Schon (1983),the Ohio University MBA faculty redesigned the curricular structure of their program so that the initial problem enables the students to develop and articulate a global framework – the business concept. (p. 38)

They also implemented a rigorous assessment process that requires students to relate what they learn in any particular problem to their global framework – their understanding of the business concept. Finally, assessments may require them to address a similar situation, but in a different context. These assessments occur both while the students are addressing the problem – functioning as reflections-in-action – and after they have completed a problem, as reflections-after-action (Schon, 1983).

These changes have materially influenced their students' recognition of the breadth and depth of their own conceptual understanding, their ability to engage in nonassociated recall, and their skills in articulating their knowledge. (p. 38)

The third guideline to follow is the importance of faculty as a variable. The role of the faculty is quite different in PBL than in the traditional classroom. He or she spends very little time up front, lecturing and transferring information to students. Rather the role becomes a combination of both learning manager and coach. (p. 39)

The faculty selects appropriate learning problem-situations, a critical responsibility. The situations must be involving, relevant, holistic, and at the appropriate level of complexity. Further, the faculty must ensure that appropriate physical resources are present. This requirement ranges from arranging panels of executives who will review student presentations and provide feedback to ensuring that appropriate data resources are available at the library or via electronic sources. (p. 39)

But the teacher is also a coach (Kraft, 1988). The teacher observes, corrects, and encourages student performance. The coach-teacher "encourages that the right way of performing be done over and over again until the requisite skill becomes a firm and stable habit of performance" (p. 1).

Much as happens in apprenticeship (Collins, Brown, and Newman, 1990), the

teacher also provides a model. At appropriate times as students are involved in a learning situation, or after they have completed it, the teacher provides a thorough and high-quality performance so that students can compare their performance to that of an expert. This can be a personal performance demonstrated by the teacher or it can be a real-life or communicated performance by some other expert. Students need some involvement, some understanding of the context, before they can benefit from modeled performance. (p. 39)

Finally, the teacher helps students generalize the learning (Collins, Brown, and Newman, 1990). As students express (in oral or written form) what they have learned while confronting the problem-situation, the teacher helps them understand how that same knowledge and skill can be used in other situations. (p. 39)

Stinson and Milter continue to write that this new faculty role represents a paradigm shift calling for new skills. The paradigm shift has been expressed as moving from being the "sage on the stage" to serving as a "guide by the side". They continue to write that students express frustration when they first encounter PBL. Most students have progressed through a typical educational system where knowledge is divided into arbitrary disciplines and taught to them through lectures, discussion sessions, or some combination. The students have learned to memorize information and regurgitate it on multiple, true-or-false, or essay examinations. This is a teacher-centered model of education, with the teacher and the textbook structuring all dimensions of learning. (p. 40)

PBL is student-centered. Students are expected to take responsibility for their own learning. The teacher does not tell them the "right answer". The teacher lets them

experiment and make mistakes. The teacher makes them go to original sources to get information. The teacher may not even answer their questions directly. They are expected to find their own answers. This creates a very ambiguous situation for students. (p. 40)

The situation is often most difficult for students who have been strong performers in the positivist learning environment. They have functioned well where their life was structured for them, and perceive being forced to structure their own learning as threatening. (p. 41)

Thus a great deal of coaching is required as students make the transition to PBL. Students must be helped and encouraged as they start to take on responsibility for their own learning. Rather than just giving an assignment, the teacher must work with the students as they take their first halting steps into an ill-structured problem-situation. Rather than giving them a direct answer to a question, the teacher should talk them through the process of answering their own questions. If coached effectively through the transition, all but the most regimented of students make the transition and eventually thrive in the new learning environment. (p. 41)

Stanford University Educational Leadership Model

Seven years ago, Edwin M. Bridges and Philip Hallinger (1996) introduced PBL to educational administration through a master's degree program for prospective public school principals at the Stanford University School of Education. More recently, professors and staff developers have used their approach in Thailand and Australia to prepare school leaders, hotel managers, and medical school administrators. (p. 53)

Their initial interest in PBL stemmed from concerns about the character of existing leadership education programs including their own. Most programs view their purpose as imparting knowledge and honing the mode of analytic thinking prized in institutions of higher education. Students learn about leadership in the abstract and, to a more limited extent, how to use this information to analyze situations that may bear little similarity to professional practice. They learn almost nothing about the types of problems they will encounter as leaders; they do not learn to apply knowledge to these problems; they do not develop skill in running meetings and writing effective memos; and they acquire little insight into the emotional aspects of leadership. (p. 53)

Moreover, the education students receive occurs within a classroom setting that bears little resemblance to the context in which leaders perform their roles (Bridges, 1977). In traditional leadership programs, students occupy a passive, individualistic, subordinate role rather than an active, interdependent, superordinate role. They learn to write using academic forms of communication instead rather than those more characteristic of managerial work, such as memos. Students also learn in an emotional climate much more placid and neutral than the one leader's face. Finally, the relatively slow tempo of the student's classroom role contrasts sharply with the accelerated work pace of an administrator. With this kind of preparation, graduates of these programs experience reality shock when they start working as leaders; they feel ill-prepared to deal with the emotional and cognitive demands of the role and often suffer from what has been called *analysis paralysis*. (p. 54)

According to Barrows (1986), one should decide on major educational objectives and then select the method of learning that best fits these objectives. The version of PBL that the authors designed reflects their belief that *the essence of leadership is*

getting results through others. Their main objectives derive from this belief and emphasize the following skills: facilitating group problem solving, building consensus, communicating ideas, acquiring the knowledge needed to deal with problems facing school leaders,

implementing solutions to these problems, and dealing with the emotional aspects of leadership. (p. 54)

To accomplish those objectives, the authors structured the basic unit of instruction around a PBL project. Much of a leader's work occurs in the context of temporary projects created to accomplish a limited set of objectives under time constraints using available resources. By conceiving of the PBL model as a project, Bridges and Hallinger created a learning context that mirrors the work environment. Learning is motivated by confronting a complex problem that requires active engagement and resolution in the form of a product. Resolution is bounded in terms of time, and the problem is addressed in collaboration with others. (p. 54)

One consequence of the project-based approach is that it forces students to cope with the emotional, as well as the cognitive, demands of leadership. The project provides opportunities for students to test their competence in interpreting and responding to the feelings of others. Moreover, while working on the projects, the team members often find themselves struggling with the dilemma that confronts every conscientious leader, how to achieve a high level of performance and sustain group cohesiveness within severe time constraints. This dilemma requires students to make difficult choices, to set priorities, and to experience the consequences. (p. 55)

Each PBL project typically takes three to five classes to complete, with each class lasting approximately three hours. However, students often become so engaged with

the project that they meet longer and more frequently than required. (p. 55)

Each project centers around learning materials consisting of four components: the focal problem, the content, the culminating product or performance, and the learning objectives. The focal problem is a typically messy situation that students are likely to encounter in their future professional practice. It may also be a problem that affects large numbers of people for an extended period of time. The problem derives choices about learning objectives, content, and the product or performance. Focal problems include the transition of a public school from an English-speaking student body to one consisting of native English, limited-English-proficient, and non-English-proficient students; a breakdown in school discipline; a school with a veteran faculty, a changing student population, and declining test scores; and a problem teacher who has tenure, to name a few. (p. 55)

Bridges and Hallinger presented these problems in different formats. Several appeared in the form of highly contextualized written cases; others were introduced via videotape, computer simulations, or live simulations. (p. 55)

For example, the *Safety and Order* project contains a written case that centers around a high school with a growing gang problem and a history of student violence. While working on this problem, students experience four unannounced interruptions, three portrayed by trained models. The first interruption involves a conference with a tenth-grade male student referred to the office. The students, in the role of the principal, have only twenty minutes to learn why the student has been referred and to decide what to do. If the student principals ask the right questions, they learn that the student, although possessing a spotless citizenship record and high grades, has struck and injured another

student during physical education class. The second interruption is a conference with the parent of the offending student. The parent believes that the penalty is too severe and demands that his son receive only a reprimand. The third interruption involves an interview with a newspaper reporter about a letter to the editor from the aggrieved parent and discipline at the school. A subsequent, negatively slanted newspaper article by the reporter provides the fourth interruption. (p. 55)

This combination of factually presented material and live surprises models several characteristics of on-the-job practice; unpredictability, ambiguity, and working on several problems at once. (pp. 55-56)

The content for each project is drawn from relevant disciplines and craft knowledge or practical wisdom. Students encounter this content through a variety of means – readings, instructional tapes, videotaped reflections of scholars and practitioners on the problem, and consultations with experts. This content illuminates aspects of the problem and its resolution. For example, as students work through the problem of a school undergoing change in the language proficiency of its students, they learn about the legal aspects of serving a multilingual student population, theory and research on second-language

acquisition, how public schools have treated recent immigrants, examples of school bilingual programs and district policies, and research on newcomer centers. (p. 56)

This multidisciplinary approach mirrors the way knowledge application occurs in the workplace. The important problems that leaders face on the job tend to be multifaceted and to require the use of knowledge from several domains. (p. 56)

Every PBL project includes a performance product. This product engages students in developing a solution to the problem(s) and in presenting that solution via the same

mode used in the workplace. The mode of resolution varies with the nature of the problem and might include a presentation, a conference, an agenda and supporting material for the first meeting of a task force, a strategic plan, or a memo. Guidelines for creating these performance products are ambiguous so that students become accustomed to dealing with unclear tasks and the attendant psychological discomfort. (p. 56)

The products also force students to grapple with issues inherent in getting results through others. Students must confront varying views about what the problem is and how it should be handled. In addition, they need to decide how they should organize themselves to create the product within the time constraints. These products also provide an incentive for learning and a way for them to judge the effectiveness of their collective efforts. (p. 56)

The impact of the performance product in this model of PBL has surprised the authors. Being responsible for a performance product provides a sharper focus to the problem solving in which students engage. The performance product component of the PBL project moves it beyond an abstract exercise, and students typically exhibit the performance anxiety one would anticipate in a real, not contrived setting. While this is particularly critical for the learning of novice leaders, it is also an important motivational and practical tool for engaging veteran leaders. (p. 56)

The learning objectives provided at the outset of each project accent what students will learn from it. These objectives relate to the problem-relevant knowledge that is the project focus, as well as the knowledge and skills needed to complete the product. For example, in the project that centers on a school undergoing a major change in the linguistic and cultural composition of its student body, the authors identified managing

an advisory committee or task force as a major requisite skill. Suspecting that students lacked this skill, they incorporated it into the objectives along with such problem-relevant goals as knowledge of the theory and research on second-language acquisition. Although the authors generally suggest five to seven learning objectives per project, they have found it productive for students to personalize their learning by focusing on those objectives that pertain to gaps in their own professional background. (pp. 56-57)

Bridge's and Hallinger's version of PBL differs in two major respects from PBL as described by Barrows and Tamblyn (1980) and Schmidt (1983). First, they have substantially altered the role of facilitator; second, they have placed considerable emphasis on implementation. (p. 57)

In the small group tutorial format of PBL, the instructor or an advanced graduate student remains an active facilitator in the group's learning process but does not provide direct instruction. In problem-based leadership education, students work without the active facilitation of a tutor and manage virtually the entire process for the duration of each project. This format creates the opportunity for students to learn and practice skills essential to getting results through people, namely, managing projects, running meetings, resolving conflict, building consensus, and collaborating with others to define problems and reach decisions. (p. 57)

The authors' model of PBL also attaches much greater weight to implementing decisions than is the case in more typical approaches. Since implementation skills are essential to effective leadership, they explicitly incorporate action-oriented performances into the projects so that students can experience, in a limited fashion, the consequences

of their actions. By according coequal status to problem analysis and implementation, they strive to prepare students who will not suffer from the kind of analysis paralysis attributed to other programs. (p. 57)

During each project, students are assigned to a team of six to seven members. Class sessions are treated as meetings of the project team. During these meetings, students play the roles of leader, facilitator, recorder, or group member. The student, acting as the leader, functions in that capacity for the entire project. Leaders have the primary responsibility for organizing the project to accomplish the objectives and to complete the product. They create a tentative completion plan for the time allotted and play a major role in drafting each session's agenda, including what the team tries to accomplish during the session and how it plans to proceed. (p. 57)

Other members of the project team take turns acting as facilitators or recorders. The facilitator suggests processes for dealing with each item on the agenda, keeps the group on task, and assists the group in reaching agreement on problem definition and resolution actions. The recorder records major ideas and decisions, and prepares a written record of the group's work. (p. 58)

Most projects culminate with the students' actually implementing their response in the form of a realistic product or performance. Implementation forces them to struggle with a range of political, cultural, organizational, and human issues inherent in putting action plans into effect. In addition, they become aware of the need to anticipate potential problems, assess their seriousness, and develop preventive or contingency plans for the most serious potential problems. Students also confront the realistic possibility that their solution may not work. If things go poorly, they learn how to deal constructively with

frustration and disappointment. If things go well, the students' level of confidence in their ability rises. (p. 58)

By way of illustration, in one project the team is the committee responsible for designing and implementing a teacher selection process (Bridges with Hallinger, 1992). The committee then implements the process with three finalists. The team evaluates how well each finalist has performed during the selection process and prepares a one-page memo to the director of personnel. The memo describes the vacancy and the process used, recommends one of the three finalists (if that seems appropriate), and justifies its recommendation. The selection process includes an interview and an observation of each finalist, teaching a group of students like those the teacher will teach. (p. 58)

Given the emphasis placed on the product and its implementation, students may become so preoccupied with solving the problem and creating the product that they slight the learning objectives. As a response to this potential difficulty, the leader has the responsibility of ensuring that the learning objectives, as well as the product, are accomplished. If leaders sense that the team is cutting corners to get the product out the door, they act as the group's conscience and refocus them on the learning objectives. Their success as leaders depends in part on how well they manage the tension between completing the product and accomplishing the learning objectives. (p. 48)

The authors' version of PBL tests both the patience and confidence of instructors. A PBL project seldom runs smoothly. Students typically experience considerable confusion mixed with a measure of nervousness about the approach of the professor and the ambiguity of the situation. They may become frustrated and direct their hostility toward the instructor. The authors believe that instructors must maintain a vantage point

above the affective and cognitive turmoil that students experience. They "need to preserve the perspective that for the students being *lost at sea* is part of the journey; not far off, near the horizon, are calmer waters that lead toward the desired destination." (Bridges with Hallinger, 1995, p. 54). Without this perspective, instructors may actually feed the students' anxiety or may take a more active role, thus undermining the self-directed learning process. (pp. 58 - 59)

Instructors can facilitate the transition to PBL and reduce frustration in many ways. To inform students about PBL and build their confidence in the approach, instructors can use a PBL project such as the one the authors developed for this purpose, "Because Wisdom Cannot be Told" (Bridges with Hallinger, 1995). The process and the content of this project work together to foster understanding and appreciation for PBL. Instructors can also ease the transition by gradually increasing the complexity of the projects. Finally, instructors can promote student success by having students learn skills in project and meeting management, problem solving, consensus building, memo writing, and oral presentation. By introducing these skills early in a leadership curriculum, the instructor provides students repeated opportunity to practice and refine these skills. Dumping students into PBL without attending to this transition may lead to disastrous results. (p. 59)

In the authors' experience and that of other users, their version of PBL requires considerably more time and attention initially than instructors are accustomed to in conventional courses (Chenoweth and Everhart, 1994). Front-loading takes several forms: creating or selecting the learning materials, reviewing and preparing PBL project materials for student use, and attending to the numerous logistic details – for example, preparing the physical environment, assigning students to teams and roles,

identifying consultants, and providing equipment. Inadequate advance attention to these issues decreases the efficiency and effectiveness of students' learning. (p. 59)

To facilitate learning in a PBL leadership environment, it is important to develop several classroom norms. One of the most important norms relates to how mistakes are viewed. Instructors should establish an environment in which mistakes are learning opportunities. There are few safe havens for leaders and prospective leaders to acquire new skills and knowledge and to practice using them without the fear of unleashing irreversible consequences. In the authors' PBL courses, the greatest learning has occurred when students experience something akin to failure and reflect on how and why that happened. This, however, places a much greater premium on providing constructive feedback. Other norms relate to time use, developing a problem-focused orientation to learning, personalizing learning, resourceful learning, and self-monitoring (Bridges and Hallinger, 1995). (p. 59)

During a PBL project, the instructor lives in the background almost all of the time. The instructor acts primarily as a process observer during meetings of the project team, clarifies project-specific issues that arise, consults on individual matters, monitors and modifies the time allocated for completion, and conducts regular debriefings. (p. 59)

Like so many users of PBL, the authors have grappled with the issue of evaluation. Fully cognizant of the lack of consensus about this topic, they adopted several principles to guide the forms evaluation would take. First, to promote transfer of learning, they base evaluation on the performance of tasks similar to the ones performed by school leaders, not on mere recall and comprehension of knowledge. Second, to promote student growth, they devote their attention to providing feedback that details each student's strengths and areas in need of improvement instead of summary ratings of

performance. Finally, to cultivate habits of self-evaluation and reflection, they have students assess the quality of their own performance.

With these guiding principles in mind, they have experimented with a wide variety of tools and techniques for assessment, such as:

1. Integrative essays in which students discuss what they have learned during a project and how they might use the knowledge and skills in the future.
2. Protocols or standards that students may use to evaluate their own performance or products.
3. Models or examples of products completed by expert practitioners against which to compare their own products.
4. Knowledge-review exercises that test the students' ability to apply their knowledge to typical situations.
5. Forms created by students to elicit feedback from their peers on aspects of their performance.
6. Structured observations that provide descriptive information about individual and group performance.
7. Probing questions for students to consider in relation to their final performance products.

Numerous examples of these assessment tools and techniques appear in Bridges with Hallinger (1995, p. 60).

Since this version of PBL is a newcomer to the field of leadership education, there has been limited evaluation of its effectiveness. In the one program (Stanford) that has used

this instructional approach most extensively and for the longest period, the results are encouraging.

Stanford University Ed.D. Model

According to Bridges and Hallinger (1995), the outcomes of Ed.D. research are similarly confused. The expectation that Ed.D. dissertations will result in publishable reports is generally not realistic. Students do not simply receive adequate preparation in research methods to carry out high-quality, social scientific independent research. When viewed as a group, Ed.D. studies tend to be narrowly focused, atheoretical, and highly limited in terms of methodological sophistication. Consequently, such studies make few recognizable contributions to the empirical research literature, theory, or practice. (p. 117)

Bridges and Hallinger conclude that the Ed.D. dissertation is often a transition ritual devoid of meaning for professional students. The Ed.D. dissertation reflects neither the work tasks nor the professional norms that characterize the career paths of professional students (Bridges, 1977). Thus, these dissertations do not serve an instrumental role by contributing to the knowledge of the *practice* of school administration. Nor do they fulfill a socialization function by preparing students for the normative expectations that characterize the higher administrative roles they may enter after obtaining the doctoral degree. (p. 117)

The compromises inherent in the conduct of Ed.D. dissertations often result in dissatisfaction for both the students and professors. Many of Stanford University's students contend that the dissertation experience fails to meet their needs as practitioners. As professors, Bridges and Hallinger often feel an acute intellectual discomfort with the

quality of Ed.D. dissertations. This result is almost inevitable given the confused goals and design of the degree program. (p. 117)

Graduates of Ed.D. programs in educational administration should be able to demonstrate their ability to apply appropriately research, theory, and craft knowledge to problems arising from educational policy and/or practice. The Ed.D. dissertation represents an experience through which students can demonstrate their achievement of this goal. (pp. 117-118)

The model Bridges and Hallinger chose to work with is referred to as research and development (R & D). Borg and Gall describe educational research and development as "a process used to develop and validate educational products" (1989, p. 782). Their description of the R & D model immediately suggests its relevance to the PBL process and its appropriateness for their purposes:

> One way to bridge the gap between research and practice in education is to do R & D. It takes the findings generated by basic and applied research and uses them to build tested products that are ready for operational use in schools. R & D increases the potential impact of basis and applied research upon school practice by translating them into usable educational practices. (p. 782)

It is in the nature of this model that the research and development process results in products that can be used in the field. At times, the R & D process may also generate original contributions to knowledge, but that is largely a byproduct, not a primary goal, of this research model. In their presentation of this methodology, Borg and Gall (1989) offer an extended example and conclude:

> (In this case) the developer was able to make a contribution not only to practice but also to research knowledge...The results of the field test

contributed new knowledge, and raised new questions (of theoretical and empirical interest)....In planning an R & D project, you too may find yourself considering alternatives about such matters as product design, product content, and target audience. It may be possible to compare several alternatives through informal or systematic experiments incorporated in the field test phases of the R & D cycle. (p. 801)

Borg and Gall have identified ten steps in the research and development process:

Steps in the Research and

Development Cycle

1. Research and information collecting
2. Planning objectives, learning activities, and small-scale testing
3. Develop preliminary form of the product

Preliminary field testing

Main product revision

6. Main field testing
7. Operational product revision
8. Operational field testing
9. Final product revision
10. Dissemination and implementation

Source: Borg and Gall (1989, pp. 784-85)

Bridges and Hallinger present two options as the focus for research and development. In the first option, the researcher poses specific research questions and draws on a

traditional array of research methods to address the research questions. In option 2, a research goal (that is, development of a usable PBL project) replaces the research questions, and the investigator employs an array of research and evaluation tools to assess the PBL project. (p. 124)

In option 1, the student conducts an Ed.D. dissertation that looks quite conventional in many respects. This option involves the framing of specific research questions concerning the nature and implementation of PBL as used in leadership education. The essential difference from the normal dissertation is that the research includes a set of steps that result in the development of a PBL project. Thus, the project involves the student in exploring a salient research question or set of questions in the context of implementing a self-authored PBL project. Bridges with Hallinger (1992) write:

> The sources for research questions within this option are varied. They may may be derived from cognitive-learning theory, literature on PBL, or research in the preparation of educational leaders. Elsewhere we have discussed potential research issues that seem fruitful for study in the realm of problem-based learning. Research questions might focus on the effectiveness of PBL when compared with traditional instruction. Alternatively, the research might explore how effective the different species of PBL are in achieving the various goals of administrator-preparation programs. (p. 112)

In this approach, according to Bridges and Hallinger, the research and development model discussed above is actually embedded within a traditional research design. This option draws on Borg and Gall's notion that the R & D process has the potential to contribute to knowledge through incorporation of appropriate assessment during the main field test. As suggested by the discussion of the R & D cycle, under this option

the student proceeds in three somewhat overlapping stages. (pp. 124-125)

In the first stage, the student identifies research questions related to PBL, review information salient to the research problem, identifies an important problem in practice, and develops a proposal for dissertation research. In the first section of the literature review, it will explore literature concerning the stated research problem. In a second section of the literature review, the student conducts a preliminary review of literature related to the focal problem that forms the basis for the PBL project. (p. 125)

Two differences that characterize the literature-review process are worthy of mention. First, as with the classroom implementation of PBL, Bridges and Hallinger encourage students to conduct a *problem-focused* review of the literature. That is, the identified problem of practice guides the student in the selection of literature for the second portion of the review. Moreover, the review is problem-focused in that Bridges and Hallinger ask students to assess the literature in terms of its ability to illuminate the problem of practice. (p. 126)

The second distinction is that the review is not limited to the literature. Students are encouraged to seek out expertise concerning the problem wherever it may be found. Students may choose to include in their review information garnered from human resources. (p. 126)

In a second stage, the student develops, field-tests, and revises a preliminary form of the PBL project. As part of a fluid *process*, the PBL project specifications are drawn up, a preliminary field test is conducted, and the project undergoes revision based on the results of the preliminary field test. After these steps, the draft project is ready for use as an *intervention* for study in the doctoral research. (p. 127)

In the third stage of the dissertation research, the student conducts a main field test of

the PBL project. This step in the research and development process fulfills two purposes. First, during the main field test the student collects formative and summative evaluation data designed to shed light on both how the PBL project might be improved and its efficacy as an instructional tool. Second, under option 1, the main field test serves the additional purpose of collecting data to answer the research questions posed for the study. Thus, under option 1, the final report of the study will present the data that informed final project revision as well as findings concerning the research questions. (pp. 127-128)

Development of a PBL project provides a unique opportunity for the professional doctoral student to synthesize skills, knowledge, and ways of thinking that Bridges and Hallinger believe are important goals for such programs. The tasks involved in PBL project development require the student to engage in meaningful problem finding, to explore a problem of practice in depth, to draw upon salient literature and other resources that illuminate the problem, and to design a means of assisting other practitioners in learning how such a problem might be addressed in organizational settings. (p. 129)

Option 2 limits the goals of the dissertation to the development and evaluation of a PBL project. Rather than combining the research and development model with a conventional study on an educational intervention, the student focuses exclusively on the research and development process. Bridges and Hallinger believe this option fulfills all normative expectations of an exit requirement for a professional doctorate in educational administration. (pp. 129-130)

In conducting a dissertation under option 2, the student limits the scope of the study

to the development and evaluation of a PBL project. He or she identifies a problem of practice; examines a full range of research, theory , and craft knowledge salient to the problem; and applies that knowledge in the context of developing a PBL project. This process, itself, is a variant of student-centered learning. (p. 130)

The accompanying sidebar presents the components of the option 2 dissertation. These components include an introduction identifying the problem and the research goals, a review of related resources, the methodology, and a description and evaluation of the PBL project.

OPTION 2 DISSERTATION: COMPONENTS

Chapter 1: Introduction

Background

Identification of the Problem in Practice

Significance of the Problem: Why the Problem is of Importance in Practice

Research Goals

Rationale for Developing a PBL Project for This Problem

Chapter 2: Review of Related Resources

Introduction: Knowledge Domains That Bear on the Problem

Identification and Review of Knowledge Domains: Text, Human, and Video Resources

Review of PBL Literature in Medical and Managerial Education

Synthesis of Context Issues as Related to the Problem and Use in PBL Project

Chapter 3: Methodology

General Design

Research and Development Cycle

Development of the PBL Project

Research and Information Collection

Planning (includes description of data collection and analysis)

Preliminary Development of the Product

Preliminary Field Testing (includes description of initial data collection/analysis)

Main Product Revision: Steps and Description of Revisions Made

Main Field Test: Description

Evaluation Procedures (includes main data collection/analysis for evaluation of the project)

Description of the PBL Project Developed for Implementation and Testing

Chapter 4: The PBL Project

Review of the Research Goals and General Design of the Project

Implementation of the PBL Project: Description

Evaluation Results

Summative Evaluation Results Concerning PBL Project Implementation (organize by Learning Objectives)

Formative Evaluation Results Concerning PBL Project Implementation

Other Results (optional)

Discussion of Final Product Revision (include in Appendix)

Revisions Indicated by the Formative and Summative Evaluation Results

Discussion of Classroom Implementation Issues

(Bridges & Hallinger, 1995, pp. 131-132)

From Bridges' and Hallinger's perspectives, the student's PBL project (and discussion of the project's development) represents a concrete demonstration of the "bridge" the student has constructed connecting research and theory to practice. (p. 138)

Students report that the process of developing and evaluating a PBL project has several tangible benefits for them. The process naturally leads students – some for the first time – to make meaningful connections across courses in their doctoral program. The R & D process requires them to integrate content from different disciplines and forces them to assess the research literature in light of problems of practice. (p. 139)

The R & D cycle also calls on students to employ inquiry skills and research tools, but for a purpose that they view as practically relevant. During the process of PBL project development, the student engages in systematic and extended problem-finding and problem-solving. The convergence of these in the process of developing a usable PBL project also validates students' experience as practitioners. (p. 139)

Bridges and Hallinger also report that the students who have incorporated PBL into their Ed.D. dissertations identify another benefit from this approach. They note that the process facilitates their transition from "graduate school" back into the workplace (whether or not they ever left). This results from three related factors inherent in the PBL process. First, the process engages students in the active integration of craft knowledge gained from their past experience with the new knowledge and skills gained through advanced training. Second, the process allows students to demonstrate that they have learned something that is academically respectable and practically relevant. Third, the process results in the creation of a product, the PBL project, that is explicitly designed for use by others in the field. Much as the Ph.D. does for future researchers, these features of the PBL research process provide an opportunity for Ed.D. students to

practice skills and ways of thinking that will have normative and instrumental value to them as administrators as they advance in their careers. (p. 140)

In addition to generating materials for the educational administration curriculum, this dissertation process has an additional potential benefit for the profession. Bridges and Hallinger sense that the students who emerge from this experience leave their programs with a healthier respect for the university and its role in professional practice. Since these graduates represent their lifeline to the field, this bodes well for maintaining the vitality of their programs. (p. 142)

Course Director's Perspectives on PBL Learning Curricula in Biochemistry

Smith, (2002), professor and former director of medical school biochemistry, Department of Biochemistry and Biophysics, University of Rochester School of Medicine and Dentistry, Rochester, New York, writes that the knowledge of the applications of biochemistry, molecular biology and genetics in the practice of medicine has been and continues to be a vital part of medical students' continuing education. The technical background and rapid expansion of information and new applications have made it an arduous task to learn and teach this material within the already crowded medical school curriculum. PBL formats are rapidly being adopted at all levels of education as not only a paradigm shift in education but also a solution for the instruction of biochemistry in medical school.

He continues with saying that his experiences in the Double Helix Curriculum at the University of Rochester School of Medicine and Dentistry (which employs PBL cases

and complementing lectures) has shown that students are excited about learning in the PBL environment and explore in depth ways of integrating biochemistry, cell biology, genetics, and molecular biology into the practice of medicine. At the same time, complimentary lectures greatly enhance uniformity in the quality, and, importantly, the accuracy of the students' learning.

PBL, he claims, can solve problems associated with the limited amount of time for biochemistry instruction and motivating students to use biochemistry for clinical problem solving. A well-written PBL case provides a learning environment in which students perceive the objectives as worth knowing because it provides opportunities for students to identify aspects of the case as learning objectives while solving the mystery of the patient's case. By working over several days on parts or "chapters" of each PBL case within small groups (six to eight students per group), students have many opportunities to revisit knowledge, conduct independent literature or online searches, and discuss the learning objectives and other ideas within and outside the group. The personalized nature of the exposure to the learning objectives allows students to more readily perceive them as part of their long-term knowledge for future clinical applications. Moreover, each student's engagement and contribution to the learning process can be ensured and greatly enhanced by a perceptive tutor who, through appropriately posed questions, enables a balanced contribution from all group members and facilitates a "safe" learning environment. In this way, the PBL's small groups and the PBL structure provide more students with repeated opportunities to actively contribute to their learning, compared with the lecture format.

Smith adds, however, that the breadth and depth of topics covered through PBL

group discussions can exceed those covered during comparable lecture time; however, this must not be overestimated. Given that the nature of PBL is to motivate learning, through a patient's health care issues, well-formulated learning objectives need to be limited in scope (the expectation of what can be achieved in a given exposure) and should not be inclusive of entire anabolic or catabolic systems. For example, a PBL case on ornithinetranscarbamylase deficiency might have among its learning objectives to: (1) understand the concept and importance of nitrogen balance and appreciate the macromolecular sources contributing to the production of ammonia; (2) understand the role of transaminases and the urea cycle intermediates in the elimination of amine groups; and (3) be able to predict the pathophysiologic consequences of the lost of function of these enzymes. The learning objective, "Know the biosynthetic and breakdown pathways for all the amino acids" would be too large, because there is a danger of underemphasizing much of the information relevant to inborn errors of amino acid metabolism. In an open-ended learning objective, students are not always able to tell what is important, and they have constraints on how much time they can (or are willing to) spend. The opposite situation, where the learning objectives of a PBL case are too narrowly focused, also risks fostering narrow learning, but for the reason that the students will rapidly arrive at the answer and perceive the scope to be sufficient.

He cautions that a related pitfall is the assumption that the burden of "life-long learning" for any given topic can be realized in a single PBL case. For most students, life-long learning is acquired and reinforced through iterative contact with knowledge and its application in problem solving. For any discipline, but for biochemistry specifically, coverage of material in one PBL case or in one course, will not be sufficient.

Part of the solution, therefore, is that the curriculum design team appreciate the significance of biochemistry, genetics, and molecular biology in the practice of medicine and be willing to help coordinate the efforts of all course directors over the entire four-year curriculum to revisit the basic science learning objectives. One way this can be accomplished is to rewrite and reuse PBL cases from the biochemistry course in other courses in subsequent years of medical school. This reinforces past learning and provides opportunities for deeper understanding and advanced applications. In addition, co-operation should be fostered between course directors and PBL writers to help each other ensure interdisciplinary coverage and the reiteration of learning objectives. Here, again, the curriculum design team and the medical school's administration have important roles in helping reshape attitudes and providing education and training opportunities to faculty.

Smith mentions that another consideration is the students' perception of time constraints. Students make choices of what to learn regardless of the educational format they are learning in. These choices may be driven by competing demands on the students' time due to upcoming examinations, tandem courses, the students' perceptions of the course material's relevance, or other factors affecting the students' abilities to commit to the learning. Often, students will emphasize (expect to have access to) the material covered in past exams regardless of the curricular format. Course directors who participate in lecture-based curricula have been concerned for years over medical students' "practical" approaches to learning biochemistry. His experience is that this has improved slightly with the introduction of PBL in biochemistry, but has not gone away.

In all curricula, what students learn has to be assessed by the faculty, and it has been his experience again, that specific learning content covered by PBL will be underemphasized (undervalued) in the students' preparation for their examination unless

it specifically tests the PBL learning objectives. His department's approach has been to inform the students that the design of the course is to have approximately 50% of the learning objectives covered in PBL and that they will test accordingly. However, students still want to see past exam questions for reasons that may be related to their discomfort with the schism between their being responsible for their own learning while the course director is responsible for their testing. He provides past exam questions online as self quizzes or "formative" exams and ask the students to use the material frequently (not just while studying for the examinations) as an "external standard" to gauge their progress.

PBL tutors, he continues to write, provide one of the most important solutions to ensuring that students assume responsibility for their own learning and receive encouragement to seek greater depths of knowledge. To do this effectively and not resort to lectures, tutors need to be trained how to motivate students to seek out relevant collateral facts and concepts and to encourage them (without becoming directive) to read and learn broadly. In this regard, PBL is unparalleled in the opportunity it affords faculty and students to realize the full potential of the learning environment.

Wanting to change to a PBL curricula, however, is not enough. Institutions must support the educational mission with the necessary physical and financial resources and provide support staff and infrastructure to train faculty and students in the PBL process. The necessary investment in PBL rooms, computers, and infrastructure can be substantial. There is no doubt that the implementation of PBL increases contact hours for the faculty and requires enlisting faculty who may have had modest or no prior involvement in medical school education. From his own experience, this may double the number of participating faculty and increase the contact hours for some faculty by two-

or threefold.

He continues to explain that there are excellent descriptions of the PBL process in medical school, and in virtually all of them, the goal of PBL is to motivate students to develop excellent problem-solving skills. Students in a traditional curriculum, on the other hand, are frequently involved in what has been termed “passive” learning because lectures typically explain facts and relationships and students do not have to synthesize information.

Many of the faculty have long been concerned over problems with the traditional curriculum. If students do not reason through relationships and form concept maps during lectures they may not understand the relevance of the material and, consequently, could have delayed development in problem-solving skills. In his experience, the lack of in-depth learning during lectures in a traditional curriculum has been evident in students’ statements that the “finally understood the lecture after independent study or during their discussion in study groups”. Also, a large percentage of the students in lecture classes typically request weekly sessions in which they want to hear the lecture material again. This has been his department’s process of teaching biochemistry for years. They tell them things, and they go away and think about them. It is not clear to anyone when during this process students actually acquire the skills of using biochemistry to solve clinical problems.

In retrospect, Smith adds that this is not to say that there are no examples where the lecturer’s style and the material being covered have enabled an exceptionally meaningful learning experience. For this to happen, however, he believes three things must be in place: (1) the lecturer’s comprehension and comfort with the material must be at such a

high level that he or she can deliver the learning objectives with the skills of a storyteller; (2) the student's background must be at a level such that he or she can place what is being said in immediate context; and (3) the learning environment must be relaxed, with no competing issues such as exams or surprises (the learning objectives for the lecture should be anticipated in the context of the material that was taught before). Most course directors and faculty strive for these ideals during their lectures, but he believes most will admit that there are few opportunities to assess whether learning has happened until the examination.

Much of the recent literature on PBL has proposed that students learn to be better problem solvers through PBL because they develop the skills to recognize where questions exist in a case and how to define answers in terms of what they know and what they still need to learn. The PBL process comes from the students, and, as such, has a higher probability than the average lecture of allowing students to think about what they are learning at the time they are exposed to relevant facts. In addition, the PBL tutor or facilitator can assess the discussion from the discussion (or lack of discussion) how learning is proceeding. Depending on the particular design of the PBL process and the skill of the tutor, opportunities will arise for timely feedback to the students on their learning process and, if necessary, allow self-correction of the learning process.

According to Smith, the question frequently asked is whether there is proof that PBL is better than a lecture format. As far as solving the problem of a crowed curriculum and thereby ensuring that students are exposed to an appropriate background and cutting-edge information are concerned, his impression (experience) with biochemistry education in medical school is that the answer is yes. Studies, however, have not backed up this impression with definitive data (Vernon & Blake, 1993; Norman and Schmidt, 1992;

Kaufmann & Mann, 1996; Lieberman et al, 1997; Neufeld et al, 1989, Albanese & Mitchell, 1993; Moore et al, 1994; David & Patel, 1995; Kaufmann & Mann, 1996 (supp.). Specifically for biochemistry, there is an insufficiency of data showing that PBL is more effective than lecture in motivating learning and the application of biochemistry and genetic principles.

Other studies, however, have suggested that, in the long term, students learning through PBL may have less recall of specific facts and terms than those learning through lecture alone, but they appear to have greater ability for long-term recall of general information and relationships. In his personal experience, PBL is a useful strategy in achieving the goal of improving instruction in biochemistry, and it enhances the likelihood that biochemistry will remain a part of the students' intellectual tools that they use to solve clinical problems.

When using the PBL process, it should include several in-class, small-group discussions that convene over consecutive parts of the case. Not handing out the entire case at once encourages students to propose and research their own hypotheses and to explore more issues collateral to the case because they are not biased by knowing what comes next and how the case ends. More importantly, there must be adequate time for independent research of learning objectives as they arise. Independent research is essential for information gathering and hypothesis testing. This, together with in-class discussion, is what builds problem-solving skills. It is vital that the curriculum provide training in how to conduct literature research and assess the quality of the information. This is accomplished in the Double Helix Curriculum by having the first-year students spend their first and last few weeks of the academic year in a course entitled "Managing Medical Informatics". In addition, ten hours per week are designated as protected self-

study curricular time during the biochemistry course. This is the department's way of overtly emphasizing to students and faculty to take independent research seriously. If PBL cases are written and implemented properly, they can solve the catch-22 of the crowded curriculum by motivating students as self-directed learners to cover much more material than could be expected by any other modality of teaching.

Smith mentions that he discussed the importance of balance in the amount of material covered by the PBL learning objectives, but timing (when the intended learning objectives are made available to the students) is also important. Providing students with a written statement of intended learning objectives ahead of time or giving them a list of questions at key points throughout a PBL case, is, in his experience, not a good strategy for biochemistry. The intent in providing the learning objectives during the PBL sessions is to help students stay on track, but this often has the unintended effect of encouraging students to emphasize or limit their learning to the particular questions they have been asked. This is particularly true for students who do not embrace the open-learning environment of PBL or take ownership for their own scopes of learning. These student will be swayed by the case writer's preformed questions and search for answers in much the same manner as a child tries to find the man with striped clothing in a "Where's Waldo" collage. If this happens, the students may miss the rich context of PBL learning objectives and may develop serious gaps in their depths of knowledge and concept maps. A well-written PBL case motivates students to propose learning objectives that will include those intended by the case writer.

However, he cautions, never telling students what the intended learning objectives are is also a mistake. It leaves them with no frame of reference, no goals, and the impression

that anything they accomplish will be satisfactory. An important goal of PBL should be that students develop skills for formulating their own questions so that they become self-directed learners and good problem solvers (Barrows, 1985; Schmidt, 1994). It has been his experience that maximum self-directed learning is encouraged by providing students with a narrative description of the intended learning objectives as the very last thing they discuss during the last in-class session of the PBL case. The student feedback has been that they are more comfortable with their self-directed learning knowing that at some point they will be able to assess this learning relative to faculty expectations.

PBL cases written to encompass too many learning objectives or too broad a topic area will be apparent to students. Students may become less motivated to participate in small-group discussion for this style of PBL because they will feel it is more efficient to take the list of learning objectives and look up details on their own.

He also notes that it is frequently argued, however, that students do not experience gaps in knowledge when learning through PBL because, as adult learners, their immersion in related subjects provides them with a broad context to meet their future needs. It should concern everyone, however, that during the first year of medical school, students are adjusting to the self-directed learning process while they are supposed to be implementing this skill to learn biochemistry. The assumption that they will learn everything because they happen to have seen it during PBL has the same inherent flaws as assuming that they are learning material just because it was covered in lecture.

Every curriculum balances what the students take away from PBL and where gaps in knowledge manifest. If potential gaps in knowledge can be identified, they can be effectively addressed through lectures, short case-based learning, or laboratory experiences. For example, lectures and PBL should work together to achieve weekly

themes that encompass groups of related learning objectives. PBL cases should be written to address a realistic number of these and related learning objectives within the weekly theme. Lectures should provide perspectives on the big-picture concepts such as the integration of metabolic control or achieve a finer focus such as the description of complex mechanisms and novel molecules. A finer focus is particularly useful for making students aware of advanced topics and future applications that are difficult to find through independent study given the current literature. The value of the lecture, therefore, is enhanced by supporting PBL because students are better prepared to listen and learn. They can place the lecture material into a context of what they have learned from PBL and information they can use in problem solving. This transformation of the lecture hour was made apparent through both an increased number of questions during lecture and a marked increase in the level of sophistication of the questions being asked.

While using PBL, Smith reported that he also relied on short case-based learning (CBL). CBL motivates students to think about more complex concepts such as macromolecules in diagnostics and as therapeutic targets, clinical trials, or world health issues. CBL involves both passive and active learning. It centers on either a patient and his or her primary care physician who comes to the lecture hall, or a short paper case, or a scientific report. For example, the primary care physician mediates an interview of the patient with class participation or a faculty facilitator introduces essential facts and relationships as background to the paper case or report during the first 20 minutes of the CBL. The class of 100 students then adjourns to assemble their respective PBL groups for 40 minutes to research one or two questions raised during the patient interview or by the faculty facilitator. The CBL session concludes with a 20 minute integration conference to discuss the students' learning and unresolved questions.

According to other research, students tend to rate lectures as being better for learning details (Kaufmann & Mann, 1996; Moore et al, 1994; Kaufmann & Mann, 1996, suppl), but whether this means that there is inherently more risk for gaps in knowledge in PBL is not clear. Comparisons of United States Medical Licensing Examinations (USMLE) results from students in PBL versus traditional curricula have suggested no significant differences in scores on the USMLE Step 1 and slightly higher scores on Step 2 for students from PBL-based curricula (Vernon & Blake, 1993; Neufeld et al, 1989; Moore et al, 1994; Albanese & Mitchell, 1993; Distlehorst & Robbs, 1998). Preparing for the board exams is, itself, a ritual of focused learning among medical students and, therefore, these test results may not be an accurate reflection of the learning that took place during the PBL course or lecture. Moreover, he suggests, the USMLE itself suffers from the crowded curriculum and has difficulty assessing the breadth of students' backgrounds and their abilities to use modern concepts in problem solving. Most faculty would argue that educating students to simply pass board questions in biochemistry, cell and molecular biology, and genetics is wrong because it does not train them to be creative thinkers and solve clinical problems. Nor does it adequately cover the breadth of material they need to know. If the medical school's intent, therefore, is to provide students with life-long learning skills and the will to use basic science to solve clinical problems, the USMLE outcome may not be a good metric to guide curricular reform. Most educators now consider the evaluation of how well our students are able to keep pace with the advances in medicine and apply them in their own practices to be an important part of the ongoing assessment of PBL (Vernon & Blake, 1993; Albanese & Mitchell, 1993, Santos-Gomez et al, 1990; Woodward et al, 1990; David & Patel, 1995; Mennin et al, 1996; Schmidt et al, 1996). Although this process will probably not

reflect how many details they learned in medical school biochemistry, it may provide a valuable measure of how well the students' intellectual skills were mentored and how comfortable they were with their backgrounds in basic science.

From a utilitarian standpoint, PBL can help solve the crowded-curriculum dilemma. A well-designed PBL program can challenge students to appreciate and remember new knowledge and applications. Lectures can be less effective in "bringing to life" educational experiences, but they frequently are very effective when the learning is targeted to specific concepts and issues or when interrelationships are profiled. In this sense, lectures can be used much like seminars to enhance the depth of learning experiences in PBL and to help bridge concepts introduced through PBL.

Smith concludes by stating that with experience in directing and lecturing in both traditional and PBL curricular formats, no single approach to learning serves all the students all the time. The most effective strategy for a basic science curriculum, such as that of biochemistry, has been to anticipate the current and future needs of students and use a variety of teaching paradigms to bring meaning and excitement to the learning experience. (Smith, H.C., 2002, Journal of Academic Medicine)

APPENDIX F

DESCRIPTION OF PBL STUDY AS
SUBMITTED TOTHE UNIVERSITY
OF NEVADA, LAS VEGAS
PROTOCOL COMMITTEE

University of Nevada, Las Vegas

Description of the Study

Department: Educational Leadership

Title of Study: The Use of Problem-Based Learning in Graduate Departments of Higher Education Administration

Subjects:

The subjects to be surveyed will be both male and female faculty members of colleges and universities which belong to the American Association of Higher Education (AAHE). The faculty members to be surveyed will be teaching graduate courses in higher education administration. Male and female graduate students who are taking courses in higher education administration from these particular faculty members will also receive survey instruments.

Purpose, Methods, Procedures:

The purpose of this study is to determine if faculty are using problem-based learning in curriculums of higher education administration and how they are applying this

methodology when teaching. This study will also compare the effectiveness of problem-based learning to traditional lecture-based learning Another purpose will be to ascertain how graduate students perceive the effectiveness of problem-based learning as a teaching methodology compared to the traditional lecture-based methodology. The research method to be used will be survey instruments which will be multiple-choice answer questionnaires. The surveys will be mailed to the faculty members, who will take the faculty survey and then they will disseminate the student survey to the students in their classes. After completing the surveys, the faculty members will then mail them back to the Cannon Research Center and the data will be analyzed.

Risks:

There is a minimal amount of risk associated with this study. The perceived risk to the faculty members who answer this survey could be their own doubt that they are not using problem-based learning correctly and are confused with the different types of problem-based learning models. This risk has been minimalized, however, as the survey allows the faculty member to select from various models that they use and the questions are generalized to cover various models of problem-based learning instead of the pure model. This is only a discovery study and seeks to understand what models are being used. The risk to the graduate students who answer the survey is minimal and the only discomfort could be the fear associated with the instructor possibly reviewing their answers after the survey is completed which could cause them to select unfavorable answers. This risk will be minimalized by having the instructor ask an assistant to handle the surveys and mail them in a sealed envelope to the Cannon Research Center.

Benefits:

The benefits from this study will help faculty who teach classes in higher education administration determine if problem-based learning is an effective teaching methodology to prepare future university administrators for their future roles as problem-solvers and critical thinkers. The other benefit will be for the students because if the results determine that problem-based learning is an effective teaching methodology, then perhaps other departments of educational leadership can adapt problem-based learning in their curriculums and students will find more success in their professional careers. Society as a whole will benefit because universities will be preparing more qualified graduates to successfully handle management positions, as well as continue to be life-long learners.

Risk-Benefit Ratio:

There is minimal risk involved with this study, however, the benefits will far outweigh the risks. The benefits of the study will allow the researcher to understand the effectiveness of problem-based learning and will allow further research to continue to answer questions about problem-based learning as an alternative teaching methodology.

Costs to Subjects:

The only cost the subjects will incur will be the time to take the survey. The survey time will be 30 minutes for faculty and 20 minutes for the graduate students.

Informed Consent:

The method of obtaining informed consent will be conducted by the Cannon Research Center. They will first obtain consent through direct communication with faculty members employed at institutions of higher education belonging to the AAHE. When sending out the surveys, a letter of informed consent will accompany the survey for each

participant. The researcher will be responsible for obtaining and writing the letter, and Cannon Research Center will be responsible for including the letter with each survey when the surveys are mailed out. The faculty members who participate in the study will be responsible for completing their letters of informed consent and will also be responsible for giving a letter to each of their students who participate in the study. The students will then be responsible for completing the letter of informed consent and giving it to their instructor. The faculty member will be responsible for returning their letter of informed consent as well as their students' letters of informed consent in the mail to UNLV's Cannon Research Center. The informed consent forms will be stored at UNLV's Cannon Research Center for 3 years after completion of the study.

APPENDIX G

COVER LETTERS FOR SURVEYS MAILED
TO GRADUATE STUDENTS
AND FACULTY

University of Nevada, Las Vegas

Department of Educational Leadership

INFORMED CONSENT FOR GRADUATE STUDENTS

General Information:

I am Lisa Ann Edler from the UNLV Department of Educational Leadership. I am the researcher on this project. You are invited to participate in a research study. The study will focus on the effectiveness of problem-based learning as a teaching methodology as used by the instructor in the classroom.

Procedure:

If you volunteer to participate in this study, you will be asked to do the following:

Your instructor will give you a questionnaire and an informed letter of consent. If you agree to participate in the study, you will then be asked to fill out the multiple-choice questionnaire using a No. 2 pencil. You will be asked to read each question thoroughly and then select the answer which you believe best answers the question. Upon

completing the questionnaire, you may then give the survey to your instructor or someone he/she has designated to serve in his/her place and he/she will mail it back to the researcher.

Benefits of Participation:

By participating you will help evaluate the effectiveness of problem-based learning compared to traditional lecture-based learning. Your feedback will be important to determine if problem-based learning is a more effective methodology than traditional lecture-based learning, or if they are both comparable, or if problem-based learning is less effective.

You will also receive an increased understanding of what problem-based learning is and how your instructor uses this methodology in the classroom. You will also be able to assess your style of learning and whether the problem-based learning methodology provides more effective learning for you as a student versus the lecture-based methodology.

Risk of Participation in:

You will experience minimal discomfort in answering these questions as they primarily pertain to curriculum assessment as well as evaluating your learning potential.

Contact Information:

If you have any questions about the study or if you experience harmful effects as a result of participation in this study, you may contact me at my e-mail address which is RLEdler@aol.com or 702-531-0996. For questions regarding the rights of research

subjects, you may contact the **UNLV Office for the Protection of Research Subjects at 895-2794.**

Voluntary Participation:

Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality:

All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for at least 3 years after completion of the study.

Participant Consent:

I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

University of Nevada, Las Vegas

Department of Educational Leadership

INFORMED CONSENT FOR FACULTY

General Information:

I am Lisa Ann Edler from the UNLV Department of Educational Leadership. I am the researcher on this project. You are invited to participate in a research study. The study will focus on the effectiveness of problem-based learning as a teaching methodology compared to the traditional lecture-based methodology.

Procedure:

If you volunteer to participate in this study, you will be asked to do the following:

You will receive a questionnaire and an informed letter of consent, and if you agree to participate in this study, you will then be asked to fill out the multiple- choice questionnaire using a No. 2 pencil. You will be asked to read each question thoroughly and then select the answer which you believe best answers the question. Upon completing the questionnaire, you may then return the survey to the Cannon Research Center at the University of Nevada, Las Vegas. You will also be given questionnaires and informed letters of consent to give to your students to allow them to assess the effectiveness of problem-based learning in the classroom. Please select an assistant to deliver these surveys to the students to protect their confidentiality. The assistant should also be responsible for gathering the surveys and mailing them back to the Cannon Research Center. You may select the time and date you wish your students to complete the surveys.

Benefits of Participation:

By participating you will help evaluate the effectiveness of problem-based learning compared to traditional lecture-based learning. Your feedback will be important to determine if problem-based learning is a more effective methodology than traditional lecture-based learning, or if they are both comparable, or if problem-based learning is less effective.

You will also receive an increased understanding of how different forms of problem-based learning can be used in the classroom. You will be able to assess your methodology of the type of problem-based learning you use and how you are implementing it and assessing it in the classroom.

Risk of Participation in:

You will experience minimal discomfort in answering these questions as they objectively Pertain to teaching methodology, curriculum design and assessment procedures.

Contact Information:

If you have any questions about the study or if you experience harmful effects as a result of participation in this study, you may contact me at my e-mail address which is RLEdler@aol.com or 702-531-0996. For questions regarding the rights of research subjects, you may contact the **UNLV Office for the Protection of Research Subjects at 895-2794.**

Voluntary Participation:

Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your

relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study. All records will be stored in a locked facility at UNLV for at least 3 years after completion of the study.

Participant Consent:

I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

APPENDIX H

COVER LETTERS TO GRADUATE STUDENTS
AND FACULTYWHO VOLUNTARILY
COMPLETED THE SURVEY

A Survey of Problem Based Learning in Higher Education
Graduate Student Survey
COMPLETED SURVEYS CAN BE RETURNED:
VIA EMAIL pgallion@ccmail.nevada.edu
Fax 895-0165 Campus mail: M/S 5008

February 24, 2003

Dear Graduate Student:

This survey is an exploratory survey designed to understand how graduate students feel about problem-based learning (PBL) as a teaching methodology and the usefulness and effectiveness it may have in the classroom and credibility in later professional life. For the purposes of this survey, the term "PBL" embraces a variety of instructional methodologies that focus on addressing "real" problems in higher education administration.

Any information you provide will be held in confidence and your responses will be treated with anonymity. This survey is composed mostly of checklists and will take much less time to complete than it might initially appear to require. The estimated time to complete this survey is fifteen to twenty minutes.

This survey is important to the research I am doing for my doctoral dissertation. It is

intended to clarify the distinction between different forms and uses of PBL. It is also important to you in order to help understand the effectiveness of PBL for the student learner as well as its effectiveness in professions of higher education administration.

I will be more than happy to share the results of this survey in summary form if your name and mailing address are provided voluntarily. Again, thank you for taking the time to contribute to this study.

Sincerely,
Lisa Edler

A Survey of Problem Based Learning in Higher Education
Faculty Survey
COMPLETED SURVEYS CAN BE RETURNED:
VIA EMAIL pgallion@ccmail.nevada.edu
Fax 895-0165 Campus mail: M/S 5008

January 28, 2003

Dear Faculty Member:

Recently we contacted you about a project we are doing to assist a doctoral candidate who is collecting data for her dissertation on the use of Problem-Based Learning (PBL) in higher education. At that time, you agreed to accept the survey and give a copy of the student survey to some of your graduate students to fill out. Enclosed, please find two separate surveys, one for you to complete, and several for your graduate students to complete. Separate envelopes have been included for the return of each of the survey instruments.

Please be assured that all of your answers will be kept strictly confidential and entered into a data base without recording names or numerical code found on the faculty survey. The code on the faculty survey is for mailing purposes only. Your responses will not be linked to you, nor will your students' responses be linked to you. As you can see, the survey for the graduate student does not have a code on it. Further, the results will only be reported in the aggregate.

Thank you for your consideration and timely response to this survey.

Sincerely,

Pam Gallion
Survey Manager

A Survey of Problem Based Learning in Higher Education
Faculty Survey
COMPLETED SURVEYS CAN BE RETURNED:
VIA EMAIL pgallion@ccmail.nevada.edu
Fax 895-0165 Campus mail: M/S 5008

February 26, 2003

Dear Faculty Member:

The attached questionnaire seeks data on how faculty define Problem-Based Learning (PBL) and use it in the classroom. For the purposes of this survey, the term "PBL" will take into account a variety of forms of this type of methodology. Any information you provide will be held in confidence and your responses will be treated with anonymity. This survey is composed mostly of checklists and will take much less time to complete than it might initially appear to require. The estimated time to complete this survey is twelve minutes.

This survey is important to the research I am doing for my doctoral dissertation. It is intended to clarify the distinction between different forms and uses of PBL. With your help, I believe it can lead to a meaningful contribution to the professional literature.

I will be more than happy to share the results of this survey in summary form if your name and mailing address are provided voluntarily. Again, thank you for taking the time to contribute to this study.

Sincerely,

Lisa Edler

APPENDIX I

WRITTEN SURVEYS: GRADUATE STUDENT SURVEY
AND FACULTY SURVEY AT INSTITUTIONS
OF HIGHER EDUCATION IN GRADUATE
DEPARTMENTS OF HIGHER
EDUCATION

A Survey of Problem Based Learning in Higher Education
Graduate Student Survey
COMPLETED SURVEYS CAN BE RETURNED:
VIA EMAIL pgallion@ccmail.nevada.edu
Fax 895-0165
Campus mail: M/S 5008

Please use a check mark to reflect your response to each item below.

Section I: Demographic Information (please check one answer only unless instructed otherwise)

1. I am working towards a: ______Master degree ______ Doctoral degree

2. The degree specialty will be:

 ______ Higher Education Administration

 ______ Student Services

 ______ Other (specify) ____

3. Age: _____ 20 to 25 years _____ 25 to 30 years ______ 30 to 35 years

 ______ 35 to 40 years ______ 40 years and older

4. The number of courses I have taken that have utilized the problem-based learning (PBL) approach are:

 ______ one ______ two to three _______ three to five _______ more than five

5. The types of courses that I have taken that used PBL are *(may check more than one):*

 _______ Administration ______ Foundations _______ Finance _______ Law

 _______ Teaching Methods ______Organizations/Leadership

 ________ Student Service _______Other (specify) ___________________________

Section II: Problem-Based Learning

6. The advantages I perceive from participating in courses that have employed PBL are *(may check more than one answer):*

   ________ Ability to apply knowledge, based on learned theories, in day-to-day administrative practices.

   ________ Development of general problem-solving skills

   ________ Appreciation of readiness to handle on-the-job responsibilities resulting from exposure to PBL

   ________ Development of lifelong learning skills

   ________ Other (please specify) ____

7. The training I received in how to use PBL in the classroom was:

   ________ None – I had to guess as I went along

   ________ Minimal – there was a brief introduction to PBL at the beginning of the course (first class) by the professor

   ________ Moderate – I had some training during the first two to three classes of the course by the professor

   ________ Extensive – I was thoroughly grounded in the methods of PBL through a seminar or series of training sessions sponsored by my department

8. The type of PBL I experienced in my course(s) was:

   ________ Lecture-based cases – students are presented with information through lectures and then case material is used to demonstrate that information.

   ________ Case-based lectures – students are presented with case histories or vignettes before a lecture that then covers relevant material.

   ________ Case method – students are given a complete case study that must be researched and prepared for discussion in the next class.

   ________ Modified case-based – students are presented with some information and are asked to decide on the forms of action and decisions they may make. Following their conclusions, they are provided with more information about the case.

   ________ Discovery – students are presented with a macro problem within which there are multiple smaller problems that students must address. Students construct their knowledge of education practices by working their way through the various problems.

   ________ Closed-loop problem-based – this is an extension of the discovery method where students are asked to consider the resources they used in the process of problem-solving in order to evaluate how they may have reasoned through the problem more effectively.

   ________ Other (please specify) ____

9. While participating in a PBL course, as compared with courses using more traditional methods, I discovered (may check more than one answer):

_______ I was/am more motivated

_______ I was/am better prepared to handle problem situations

_______ I was/am more capable of leadership responsibilities

_______ That working as a team to solve problems is valuable

_______ I am able to apply what I have learned to "real" problems.

_______ I was/am a more self-directed learner.

_______ Other (please specify) ____

10. I feel that lecture-based traditional learning when compared to PBL is:

_______ Equally as effective ________ Less effective _________ More effective

11. When comparing PBL to more traditional methods of instruction, I have found PBL *(may check more than one answer):*

________ Offers more critical thinking

________ Offers the same amount of critical thinking

________ Offers a lesser amount of critical thinking

________ Provides more opportunities to solve real-life problems

________ I was/am able to use my on- the-job experiences when solving PBL models in class

_______ I was/am able to use my previous knowledge in education when solving PBL models in class

________ Reinforces self-directed learning more effectively

________ Allows for more discovery of theories and knowledge and application of both

________ Provides more opportunity for in-depth thinking and understanding

12. During the term, the amount of time that the professor lectured or employed other than PBL strategies was _______% (please fill in percent and select either:) More ____ or Less______

13. Compared with other instructional approaches I have experienced, the expectations in PBL courses were:

________ Higher ________ About the same ________ Lower

14. Any frustration(s) I felt when working in a PBL class were due to *(may check more than one answer):*

_________ Confusion – it was difficult to understand what the professor wanted because I was expected to find my own answers

_________ Stress – it was hard to work within limited time constraints or deadlines for completion

_________ Inappropriateness of assignment - the problem the professor selected did not fit the course material

_________ Isolation – I had to discover learning on my own with little guidance or assistance

_________ Poor group cohesion – when groups or cooperative learning occurred, the group I was in did not cooperate which was an unpleasant experience

_________ There were no frustrations to speak of in PBL

_________ Other (please specify) ____

15. Comparing a PBL course to other more traditional approaches, the professor spent:

_________ More contact hours with students _________ Less contact hours with students

_________ About the same amount of contact hours with students

16. When comparing learning about theories and models, as well as knowledge content, I:

_______ Learn more from a PBL course than courses that are more traditional

_______ Learn less from a PBL course than courses that are more traditional

_______ Learn about the same in a PBL course than courses that are more traditional

17. Compared to more traditional courses, I discovered the advantages of PBL have been *(may check more than one answer):*

_______ More involvement with my own learning

_______ Better problem-solving skills

_______ Became a self-directed learner

_______ Better knowledge retention skills

_______ Better mastery of course material and theories

_______ Experienced no difference at all when compared to more traditional course methodologies

_______ Other (please specify) ____

18. Compared to more traditional courses, the disadvantages of PBL courses have been *(may check more than one answer):*

_______ More time-consuming – takes more student time and dedication

_______ Less choice in working independently or in groups

_______ More difficulty in applying concepts globally – to see where everything fits and connects

_______ Less structured and thus more ambiguous objectives

_______ Students are forced to think on their own and so cannot simply memorize and regurgitate as in other courses

_______ Less adaptable as to strict time constraints and thus amenable to time management schedules

_______ Other (please specify) ____

19. If offered the opportunity to take a future PBL course, I would:

_______ Definitely elect to do so _______ Probably elect not to do so

_______ Probably elect to do so _______ Do so only if required.

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Faculty Survey
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VIA EMAIL pgallion@ccmail.nevada.edu
Fax 895-0165
Campus mail: M/S 5008

Section 1: Demographic information

1. The institution I work for is classified as:
   - o Research Extensive
   - o Research Intensive
   - o Comprehensive Doctoral
   - o Comprehensive Non-Doctoral

2. I have taught courses in the area of higher education for:
   - o 1 to 8 years
   - o 5 to 10 years
   - o 10 to 20 years
   - o 20 years or more

3. The types of courses that I teach are: (select all that apply)
   - o Foundation
   - o Finance
   - o Organization
   - o Law
   - o Student Services
   - o Other ____________________

4. I have never used PBL or a form of PBL in teaching:
   - o Never
   - o 1 or 2 years
   - o More than 2 years

(if you answered never to #4, stop and return the questionnaire in the envelope provided.)

Section 2: Problem-Based Learning

5. The definition of Problem-Based Learning that i utilize when teaching is: (select only one)
   - ❑ Lecture-based cases – students are presented with information through lectures and then case material is used to demonstrate that information.
   - ❑ Case-based lectures – students are presented with case histories or vignettes before a lecture that then covers relevant materials.
   - ❑ Case-method -- students are given a complete case study that must be researched and prepared for discussion in the next class.
   - ❑ Modified case-based – students are presented with some information and are asked to decide on the forms of action and decisions they may make. Following their conclusions, they are provided with more information about the case.
   - ❑ Discovery – students are presented with a macro problem within which there are multiple smaller problems that must be addressed. Students construct their knowledge of education practices by working their way through the various problems.
   - ❑ Ciose-loop problem-based – this is an extension of the discovery method where students are asked to consider the resources they used in the process of problem solving in order to evaluate how they may have reasoned through the problem more effectively.

6. In using PBL, I structure the assignments to be completed:

   - By each student working independently
   - By students working in small groups of three to five
   - By students working in group of six or more
   - Other (specify) ____

7. The amount of time I spend in designing and preparing my curriculum when using PBL compared to the amount of time I previously used with other methods is: __________% (fill in percent)

7a. Is the percentage of time spent on designing and preparing a curriculum using PBL more or less compared to time spent previously with other methods?

   - More time
   - Less time

8. I chose to use PBL or a version of PBL as my teaching method because (may select more than one):

   - Students were not learning or responding to lectures.
   - Students were not successfully applying educational theories in coursework or exams.
   - I prefer using the constructive or "hands on" approach.
   - I prefer being a facilitator/coach versus other roles.
   - I wanted to challenge students and increase critical thinking skills.
   - I want to challenge students to develop problem-solving skills.
   - I feel students will be better prepared in professional positions.
   - I feel students can apply educational theories more readily in real-life situations.
   - I want students to receive a more in-depth education.
   - I want students to assume ownership for their learning.
   - Other (specify) ____

9. Administrative support for implementing PBL in my curriculum has been:

   - Strong
   - Ambivalent
   - Unconcerned
   - Resistant

10. Colleague support for implementing PBL in my curriculum has been:

   - Strong
   - Ambivalent
   - Unconcerned
   - Resistant

11. When trying to find appropriate PBL problems, I (may select more than one):

    - Write my own problems based on my previous experience.
    - Use outside resources, i.e. the internet, Chronicle of Higher Education, and other publications.
    - Use problems from other university programs.
    - Have a formal curriculum committee design problems.
    - Belong to a faculty committee that designs the problems.
    - Have purchased a "PBL" program from (specify): ______________________________
    - Other (specify) ____

12. The challenge of using PBL has been (may select more than one):

    - It is time consuming.
    - It is cost prohibitive.
    - Finding and implementing problems that are authentic, engaging, and contemporary.
    - Feeling a lack of colleague support.
    - Having to address teamwork issues or interpersonal conflicts among students.
    - Having less control over what students have internalized regarding learning objectives and knowledge.
    - Other (specify) ____

13. At the beginning of a course, I introduce the PBL process by (may select more than one):

    - Verbally describing PBL, its elements, its merits, and the format that will be used.
    - Presenting a PBL scenario and working through it as an in-class experience.
    - Other (specify) ____

14. I assess the performance of students in my PBL course through grading of (may select more than one):

    - Oral group presentations
    - Self and peer assessments by students
    - A final written report by each student
    - A combination of a final written report and a group oral presentation
    - A comprehensive final exam taken by each student on the problem area
    - Other (specify) ____

15. I see results using PBL in the following ways (may select more than one):

- o Students perform better on their master and/or doctoral comprehensive or preliminary exams.
- o Former students, who are practitioners report resolving "real" problems in their professions.
- o Students are better able to retain and/or recall information.
- o Students are better able to effectively apply content of what they have learned.
- o Students show they know how to work more cooperatively in teams.
- o Students demonstrate they are better able to solve practical problems.
- o Students become self-directed learners.
- o Graduate student dissertations are often developed into a PBL project.
- o Master thesis/doctoral dissertations are more comprehensive.
- o Other (specify) ____

16. I have been disappointed with PBL because (may select more than one):

- o Too time consuming to implement.
- o Difficult to find time to balance teaching and research.
- o Too expensive to implement.
- o Lack of colleague interest.
- o Lack of colleague commitment.
- o Lack of administrative interest.
- o Insufficient research and/or development on PBL.
- o Within the time constraints of a course, balancing time needed for teaching and for problem-solving is difficult.
- o Finding assessment methods that match the learning outcomes sought in PBL.
- o Difficult to measure if PBL is more effective than traditional methods for graduate students in higher education administration.
- o Other (specify) ____

17. I believe that PBL is:

- o Here to stay
- o Will most likely fade from use over time
- o Here to stay, but will be modified and improved over time

18. Please record your gender: _____ Male _____ Female 19. Please indicate your age: _____

If you would like to attach an example of a lesson plan from one of your classes, a "problem" or a "case study", and an example of an examination, please return it with this survey. Thank you.

APPENDIX J

EXAMPLES OF A PBL CURRICULUM IN
A STUDENT SERVICES GRADUATE COURSE

INTRODUCTION TO STUDENT SERVICES
07C:330 – Fall 2000
Tuesdays and Thursdays, 1:05-2:20

Instructor: Professor C

Catalog Description: 3 cr. History, philosophy, overview of student services in higher education; review of standards and ethics; emphasis on institutional cultures, student trends.

Course Objectives: The primary objective of this course is to introduce students to the work of student services in postsecondary settings in this country. In this course students will:
(1) gain an understanding of the historical development of higher education in the United States in general, and student affairs work in particular;
(2) become familiar with the values, philosophical commitments, and standards underlying student affairs work;.
(3) become familiar with the purpose, organization, and functions of various student services, and understand their relationship to the academic mission of higher education;
(4) gain an understanding of the internal and external factors influencing student affairs work;
(5) be introduced to the scholarly research upon which student affairs practice is based;
(6) develop a beginning sense of yourselves as student affairs professionals;
(7) develop skills of critical analysis, problem-solving, synthesis, and communication (written and oral)
(8) develop your ability to work as part of a team to solve a complex ill-structured problem.

Required Texts and Readings:
Komives, S. & Woodard, D (1996). *Student Services: A Handbook for the Profession. (3rd Ed.*. San Francisco: Jossey-Bass.

A variety of books, articles, and Internet resources that you will locate as you work inyour problem-solving groups. I will give you a beginning bibliography when your problem is assigned.

Course Requirements:
This course will be taught primarily using a pedagogy called "Problem-Based Learning" or PBL. A complex, ill-structured, but realistic problem is the centerpoint of a PBL class. The "content" of the class will be created by the students and the instructor (and other experts if desired) as it is needed to solve the central problem of the course. In other words, when you, as problem-solvers decide that you need information, you, with my help as instructor, will go in search of the content you need. For this class, you will be assigned to a group that will be given a complex, ill-structured problem from the realm of student affairs work. As a group, you will call on your previous experience and knowledge, the knowledge of the instructor, resources from the library, experts from campus (or nationally or internationally if you prefer) to help you solve this problem.

In traditional courses, I, as instructor, would tell you what you need to learn in this class. In this PBL class, you will tell me what you need to learn in order to solve the problem I have presented to you. This will require active learning on your part. However, I believe this form of learning better represents the type of learning you will encounter outside of formal academic classrooms. The pedagogy of this class will support you to develop "life-long learning" skills that you can draw upon after your formal educational experience is complete.

A crucial aspect of your participation in this class will be your role as an active agent in the process of generating knowledge. We all come from our own particular positions, both within and outside the university, before and beyond our experiences here. As a class comprised of many individuals from diverse backgrounds and experiences, we owe each other respect, courtesy, and active engagement with the cooperative work we are doing.

1) Participation. The most important assignment for this course is a group problem-solving assignment. You are expected to actively participate and fully contribute to the group assignment. You will be graded by, and in turn grade, all member of your group. Please take this evaluation seriously. You will be asked to provide numerical assessments as well as written comments. Your comments will be kept confidential and will not be made available to the individual you are assessing. If, however, the comments of your group can be used to constructively assist a group member with improving their future performance in work groups or as a professional, the instructor may share an amended summary of the evaluations with the student in question. In addition, if your peers in your group find you to be non-cooperative, slacking off, or disrespectful of others work, they may initiate a process to fire you from the group. If you are fired from your group it will have serious consequences for your grade in this class. I will not require you to attend class. However, since most classes will have time set aside for group work, your group's assessment of your participation may be affected by skipping a large number of classes. We will complete group participation assessments on **12/ 7**.

2) Personal statement of your philosophy of student affairs practice. For this assignment you will write a short paper (no more than 4 pages, typed, double-spaced)

describing and discussing your philosophy of student affairs work. In most circumstances, this paper will be a reflection on your own life experiences and beliefs and will not reference the scholarly literature (unless the literature truly expresses your viewpoint.) Due **9/12**.

3) Journal. Most of the work for this class will be done within your assigned groups. I will probably view only a small part of the activities that you will be involved in as you engage in the learning process in this group. In order to increase my awareness of your activities, I am asking you to keep a journal of your activities, readings, and research in relation to this class. This journal will provide me with a glimpse of the type of work that you personally invest in this project. You can keep this journal in any format you wish, however, I would suggest making brief entries anytime you do reading, browse the web, look up information in the library, visit an "expert" to gather information, or meet with your group (including meetings during class). Also note frustrations and problems that you encounter as you work through your group problem. Please also include notes regarding your perspective on how the group is functioning and why. These journals will be turned in to me on three separate occasions. Due **10/5, 10/19, and 12/7**.

4) Student Services Problem. This a group problem. It is nearly impossible to complete this assignment without the cooperation and participation of all group members. You will be graded on how you achieve a solution to this problem as a group. The problem for this class if complex and ambiguous. I will lead the groups through this problem in stages. (This is called progressive disclosure). Before we move on to a new stage of the problem, I will ask each group to submit a draft of the work that has so far been completed. Draft proposals will be due **10/10 and 10/24**.

In addition, each group will present their finished solution to the problem in two ways: a group presentation to a panel of experts and a final written proposal.

4a) Presentation. Your group's solution to the Student Services Problem will be presented to the class and to a panel of experts during class on **11/28 or 11/30**. This presentation should be completed in a professional manner using a software package such as Microsoft Powerpoint. (We will meet in a setting that will provide the technology necessary for this type of presentation.) Your presentation does not need to address all the aspects of your proposal, rather, it should present the main points of your proposal, with enough detail included so that our panel can make reasonable judgments regarding your program's overall purpose, creative and unique elements, comprehensiveness, and feasibility.

4b) Written Proposal. You will submit a written proposal for your student services problem due **12/12.** You may choose to turn in a group proposal or an individually written proposal. Group proposals should clearly indicate 1) the original members of the group and 2) the group authors who wish to have their proposal graded together.

Individual proposals should clearly indicate 1) the original members of your group and 2) that you have individually authored your proposal and wish it to be evaluated as such.
5) Reading: I will require very few readings for this course. However, in order to accomplish successfully your group assignment, you will need to pursue reading outside the class reading list.

Final Grades:

The approximate weighting of the above requirements into your final grade is:

Participation (As evaluated by your peers)	20%
Philosophy Statement	10%
Journal	10%
Student Services Problem	60%
Preliminary Draft Proposals -- 1/3 of 60% or 20% of overall grade	
Group Presentation -- 1/3 of 60% or 20% of overall grade	
Written Proposal -- 1/3 of 60% or 20% of overall grade	
Total	100%

Course Schedule

WEEK	Date	Topics	Assignments	Due dates and Misc.
Week 1	8/22 8/24	Introductions A discussion of Teaching and Learning	Majors	
Week 2	8/29 8/31	History of US Higher Education History of Student Affairs	KW: Chp 1 Levine and Nidiffer KW: Chp 2	
Week 3	9/5 9/7	Philosophy of student affairs practice Ethics	KW: Chp 5, Student Learning Imperative (Web) KW: Chp 6, 7 and Appendices A and B	
Week 4	9/12 9/14	Asessments PBL Assignments		Personal statement of your philosoph y of student affairs due 9/12
Week 5	9/19 9/21	PBL	Readings assigned as needed for class	
Week 6	9/26 9/28	PBL		
Week 7	10/3 10/5	PBL		Journals due 10/5
Week 8	10/10 10/12	Progressive Disclosure 1		Preliminar y Draft Proposal 1 due 10/10

Week 9	10/17	PBL	
	10/19		Journals due 10/19
Week 10	10/24 10/26	Progressive Disclosure 2	Draft Proposal 2 due 10/24
Week 11	10/31	NO CLASS	
	11/1	PBL	
Week 12	11/7	PBL	
	11/9		
Week 13	11/14	Practice presentations	
	11/16	Practice presentations	
Thanks-giving	11/21 11/23	NO CLASS	
Week 14	11/28	Group Presentations	Presenta-tions
	11/30	Group Presentations	
Week 15	12/ 5	Presentation Debrief	
	12/7	End of Term Assessment	Journals Due 12/7
Finals	12/12		Final Proposals due 12/12

BCE 520 Student Personnel Work in Higher Education II --Theory into Practice*

(*note: for the purposes of this class, I have created a fictional VP of Student Affairs, name Dr. Jones)

Multicultural Community Problem

This a group problem. It is nearly impossible to complete this assignment without the cooperation and participation of all group members. You will be graded on how you achieve a solution to this problem as a group.

Background:

In 1965, Vivian Malone became the first African American graduate of the University of Alabama. Prior to Ms. Malone's enrollment, the University had been the site for social, political, and sometime violent confrontations over race. Today, 13.4% of undergraduates and 8.6% of the graduate students enrolled at the University of Alabama are African American. Another 1% of undergraduates are Hispanic American or Asian American. International students comprise 3% of the undergraduate population.

In 1997, President Andrew Sorensen proposed five strategic directions to serve as focal points for development and planning at the University of Alabama. One of the five areas that was to receive attention was "enhancing the Diversity of our University community". Several of the specific objectives (see attached summary for details of the current status of this strategic direction) outlined within the "increasing diversity" initiative have implications for the division of student affairs on this campus. Many of the objectives would suggest a partnership between academic and student affairs personnel.

The Context:

As the VP for Student Affairs, Dr. Jones has charged your committee with the task of developing a proposal for a multicultural initiative at the University. Dr. Jones has encouraged you to think of this initiative as one that will bridge across the division of Student Affairs, but that will also forge strong reciprocal connections to the division of Academic Affairs. In other words, while you are staff members in the Division of Student Affairs, for this particular project you have been encouraged to think "campus-wide." Dr. Jones has also noted that the final objective of the "increasing diversity" strategic directive seeks to establish relationships with Stillman College and the greater Tuscaloosa community. She mentions that she believes that these ties should also include Shelton State CC and other community colleges in the vicinity.

In addition, Dr. Jones is known for her strong stance on program development. All Student Affairs staff members know that Dr. Jones encourages both theoretical and research-based justifications for programming directions. She is much more likely to provide resources for a proposal that presents a strong theoretical and/or research-based argument.

Dr. Jones has charged your committee with developing this strategic initiative by the end of Spring semester. She has also encouraged your committee to be creative – thinking outside normal institutional structures – if that will best serve the purpose of "enhancing diversity." While she has not specifically given you a target budget, she has agreed to provide you with a ballpark figure after a university budget meeting next month.

The Problem:

Devise a comprehensive curricular and co-curricular organizational structure to serve as the focus for multicultural activities at the University of Alabama. Submit a written proposal for an organizational structure to be initiated in Fall 2001. This proposal must address the following issues:

A. A vision or philosophy statement for your program
B. The theoretical basis for your plan
C. A summary of research that supports your design (complete citations required)
D. Coordination of academic and student affairs aspects of the program
E. Working relationships of constituent groups
F. Sample plan of programs and activities for one year.
G. Hiring and Training of Professional and/or Student Staff
H. A reasonable budget for one year.
I. An Assessment Plan

	Suggested Deadlines
1/24	Receive statement of the problem and group assignment
1/31	
2/7	
2/14	Analysis of the institutional environment. Chose base theory/theories.
2/21	Written mission or philosophy statement. Summary of previous research to support program design.
2/28	
3/6	Basic plan for curricular and co-curricular elements. Draft of sample programming for year one. Assessment plan.
3/13	Analysis of constituent groups. Draft Organization chart.
3/20	Present staffing plan. Outline staff hiring and training.
3/27	*Spring Break -- Enjoy!*
4/3	Draft Budget
4/10	
4/17	**Group Presentations**
4/24	Class evaluations
5/1	**Written Proposal due**

EDLD 535
STUDENT SERVICES
Spring 2003
Wednesdays 6:10-9:00pm

Catalog Description: 3 cr. The current philosophical, organizational and programmatic concepts in student services are examined as are a wide variety of student services professions. Studen affairs professionalism, ethics, legal issues and organizations are also studied.

Course Objectives: The primary objective of this course is to introduce students to the work of student services in postsecondary settings in this country. In this course students will:
(1) gain an understanding of the historical development of higher education in the United States in general, and student affairs work in particular;
(2) become familiar with the values, philosophical commitments, and standards underlying student affairs work;
(3) become familiar with the purpose, organization, and functions of various student services, and understand their relationship to the academic mission of higher education;
(4) gain an understanding of the internal and external factors influencing student affairs work;
(5) be introduced to the scholarly research upon which student affairs practice is based;
(9) develop a beginning sense of yourselves as student affairs professionals;
(10) develop skills of critical analysis, problem-solving, synthesis, and communication (written and oral);
(11) develop your ability to work as part of a team to solve a complex ill-structured problem.

Required Texts and Readings:
Barr, M. J. and Associates (2000). *The Handbook of Student Affairs Administration. (2nd Ed.*. San Francisco: Jossey-Bass.
Reserve Readings
A variety of books, articles, and Internet resources that you will locate as you work in your problem-solving groups.

Course Requirements:
This course will be taught primarily using a pedagogy called "Problem-Based Learning"or PBL. A complex, ill-structured, but realistic problem is the center point of a PBL class. The "content" of the class will be created by the students and the instructors (and other experts if desired) as it is needed to solve the central problem of the course. In other words, when you, as problem-solvers decide that you need information, you, with the help of the instructors, will go in search of the content you need. For this class, you will be assigned to a group that will be given a complex, ill-structured problem from the realm of student affairs work. As a group, you will call on your previous experience and knowledge, the knowledge of the instructors, resources

from the library, experts from campus (or nationally or internationally if you prefer) to help you solve this problem. In traditional courses, instructors tell you what you need to learn in this class. In this PBL class, you will tell us what you need to learn in order to solve the problem we have presented to you. This will require active learning on your part. However, we believe this form of learning better represents the type of learning you will encounter outside of formal academic classrooms. The pedagogy of this class will support you to develop "life-long learning" skills that you can draw upon after your formal educational experience is complete.

A crucial aspect of your participation in this class will be your role as an active agent in the process of generating knowledge. We all come from our own particular positions, both within and outside the university, before and beyond our experiences here. As a class comprised of many individuals from diverse backgrounds and experiences, we owe each other respect, courtesy, and active engagement with the cooperative work we are doing.

1) **Participation**. The most important assignment for this course is a group problem-solving assignment. You are expected to actively participate and fully contribute to the group assignment. You will be graded by, and in turn grade, all member of your group. Please take this evaluation seriously. You will be asked to provide numerical assessments as well as written comments. Your comments will be kept confidential and will not be made available to the individual you are assessing. If, however, the comments of your group can be used to constructively assist a group member with improving their future performance in work groups or as a professional, the instructors may share an amended summary of the evaluations with the student in question. In addition, if your peers in your group find you to be non-cooperative, slacking off, or disrespectful of others work, they may initiate a process to fire you from the group. If you are fired from your group it will have serious consequences for your grade in this class. We will not require you to attend class, however, since most classes will have time set aside for group work, your group's assessment of your participation may be affected by skipping a large number of classes. We will complete group participation assessments on **4/ 30**.

2) **Personal statement of your philosophy of student affairs practice.** For this assignment you will write a short paper (no more than 4 pages, typed, double-spaced) describing and discussing your philosophy of student affairs work. In most circumstances, this paper will be a reflection on your own life experiences and beliefs and will not reference the scholarly literature (unless the literature truly expresses your viewpoint.) Due **2/12**.

3) **Journal.** Most of the work for this class will be done within your assigned groups. The instructors will probably view only a small part of the activities that you will be involved in as you engage in the learning process in this group. In order to increase our awareness of your activities, we ask that you keep a journal of your activities, readings, and research in relation to this class. This journal will provide us with a glimpse of the type of work that you personally invest in this project. You can keep this journal in any format you wish, however, we suggest that you make brief entries anytime you do

reading, browse the web, look up information in the library, visit an "expert" to gather information, or meet with your group (including meetings during class). Also note frustrations and problems that you encounter as you work through your group problem. Please also include notes regarding your perspective on how the group is functioning and why. These journals will be turned in on three separate occasions. Due **2/19, 3/12,** and **4/9**.

4) **Student Services Problem**. The problem for this class is complex and ambiguous. This is a group problem. It is nearly impossible to complete this assignment without the cooperation and participation of all group members. You will be graded on how you achieve a solution to this problem as a group. Draft proposals will be due **3/5 and 4/9**.

In addition, each group will present their finished solution to the problem in two ways: a group presentation to a panel of experts and a final written proposal.

4a) Presentations. You will present a draft of your presentation to the class and a panel of faculty and staff on 4/23. This practice session will afford you the opportunity to receive constructive feedback to improve your presentations in preparation for the public presentation of your work. Your group's solution to the Student Services Problem will be presented in a public forum where campus faculty and administrators (including President Gamble) will be invited at 4pm on Wednesday **4/30**. Your presentations should be completed in a professional manner using appropriate visual aids. (We will meet in a setting that will provide the technology necessary for this type of presentation.) Your presentation does not need to address all the aspects of your proposal; rather, it should present the main points of your proposal, with enough detail included so that our guests can make reasonable judgements regarding your program's overall purpose, creative and unique elements, comprehensiveness, and feasibility.

4b) Written Proposal. You will submit a written proposal for your student services problem due **5/7.** You may choose to turn in a group proposal or an individually written proposal. Group proposals should clearly indicate 1) the original members of the group and 2) the group authors who wish to have their proposal graded together. Individual proposals should clearly indicate 1) the original members of your group and 2) that you have individually authored your proposal and wish it to be evaluated as such.

Final Grades:

The approximate weighting of the above requirements into your final grade is:

Participation (As evaluated by your peers)	20%
Philosophy Statement	10%
Journal	10%
Student Services Problem	60%
Preliminary Draft Proposals -- 1/3 of 60% or 20% of overall grade	
Group Presentation -- 1/3 of 60% or 20% of overall grade	
Written Proposal -- 1/3 of 60% or 20% of overall grade	
Total	100%

Schedule of Readings:

1/15	History of Student Services **Introduction to PBL**	BARR, Chp. 1: pp. 3-24
1/22	Campus Environments	BARR, Chp. 2-6: pp. 25-118
1/29	Philosophical and Theoretical Foundations **Introduction to Semester Problem, SWOT Analysis, Strategic Planning**	BARR, Chp. 13: pp 231-249; Young, R. B. *Guiding Values and Philosophy* **On Reserve;** *Principals of Good Practice for Student Affairs* **On Reserve or at http://www.naspa.org/resources/principles.cfm**
2/5	Legal and Ethical Issues	BARR, Chp. 19 & 22: pp 347-376 & 410-424
2/12	Using Research **MSU Retention**	BARR, Chp. 16: pp. 285-310
2/19	**PBL Problem-solving**	TO BE ASSIGNED
2/26	Connection to Academics	BARR, Chp 23: pp. 425-452 *Student Learning Imperative* **On Reserve**
3/5	**PBL Problem-solving**	TO BE ASSIGNED
3/12	SPRING BREAK	
3/19	Budgets and Fiscal Issues	BARR, Chp 18: pp. 327-346; UPBAC website at http://www.montana.edu/upba/index.html
3/26	**PBL Problem-solving**	TO BE ASSIGNED
4/9	**PBL Problem-solving**	TO BE ASSIGNED
4/16	Professional Development	BARR Chp. 25-28: pp. 475-553
4/23	**PBL Practice Presentations**	

4/30	**PBL PUBLIC PRESENTATIONS**	
5/7	**PBL FINAL PROPOSAL DUE**	

EDLD 535
Student Services
Spring 2003

Student Services Problem

(For the purpose of this assignment, fictional names have been used)

Background

In AY 2001-02, President Miles announced to the university community her strategic concepts and top priorities for the university strategic and budget planning process.

Strategic Concepts

- Given its vision and mission statement, University A should continue to plan and allocate resources to sustain and achieve excellence within its undergraduate and graduate programs. It is recognized that excellence must be defined and understood within the specific contexts and roles that our various programs have in fulfilling University A's mission.
- University A can achieve national prominence as a student-centered, "research-intensive" land grant university that is devoted to undergraduate education. An essential step in achieving this goal is the integration of research, scholarship, and creative work throughout the undergraduate educational experience.
- University A can capitalize on its unique location to improve its recruitment of students, faculty, and staff and to attract additional resources.

Priorities

- The three previously identified priorities (from FY 03) will remain priorities for the next biennium. These are as follows. Recruitment. In this priority area emphasis will be placed on: (1) enhancing student recruitment efforts; (2) expanding the graduate student population; (3) increasing student scholarships and fellowships at both the undergraduate and graduate levels; (4) increasing access to university programs both on campus and throughout the state. **Retention. In this priority area emphasis will be placed on: (1) improving the university's overall rate of retention; (2) fulfilling student interests/preferences for specific academic programs; (3) sustaining increased enrollment; (4) recognizing enrollment growth in specific academic programs.** Quality Enhancements. The emphasis here will be on: (1) sustaining and enhancing the quality of our academic offerings; (2) supporting the development, retention, and recruitment of high quality, dedicated faculty, staff, and administrators; and 3) sustaining and enhancing the quality of our physical and technological infrastructure.
- In addition, UPBAC adopts the following priorities. (1) Raise the academic profile of University A via recruiting, increased retention, and marketing. These

steps may increase the selectivity of University A. (2) Enhance the relationship between University A and University B with the goal of expanding the scope of COT programs offered at University A.

These five priorities constitute the key focal points for consideration as the university engages in strategic planning and budget development at University A.

One of the five areas highlighted by the president includes a new focus on retention. At this point in time there is no comprehensive plan for retention at University A that addresses student retention through graduation.

Context

As the president of University A, Dr. Miles has charged your committee with the task of developing a comprehensive plan for retention for the university.

University A
Retention Management Council

Presidential Statement:

Land-grant institutions like University A have a long tradition of being very successful in affording access to higher education for a broad range of students. Indeed, University A has had a great impact on the creation of higher education opportunities for its citizens. In contrast to this however, University A has not been equally efficacious in keeping those students in school and bringing them to graduation. *Access* has not always meant *success* for many of University A's students. When you consider the retention and graduation rates at our university, we hold up fairly well against our peer institutions. This is not good enough. Quantitative accountability measures focusing on retention and graduation rates are not enough to convince a discerning public that this institution is fulfilling its mission. We have an obligation to move beyond student access and focus on student success at University A. Toward this end, it is imperative that University A develop a comprehensive plan for retention that addresses one of the institutions top priorities—retention of students through graduation.

Student access and success are key components of University A's mission and we must create an infrastructure that supports this rhetoric. Developing a comprehensive plan for retention is critical to the process of changing campus culture and converting access to success is one of the keys to accomplishing this task. To be successful in our retention endeavors, University A will need to focus on strategies effecting institutional change. This change cannot be achieved by superficial means. It will require the development of a plan that outlines the university's philosophy of student success. Retention and student success are synonymous concepts. In our philosophy of student retention and success, retention does not mean lowering standards—it means raising them.

Retention and success
- Begin and end with a focus on the individual student;
- Are not the end goals—they are the direct result of student accomplishment; and
- Are a campus-wide responsibility.

Campus synergy is the key to maximizing the impact of our efforts—the whole is greater than the sum of its parts.

Charge:

President Miles has charged the Retention Management Council to develop and oversee the implementation of a comprehensive plan for retention at University A. This group will:
1. Develop a comprehensive university retention plan;
2. Oversee implementation of the plan;
3. Communicate the activities of the retention management council to the entire campus on a regular basis; and
4. Prepare an annual retention progress report to the president.

Membership:

The Retention Management Council comprises representatives from a wide range of campus stakeholders including student, parent and faculty organizations.

<u>Chair or Co-Chairs</u>

<u>Members</u>

Dean
Department Head
Faculty
Professional Staff
Student Affairs Representative
Classified Staff
Students (2)
Parent

Responsibilities:

In addition to the general charge presented above, the council will need to attend to four specific tasks:

1. Establishing retention priorities (examples include setting persistence goals; quality service goals, etc…);
2. Integrating retention goals with institutional programs and services;
3. Assessing and evaluating retention outcomes; and
4. Preparing realistic retention timelines (examples include a short-term plan, three-year action plan, resource allocation plan, etc…).

In addition to the above charge, Dr. Miles has indicated clearly that she feels strongly about program development that is based solidly in theory and driven by data. In other words, Dr. Miles is much more likely to provide resources for a plan that presents a strong theoretical and research-based argument.

Dr. Miles has charged you with developing a comprehensive retention plan by the end of the semester. She has strongly encouraged your committee to be creative—thinking outside "typical" institutional models /constructs. President Miles also has recommended your committee employ best practices as they apply to retention programming and planning.

The Problem

Develop a comprehensive plan for retention focusing on the undergraduate student experience at University A. Submit a plan with goals for retention for entering Fall 2003 students and six year projections. This plan must address the following issues:

1. A vision or philosophy statement for the plan;
2. Theoretical basis for the plan;
3. A summary of research that supports your design (complete citations required);
4. Clearly articulated goals and strategies for achieving those goals (action plans);
5. Coordination of academic and student affairs aspects of the plan;
6. Working relationships of constituent groups;
7. Sample of programs, activities and events for one year;
8. Staffing needs;
9. A reasonable budget for one year; and
10. An assessment/evaluation component.

Student Services Problem

A group of business people and investors have decided to develop an innovative educational institution. They are currently developing a proposal for "THE VIRTUAL LIBERAL ARTS COLLEGE" (VLAC) The group has done some research and realizes that postsecondary institutions all seem to have an administrative structure called "student services" so they believe their virtual college will probably have to have this function as well. They have hired you, as consultants, to develop this part of their proposal.

They have asked you to:

1. Describe traditional student services functions at mainstream liberal arts colleges including a brief history, the purposes of student services, a typical administrative structure and a description of the preparation and backgrounds of typical personnel who staff these offices
2. Describe a plan for student services division for the virtual campus. Group these services into categories: those services which are absolutely essential to a functioning institution, those services which are important, but not essential, those services which add to the campus but are not essential and those services which might be important on a traditional campus but are unnecessary for a virtual campus. Within each group, rank order the services in order of importance (the investors will have limited funds to begin with and may need to add services in phases.)

The early demographic projections suggest that VLAC students will be about 50% middle-class and 50% working class students. About 70% will be white, 10% African American, 10% Asian American and 10% everything else. The age range of the students will vary. About 60% will be between 18 and 22 when they begin their VLAC experience. The other 40% will be older. The investment group expects that after 3-5 years of operation, they will begin to attract international students and that this population will eventually fill about 30% of the "entering class" in any given year.

Two weeks into the project:
The investment group after much market research, has decided that one of the most succcessful aspects of the liberal arts college experience is that students live on campus, interacting with each other and their faculty. While the VLAC cannot simulate a true residential college experience, the group has come up with a novel approach (this will also separate them out from other virtual universities) to the residential question. They prose to contract with other liberal arts colleges each summer when they are typically not in operation, and bring the VLAC students to a campus for 3-6 weeks each summer. The group now asks you to revise your listing of essential student services and add essential services for the "on-campus" aspect of the VLAC

Six weeks into the project:

One of the investors in the project discovered a federal grant project that will supply capitol and operating expenses for institutions that develop innovative educational strategies for inner city youth. The investment group thinks this will be an excellent source of students (and the money is a good thing too). They now ask you to revise your plan. Between 20 and 30 percent of the VLAC students will come from inner city school systems. Most of these students will be underprepared academically, but the group is confident that the student service aspect of the VLAC will be able to address this issue. The current demographic projects suggest that this particular group will be 40% African American, 30% Chicano/a or Latino/a, 25% Asian-American (especially new immigrant populations from southeast Asia) and 5% native American.

BIBLIOGRAPHY

Ackoff, R. (1979). The future of operations research is past. *Journal of Operations Research Society, 30*(Suppl.2), 93-104.

Albanese, M.A. & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Journal of Academic Medicine, 68*(Supp.1), 52-81.

Albanese, M.A. (2000). Problem-based learning: why curricula are likely to show little effect on knowledge and clinical skills. *Journal of Medical Education 34*, 729-38.

Alverno College Faculty. (1989). *Liberal learning at Alverno College.* (4th ed.). Milwaukee, WI: Alverno Productions.

Andersen, A. S. (1997). Conversion to problem-based learning in 15 months. In D. Boud & G. Feletti (Eds.), *The challenge to problem-based learning* (2nd ed., pp. 64-72). London: Kogan Page, Ltd.

Armstrong, E. G. (1997). A hybrid model of problem-based learning. In D. Boud & G. Feletti (Eds.). *The challenge of problem-based learning* (2nd ed., pp. 137 - 150). London: Kogan Page, Ltd.

Aspy, D. N., Aspy, C. B., & Quimby, P.M. (1993). What doctors can teach teachers about problem-based learning. *Educational Leadership 50*(Supp.7), 22-24.

Association of University Teachers, (AUT) (1995). *Higher education – preparing for the 21st century.* London: Association of University Teachers.

Bandura, A. (1977). *Social learning theory.* Inglewood Cliffs, New Jersey: Prentice-Hall.

Barnett, R. (1994). *The limits of competence.* Buckingham: Open University Press/ The Society for Research into Higher Education.

Barnett, R. (1997). *Higher education: A critical business.* Buckingham: Open University Press/SRHE.

Barrows, H. S. (1985). *How to design a problem-based curriculum for the preclinical years.* New York: Springer.

Barrows, H. S. (1986). A taxonomy of problem based learning methods. *Journal of Medical Education, vol. 20,*(Supp.6), 481-486.

Barrows, H. S. (1987). *Simulated (standardized) patients and other human simulations.* Chapel Hill, N.C.: Health Sciences Consortium.

Barrows, H. S. (1988). *The tutorial process.* Springfield: Southern Illinois University School of Medicine.

Barrows, H.S. (1990). Inquiry: the pedagogical importance of a skill central to clinical practice. *Journal of Medical Education, 24*, 3-5.

Barrows. H.S. (1996). Problem-based learning and problem-solving. *PROBE Newsletter of the Australian Problem-Based Learning Network, 26*, 8-9.

Barrows, H. S. (1996, Winter). Problem-based learning in medicine and beyond: A brief overview. In L.Wilkerson, & W.H.Gijselaers, (Eds), Bringing problem-based learning to higher education: Theory and practice. *New Directions for Teaching and Learning, 68,* 3 – 12. San Franciso: Jossey-Bass.

Barrows, H. S. & Bennett, K. (1972). The diagnostic (problem-solving) skill of the neurologist. *Archives of Neurology, 26*, 273-277.

Barrows, H.S., & Tamblyn, R. M. (1977). The portable patient problem pack: A problem based learning unit. *Journal of Medical Education, 52*(Supp.12), 1002-1004.

Barrows. H. S. & Tamblyn, R. M. (1980). *Problem-based learning, an approach to medical education.* New York: Springer.

Beck, U. (1992). *Risk society.* London: Sage.

Belenky, M.F. et al. (1986). *Women's way of knowing: The development of self, voice and mind.* New York: Basic Books.

Bennett, A. (1988). *Talking heads.* London: BBC Books.

Bereiter, C. & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L.B. Resnick (Ed.) *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 361-392). Hillsdale, New Jersey: Erlbaum

Bereiter, C. & Scardamalia, M. (1992). Cognition and curriculum. In P.W. Jackson (Ed.) *Handbook of research on curriculum.* New Jersey: Macmillan.

Bereiter, C. & Scardamalia, M. (2000). Commentary on part I: Process and product in problem-based learning (pbl) research. In D. H. Evensen & C. E. Hmelo (Eds.), *Problem-based learning. A research perspective on learning interactions* (pp. 185 – 195). Mahjaw, NJ: Erlbaum.

Bereiter, C., Scardamalia, M., Cassels, C. & Hewitt, J. (1997). Postmodernism, knowledge-building, and elementary science. *Elementary School Journal, 97,* 329-340.

Berkson, L. (1993, October). Problem-based learning: Have the expectations been met? *Journal of Academic Medicine, 68*(Suppl.10), S79 – S88.

Blake, R. L., Parkison, L. (1998). Faculty evaluation of the clinical performances of students in a problem-based learning curriculum. *Teach Learning Medicine, 10,* 69-73.

Blake, R. L., Hosokawa, M. C., & Riley, S. L. (2000). Student performances on step 1 and step 2 of the United States medical licensing examination following implementation of a problem-based learning curriculum. *Journal of Academic Medicine, 75*(Suppl.1), 66-70.
URL: http:// www. academicmedicine.org/cgi/content/full/75/1/66

Block, S. D., & Moore, G. T. (1994). Project evaluation. In D.C. Tosteson, S. J. Adelstein, & S.T. Carver (Eds.), *New pathways to medical education: Learning to learn at Harvard Medical School.* Cambridge, M.A.: Harvard University Press.

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives: the classification of educational goals.* New York: Longman.

Bloom, S.W. (1989). The medical school as a social organization: the sources of resistance to change. *Journal of Medical Education, 23,* 238-241.

Bok, D. (1989). Needed: A new way to train doctors. In H. Schmidt et al. (Eds.), *New directions for medical education* (pp. 17-38). New York: Springer-Verlag.

Bonwell, C., & Eison, J.A. (1991). Active learning: Creating excitement in the classroom. In Burrch, K., *A primer on problem-based learning: Examples from international relations courses.* Paper presented at the 1997 APSA convention. URL: http//www.ntlf.com/htm/lib/supmat/82pblprimer.htm.

Bordage, G., & Zachs, R. (1984). The structure of medical knowledge in the memories of medical students and general practitioners, categories and prototypes. *Journal of Medical Education 18,* 406 – 416.

Borg, W. & Gall, M. (1989). Educational research and development. *In educational research: An introduction.* (5th ed.) White Plains, N. Y.: Longman.

Boshuizen, H. P. (1995). Teaching for expertise. In W. H. Gijselaers, D. T. Tempelaar, P. K. Keizer, J. M. Blommart, E. M. Bernard, & H. Kasper (Eds.), *Educational innovation in economics and business administration: The case of problem-based learning.* Massachusetts: Kluwer.

Boud, D., & Feletti, G. (1997). Changing problem-based learning. Introduction to the second edition. In D. Boud & G. Feletti (Eds.). *The challenge of problem-based learning* (2nd ed., pp. 1 – 14). London: Kogan Page.

Boud, D. & Feletti, G. (Eds.) (1997). *The challenge of problem-based learning.* (2nd ed.). London: Kogan Page.

Boud, D., Keogh, R., & Walker, D. (1985). Promoting reflection in learning: A model. In D. Boud, R. Keogh, & D. Walker (Eds.) *Reflections: Turning experience into learning*. London: Kogan Page.

Boyd, E.M., & Fales, A.W. (1983). Reflective learning: The key to learning from experience. *Journal of Humanistic Psychology, 23,* 99 - 117.

Boyer Commission on Educating Undergraduates in the Research University for the Carnegie Foundation for the Advancement of Teaching. (1998). *Reinventing undergraduate education: A blueprint for America's research universities.* URL: http://notes.cc.sunysb.edu/Pres/boyer.nsf.

Bransford, J. D., Franks, J. J., Vye, N. J., & Sherwood, R. (1989). New approaches to instruction: Because wisdom can't be told. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 470-479). New York: Cambridge University Press.

Bransford, J. D., Vye, N., Kinzer, C., & Risko, V. (1990). Teaching thinking and content knowledge: Toward an integrated approach. In B. F. Jones, & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 93 – 110). Hillsdale, N. J.: Erlbaum.

Bridges, D. (1993). Transferable skills: A philosophical perspective. *Studies in Higher Education, 18*(Suppl.1), 43-51.

Bridges, E. M. (1977) The nature of leadership. In L. Cunningham, W. Hack, & R. Nystand (Eds.), *Educational administration: The developing decades.* Berkeley, CA: McCutchan.

Bridges, E.M., & Hallinger, P. (1991, September). *Problem-based learning in medical and managerial education.* Paper presented for the Cognition and School Leadership Conference of the National Center for Educational Leadership and the Ontario Institute for Studies in Education, Nashville, TN.

Bridges, E. M. with Hallinger, P. (1992). *Problem-based learning for administrators.* Oregon: ERIC Clearinghouse on Educational Management, University of Oregon.

Bridges, E. M. & Hallinger, P. (1995). *Implementing problem-based learning in leadership development.* Eugene, OR: ERIC Clearinghouse on Educational Management.

Broadbent, D. E. (1976). Cognitive psychology and education. *British Journal of Educational Psychology, 45* (Suppl.2), 162 – 176.

Brockett, R. G. & Hiemstra, R. (1986). Bridging the theory-practice gap in self-directed learning. In S. Brookfield (Ed.), *Self-directed learning: from theory to practice.* San Francisco: Jossey-Bass.

Brookfield, S. D. (1987). *Developing critical thinkers: Challenging adults to explore alternative ways of thinking and acting.* San Francisco, CA: Jossey-Bass.

Brown, A.L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(Suppl. 2),141 – 178.

Brown, J.S., Collins, A., & Duguid, P. (1989, Jan. – Feb.). Situated cognition and the culture of learning. *Educational Researcher,* 89-99.

Bruer, J. T. (1993). *Schools for thought: A science of learning in the classroom.* Massachusetts: MIT Press.

Bruning, R. H., Schraw, G. J., & Ronning, R. R. (1995). *Cognitive psychology and instruction.* (2nd ed.) Inglewood Cliffs, New Jersey: Prentice Hall.

Burke, K. (1935). *Permanence and change.* New York: Republic.

Bussigel, M., Barzansky, B., & Grenholm, G. (1988). *Innovative processes in medical education.* New York: Praeger.

Candy, P. (1991). *Self direction for life long learning: A comprehensive guide to theory and practice.* San Francicso: Jossey-Bass.

Cawley, P. (1997). A problem-based module in mechanical engineering. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 185 - 193). London: Kogan Page.

Center for Applications for Psychological Type (CAPT), Inc. (1993). *Psychological type in education: A summary of information about Myers-Briggs Type Indicator.* Gainesville, FL: CAPT.

Chalupa, M. R. (1992, October). Critical thinking – getting minds to work. *Business Education Forum, 47,*(Suppl.1), 21 – 24.

Charters, W., & Jones, J. (1975). On the neglect of the independent variable in Program evaluation. In J. V. Baldridge & T. Deal (Eds.), *Managing change in educational organizations: Sociological perspectives, strategies, and other case studies.* Berkeley, CA: McCutchan.

Chase, W.G., & Simon, H.A. (1973). Perception in chess. *Cognitive Psychology,4,* 55 – 81.

Chenoweth, T. & Everhart, R. (1994). Preparing leaders to understand and facilitate Change: A problem-based learning approach. *Journal of School Leadership,* (Suppl. 4), 414-431.

Chi, M. T. H., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), *Advances in the psychology of human intelligence* (pp. 7 – 75). Hillsdale, N. J.: Erlbaum .

Christensen, C. R. (1987). *Teaching and the case method.* Boston: Harvard Business School Publishing.

Clark, R. M. (1984). Organizing an institution to deliver educational programmes designed to achieve capability. *Programmed Learning and Educational Technology, 21,* 301-306.

Coles, C. R. (1985a). Differences between conventional and problem-based curricula in their students' approaches to studying. *Journal of Medical Education, 19,* 308 – 309.

Coles, C. R. (1985b). *A study of the relationship between curriculum and learning in undergraduate medical education.* Ph.D. Thesis, University of Southhampton.

Coles, C. R. (1989). Self-assessment and medical audit: An educational approach. *British Medical Journal, 299,* 807 – 808.

Coles, C.R. (1990). Elaborated learning in undergraduate medical education. *Journal of Medical Education, 24,* 14 – 22.

Coles, C. (1997). Is problem-based learning the only way? In D. Boud & G. Feletti, (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 313 – 325). London: Kogan Page.

Collins, A. (1990). *Generalizing from situated knowledge to robust understanding.* Paper presented at the American Educational Research Association annual meeting, Boston.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing and mathematics. In L. B. Resnick (Ed.), *Knowing, learning and instruction: Essays in honor of Robert Glaser.* Hilldale, N. J.: Erlbaum.

Collins, A., Brown, J. S., & Newman, S. E. (1990). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (Ed.), *Cognition and instruction: Issues and agendas.* Hillsdale, N. J.: Erlbaum.

Collins, A., & Stevens, A. L. (1982). Goals and strategies of inquiry teachers. In R. Glaser (Ed.), *Advances In Instructional Psychology: Vol. 2,* (pp. 65 – 119). Hillsdale, N. J.: Erlbaum.

Colliver, J. A. C. (2000). Effectiveness of problem-based learning curricula. research and theory. *Journal of Academic Medicine, 3,* 259-266. URL: http:// www.academicmedicine.org/cgi/content/full/75/3/259

Coulson, R. L. (1983). Problem-based student-centered learning of the cardiovascular system using the problem-based learning module (PBLM). *Physiologist, 26,* 220 – 224.

Dathe, D., O'Brien, K., Loacker, G. & Matlock, M. G. (1997). Learning from the assessment of problem solving. In D. Boud, & G. Feletti (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 283 - 293). London: Kogan Page, Ltd.

David, T. J., & Patel, L. (1995). Adult learning theory, problem-based learning and pediatrics. *Arch. Dis. Child. 73,* 357-363.

DeGrave, W. S., Schmidt, H. G., Belien, J.J., Moust, J.H.C., De Volder, M.L. & Kerkhofs, L.M.M. (1984). *Effecten van verschillende typen van activatie van Vorkennis op recall, gemeten met een aanvultoets.* (Effects of different types of activation of prior knowledge on recall, measured with a close procedure.) Paper presented at the Onderwijs Research Dagen, Tilburg, the Netherlands.

DeGrave, W.S., Boshuizen, H.P.A., & Schmidt, H.G. (1996). Problem-based learning: Cognitive and metacognitive processes during problem analysis. *Instructional Science, 24,* 321-341.

De Volder, M. L., Schmidt, H. G., Moust, J. H. C., & De Grave, W. S. (1986). Problem-based learning and intrinsic motivation. In J. H. C. van der Berchen, Th. C. M. Bergen & E. E. I. de Bruyn (Eds.), *Achievement and task motivation* (pp. 128-134). Berwyn: Swets North America.

DeVolder, M., & DeGrave, W. (1989). Approaches to learning in a problem-based medical programme: A developmental study. *Journal of Medical Education, 23,* 262 – 264.

De Volder, M. L., Schmidt, H. G., Moust, J. H. C., & DeGrave, W. S. (1989). Motivation and achievement in cooperative learning. In J. H. C. van der Berchen, Th. C. M. Bergen, & E. E. I. de Bruyn (Eds.), *Achievement and task motivation* (pp. 123-134). Berwyn: Swets North America.

DeVries, M., Schmidt, H., & DeGraaff, E. (1989). Dutch comparisons: cognitive and motivational effects of problem-based learning on medical students. In H. Schmidt, et al (Eds.), *New directions for medical education* (pp. 231-38). New York: Springer-Verlag.

Dewey, J. (1938). *Experience and education.* New York: Collier and Kappa Delta Pi.

diSessa, A. A. (1982). Unlearning Aristoleian phsyics: A study of knowledge-based learning. *Cognitive Science, 6,* 37 – 75.

Distlehorst, L. H., & Barrows, H. S. A new tool for problem-based self-directed learning. *Journal of Medical Education, 57*(Suppl. 6), 486-488.

Distelhorst, L. H., & Robbs, R. S. (1998). A comparison of problem-based learning and standard curriculum students: Three years of retrospective data. *Teach Learn Medicine 10,* 131-137.

Dolmans, D. H. J. M., & Schmidt, H. G. (2000). What directs self-directed learning in problem-based curriculum? In D. H. Evensen & C. E. Hmelo (Eds.), *Problem -based learning. A research perspective on learning interactions* (pp. 251 – 262). Mahjaw, New Jersey: Erlbaum.

Donham, R. S., Schmieg, F. I., & Allen, D. E. (2001). The large and the small of it. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 179 – 190). Virginia: Stylus Publishing, LLC.

Drinan, J. (1997). The limits of problem-based learning. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 333 - 339). London: Kogan Page Ltd.

Drucker, P. (1985). *Innovation and entrepreneurship.* New York: Harper & Row.

Duch, B. J. (2001a). Models for problem-based instruction in undergraduate courses. In B. J. Duch , S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 39 – 45). Virginia: Stylus Publishing, LLC.

Duch, B. J. (2001b). Writing problems for deeper understanding. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 47 – 53). Virginia: Stylus Publishing, LLC.

Duch, B. J., Groh, S. E. & Allen, D. E. (2001). *The power of problem-based learning.* Virginia: Stylus Publishing, LLC.

Duch, B.J., & Groh, S. E. (2001). Assessment strategies in a problem-based learning course. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 95 – 106). Virginia: Stylus Publishing, LLC.

Duffy, T. M. & Jonassen, D. H. (1991, May). Constructivism: new implications for instructional technology? *Educational Technology,* 7-12.

Eisenstaedt, R.S., Barry, W.E., & Glanz, K. (1990). Problem-based learning: Cognitiveretention and cohort traits of randomly selected participants and decliners. *Journal of Academic Medicine, 65,* (Suppl.11).

Elstein, A. S., Schulman, L. S., & Sprafka, S. A. (1978). *Medical problem solving: Ten-year retrospective.* Cambridge, MA: Harvard University Press.

Engel, C. E. (1997). Not just a method buy a way of learning. In D. Boud & G. Feletti (Eds.) *The challenge of problem-based learning* (2nd ed., pp. 17 - 27). London: Kogan Page Ltd.

English, B., Gaha, J., & Gibbons, J. (1994). Preparing social workers for an uncertain future. *In reflections on problem-based learning.* Campbelltown, NSW: Australian, PBL Network, 279 – 296.

Entwistle, N. J. (1983). *Styles of learning and teaching.* Chichester: John Wiley.

Eraut, M. (1985). Knowledge creation and knowledge in use in professional contexts. Studies in Higher Education, 10(Suppl. 2), 117-133.

Evensen, D. H. & Hmelo, C. E. (Eds.). (2000). *Problem-based learning. A research perspective on learning interactions.* Mahwah, NJ: Erlbaum.

Faidley, J., Evensen, D., Salisbury-Glennon, J., Glenn, J., & Hmelo, C. (2000). How are we doing? Methods of assessing group processing in a problem-based learning context. In D. Evensen, & C. Hmelo (Eds.), *Problem-based learning. A research perspective on learning interactions* (pp. 109 – 135). Mahwah, N. J.: Erlbaum.

Feletti, G. I., Saunders, N. A. & Smith, A. J. (1983). Comprehensive assessment of final-year medical student performance based on undergraduate programme objectives. *The Lancet, 2,* 34-37.

Fogg, Piper. (2002, September 19). Carnegie corporation call for major reform in teacher education. *The Chronicle of Higher Education.* URL: http://chronicle.com/daily/2002/2002091904n.htm.

Gagne, R. (1985). *The conditions of learning.* New York: Holt, Rinehart and Winston.

Gale, J., & Marsden, P. (1983). *Medical diagnosis: From student to clinician.* Oxford: Oxford University Press.

Garrett, R. (1987). *The learning organization.* London: Fontana/Collins.

Geerlings, T. (1995). Students' thoughts during problem-based small-group discussions. *Instructional Science, 22,* 269-278.

Gibbs, G. (1982). Better teaching or better learning? In T. Habershaw (Ed.) *Three ways to learn.* Occasional Paper 12, Standing Conference on Educational Development Services in Polytechnics: Preston, UK.

Gibson, E. J. (1982). The concept of affordances in development: The renaissance of functionalism. In W. A. Collins (Ed.), *The concept of development: The Minnesota symposium on child psychology* (Vol. 15, pp. 55-81). Hillsdale, NJ: Erlbaum.

Gibson, E. J. (1991). The concept of affordances in development: The renaissance of funtionalism. In E. J. Gibson (Ed.), *An odyssey in learning and perception.* Cambridge, MA: MIT Press.

Gibson, J. J. (1977a). *An ecological approach to visual perception.* Boston: Houghton-Mifflin. Reprint, Hillsdale, NJ: Erlbaum.

Gibson, J. J. (1977b). The theory of affordances. In R. F. Shaw & J. D. Bransford (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology* (pp. 67-82). Hillsdale, NJ: Erlbaum.

Gibson, J. J. (1986). *The ecological approach in visual perception.* Boston: Houghton-Mifflin. Reprint, Hillsdale, NJ: Erlbaum.

Gijselaers, W. H. (1995). Perspectives on problem-based learning. In W.H. Gijselaers, D. T. Tempelaar, P. K. Keizer, J. M. Blommaert, E. M. Bernard, & H. Kasper (Eds.), *Educational innovation in economics and business administration: The case of problem-based learning.* Massachusetts: Kluwer.

Gilbert A., & Foster, S. F. (1997). Experiences with problem-based learning in business and management. In D. Boud & G. Feletti, (Eds.) *The challenge of problem- based learning* (2nd ed., pp. 244 – 252). London: Kogan Page Ltd.

Giroux, H. (1992). *Border crossings.* London: Routledge.

Glaser, R. (1984). The role of knowledge. *American Psychologist, 39,* 105 – 116.

Glaser, R. (1991). The maturing of the relationship between the science of learning and cognition and educational practice. *Learning and Instruction, 1,* 129-144.

Glick, T. & Armstrong, E. (1996). Crafting cases for problem based learning: experience in a neuroscience course. *Journal of Medical Education, 30,*(Suppl.1), 24-30.

Godden, D., & Baddeley, A. (1975). Context-dependent memory in two natural environments: On land and underwater. *British Journal of Psychology, 66,* 325 – 332.

Good, T., & Brophy, J. (1991). *Looking in classrooms.* New York: Harper & Row.

Grant, J. & Gale, R. (1989). Changing medical education. *Journal of Medical Education,23,* 252-257.

Greeno, J. G., Collins, A. M., & Resnick, L. (1996). Cognition and learning. In R. C. Calfee & D. C. Berliner (Eds.), *Handbook of educational psychology* (pp. 15-46). New York: Simon & Schuster Macmillan.

Habermas, J. (1990). *Moral consciousness and communicative action.* Cambridge: MIT Press.

Hafler, J. P. (1997). Case writing: Case writer's perspectives. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning.* (2nd ed., pp. 151 - 159) London: Kogan Page Ltd.

Hager, P. & Butler, J. (1994). Problem based learning and paradigms of assessment. *In reflections on problem-based learning.* Campbelltown, NSW: Australian PBL Network, 35 – 44.

Hallinger, P., Lerrhwood, K., & Murphy, J. (1993). *Cognitive perspectives on educational leadership.* New York: Teacher's College Press.

Handy, C. (1989). *The age of unreason.* London: Business Books Ltd.

Hans, V. P. (2001). Integrating active learning and the use of technology in legal studies courses. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 141 – 148). Virginia: Stylus Publishing, LLC.

Harley, P. & Lowe, S. (1998). *Academics divided: The research assessment exercise and the academic labour process.* Conference paper, Higher Education Close Up Conference, University of Central Lancashire, 6 – 8 July.

Harvard, M., Hughes, M, & Clark, J. (1998). The introduction and evaluation of key skills in undergraduate courses. *Journal of Further and Higher Education, 22,* (Suppl.1), 61-68.

Heppell, S. & Ramondt, L. (1998). Online learning – implications for the university for industry; a preliminary case study report. *Journal of Education through Partnership, 2*(Suppl. 2), 7-28.

Honebein, P.C., Duffy, T.M., & Fishman, B. J. (1993). Constructivism and the design of learning environments: Context and authentic activities for learning. In T.M. Duffy, J. Lowyck, & D. H. Jonassen (Eds), *Designing environments for constructive learning.* Berlin: Springer-Verlag.

Houle, C. O. (1961). *The inquiring mind.* Madison: University of Wisconsin Press.

Jansen, T. & Van Der Veen, R. (1992). Reflexive modernity, self-reflective biographies: Adult education in the light of the risk society. *International Journal of Lifelong Education, 1* (Suppl. 4), 275-86.

Jarvis, P., Holford, J., & Colin, G. (1999), *The theory and practice of learning.* Virginia: Stylus Publishing, LLC.

Johnson, S. D., & Thomas, R. (1992, January). Technology education and the cognitive revolution. *Technology Teacher, 51,*(Suppl. 4), 7 – 12.

John-Steiner, V., & Mahn, H. (1996). Sociocultural approaches to learning and development: A vygotskian framework. *Educational Psychologist, 31,* 191-206.

Jonas, H., Etzel, S., & Barzansky, B. (1989, August 25). Undergraduate medical education. *Journal of the American Medical Association 262,*(Suppl. 8), 1101-19.

Jones, J. W., Bieber, L. L., Echt, R., Scheifley, V. & Ways, P. O. (1984). A problem-based curriculum – ten years of experience. In H.G. Schmidt & M. L. DeVolder (Eds.), *Tutorials in problem-based learning.* The Netherlands: Assen/Maastricht, Van Gorcum.

Kaufman, A. (Ed.) (1985). *Implementing problem-based medical education: lessons from successful innovations.* New York: Springer.

Kaufman, A., Mennin, S., Waterman, R., Duban, S., Hansbarger, C., Silverblatt, H., Obenshain, S. S., Kantrowitz, M., Becker, T., Samet, J. & Wiese, W. (1989). The New Mexico experiment: Educational innovation and institutional change. *Journal of Academic Medicine 64,* 285-294.

Kaufman, D. M., & Mann, K. V. (1996). Student's perceptions about their courses in problem-based learning and conventional curricula. *Journal of Academic Medicine 71,* S52-S54.

Kaufman, D. M., & Mann, K. V. (1996). Comparing student's attitudes in problem-based learning. *Journal of Academic Medicine 71,* 1096-1099.

Keck, C. (1997, March 4). The constructivist classroom. *Wall Street Journal,* p. A 19.

Kelson, M. C. A. (2000). Assessment of students for proactive lifelong learning. In C. E. Hmelo, & D. H. Evensen (Eds.), *Problem-based learning: A research perspective on learning interactions* (pp. 315 – 345). Mahjaw, NJ: Erlbaum.

Kember, D. (2000). *Action learning and action research. Improving the quality of teaching & learning.* Virginia: Stylus Publishing Inc.

Kearsley, G. (1996). *Explorations in learning and instruction: The theory into practice database.* Washington, D.C.: http://www.gwu.edu/-tip/.

Knowles, M. (1975). *Self-directed learning: A guide for learners and teachers.* New York: Association Press.

Knowles, M. (1990). *The adult learner, a neglected species.* Houston: Gulf Publishing Company.

Kolb, D. & Fry, R. (1975). Towards an applied theory of experiential learning. C. Cooper (Ed.), *Theories of group processes.* London: Wiley.

Kolb, D. (1981). Learning styles and disciplinary differences. A. W. Chickering (Ed.), *The modern American college.* San Francisco: Jossey-Bass.

Kolb, D. (1984). *Experiential learning.* Englewood Cliffs, NJ: Prentice-Hall.

Koschmann, T., Glenn, P., & Conlee, M. (2000) When is a problem-based tutorial not tutorial? Analyzing the tutor's role in the emergence of a learning issue. In D.H. Evensen, & C. Hmelo (Eds.), *Problem-based learning. A research perspective on learning interactions* (pp. 53 – 74). Mahwah, N. J.: Erlbaum.

Kraft, R. (1988). Coaching to learn. *The Teaching Professor, 2,*(Suppl.1), 1-2.

Lampert, M. (1990). When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching. *American Educational Research Journal, 27,*(Suppl.1), 29-64.

Lave, J. (1977). Tailor-made experiments and evaluating the intellectual consequences of apprenticeship training. *Cognition and Instruction, 3,* 305 – 342.

Lave, J. (1988a). *Cognition in practice.* Boston, MA: Cambridge.

Lave, J. (1988b). *The culture of acquisition and the practice of understanding.* IRL Report 88-0087. Palto Alto, CA: Institute for Research on Learning.

Lee, H. D. (1989). *Thinking skills and coaching strategies workshop.* Menomonie: Center for Vocational, Technical, and Adult Education, University of Wisconsin – Stout.

Lesgold, A. M., Rubinson, H., Feltovich, P. J., Glaser, R., Klopfer, D., & Wang, Y. (1988). Expertise in a complex skills: Diagnosing x-ray pictures. In M. T. H. Chi, R. Glaser & M. J. Farrs (Eds.). *The nature of expertise* (pp. 322 – 342). Hillsdale, N. Erlbaum.

Levine, H. G. & Forman, P. B. (1973). A study of retention of knowledge of neurosciences information *Journal of Medical Education 48,*(Suppl. 9), 867-869.

Lieux, E. M. (2001). A skeptic's look at PBL. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 223 – 235). Virginia: Stylus Publishing, LLC.

Lijphart, A. (1971). Comparative politics and the comparative method. *American Political Science Review 65,* 682-694.

Lovie-Kitchin, J. (1997). Problem-based learning in optometry. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 203 - 210). London: Kogan Page Limited.

Maddison, D. C. (1978). What's wrong with medical education? *Journal of Medical Education, 12,* 111 – 113.

Maki, P. (2002). *Learning contexts inside and outside of the academy.* URL: http://www.aahe.org/special reports/part2.htm.

Manning, P. & DeBakey, L. (1987). *Medicine: Preserving the passion.* New York: Springer-Verlag.

Margetson, D., Eriksson, H., & Ingelman-Sundberg, M. (1985). Medical chemistry: Evaluation of active and problem-oriented teaching methods. *Journal of Medical Education,19,* 34-42.

Margetson, D. (1997). Why is problem-based learning a challenge? In D. Boud & G. Feletti (Eds), *The challenge of problem-based learning* (2nd ed., pp. 36 - 44). London: Kogan Page.

Martenson, D. F. (1986). Students' approaches to studying in four medical schools. *Journal of Medical Education, 20,* 532 – 534.

Marton, F. (1984). Approaches to learning. In F. Martin, D. Hounsell, & N. Entwistle (Eds.), *The experience of learning.* Edinburgh: Scottish Universities Press.

Marton, F., & Saljo, R. (1976). On qualitative differences in learning I – out – come and process. *British Journal of Educational Psychology, 46,* 4 – 11.

Marx, R. W., Blumenfeld, P. C., Krajcik, J. S. & Soloway, E. (1997). Enacting project-based science. *Elementary School Journal, 97,* 341-358.

Mayer, R. E. (1979). Twenty years of research into advanced organizers: Assimilation theory is still the best predictor of results. *Instructional Science, 8,* 133 – 167.

Mayo, P., Donnelly, M. B., Nash, P. P. & Schwartz, R. N. (1993). Student perceptions of tutor effectiveness in problem-based surgery clerkship. *Teaching and Learning in Medicine 5,*(Suppl. 4), 227-233.

McDiarmid, G. M. (1996). Challenging prospective teacher's understandings of history: An examination of a historiography seminar. In L. Schauble & R. Glaser (Eds.), *Innovations in learning: New environments for education.* Mahwah, N. J.: Erlbaum.

McNay, I. (1995). From the collegial academy to corporate enterprise: The changing cultures of universities. In T. Schuller (Ed.), *The changing university?* Buckingham: Open University Press/SRHE.

McGill, I. & Beaty, L. (1995). *Action learning: A guide for professional management and educational development.* (2nd ed.) London: Kogan Page.

McGlynn, E. (1988). *Physicians' job satisfaction: its measurement and use as an indicator of system performance.* Unpublished doctoral dissertation. Santa Monica, CA: Rand Graduate School.

Mennin, S. & Martinez-Burrola, N. (1986). The cost of problem-based vs. traditional and medical education. *Medical Education, 20,* 187-194.

Mennin, S. P., Kalishman, S., Friedman, M., Pathak, D., & Snyder, J. A. (1996). A survey of graduates in practice from the University of New Mexico's conventional and community-oriented, problem-based learning tracks. *Journal of Academic Medicine 71,* 357-363.

Mentkowski, M. & Doherty, A. (1987). *Careering after college: Establishing the validity of abilities learned in college for later careering and professional performance.* (2nd ed.). Milwaukee, WI: Alverno Productions.

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Francisco: Jossey-Bass.

Mezirow, J. and Associates. (2000). *Learning as transformation.* San Francisco: Jossey-Bass.

Middlehurst, R. (1995). Changing leadership in universities. In T. Schuller (Ed.), *The changing university?* Buckingham: Open University Press/SRHE.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook.* 2nd ed. Thousand Oaks, CA: Sage.

Miller, D. L. (1973). *George Herbert Mead: Self, language, and the world.* Austin: University of Texas Press.

Moore, G. T. (1991). The effect of compulsory students in problem-based learning. *Journal of Medical Education, 25,* 140-143.

Moore, G. T. (1997). Initiating problem-based learning at Harvard Medical School. In D. Boud, & G. Feletti (Eds.), *The challenge of problem-based learning*(2nd ed., pp. 73 - 80). London: Kogan Page, Ltd.

Moore, G. T., Black, S., & Mitchell, R. (1990). *A randomized trial evaluating the impact of the new pathway curriculum at Harvard Medical School.* Report to the Fund for the Improvement of Post-Secondary Education. Cambridge, MA: Harvard Medical School.

Moore, G. T., Block, S. D., Style, C. B., & Mitchell, R. (1994). The influence of the New Pathway curriculum on Harvard medical students. *Journal of Academic Medicine 69,* 983-989.

Morgan, G. (1997). *Images of organization.* (2nd ed.) London: Sage Publishing Company.

Morgan, R., Ponticell, J. & Gordon, E. (1998). *Enhancing learning in training and adult education.* Connecticut: Praeger Publishers.

Mountford, B. (1989). *Teaching and learning medicine: A study of teachers and learners in a young medical school.* Ph.D. thesis, University of Southhampton.

Moust, J. H. C., H. G., De Volder, M. L. Belien, J.J.J., & De Grave, W.S. (1986). Effects of verbal participation in small-group discussion on learning. In J.T.E. Richardson, M. E. Eysenck, & D. W. Pipers (Eds.), *Student learning: Research in education and cognitive psychology*(pp. 147-155). Guildord, UK: Society for Research into Higher Education.

Muller, S. (Chair) (1984). Physicians for the twenty-first century: Report of the project panel on the general professional education of the physician and college preparation for medicine. *Journal of Medical Education, 59* (11, Part 2).

Murphy, J. (1992). *The landscape of leadership preparation: Patterns and possibilities.* Beverly Hills, CA: Corwin and Sage Publications.

Myers, I. B. (1993). *Introduction to type: A guide to understanding your results on the Myers-Briggs Type Indicator.* (5th ed.). (Rev. ed.). Englewood Cliffs, NJ: Prentice-Hall.

Myers Kelson, A. C., & Distlehorst, L. (2000). Groups in problem-based learning (PBL):Essential elements in theory and practice. In D. Evensen, & C. Hmelo (Eds.), *Problem-based learning. A research perspective on learning interactions* (pp. 167 – 184). Mahwah, N. J.: Erlbaum.

National Committee of Inquiry into Higher Education (NCIHE) (1997). *Higher Education in the Learning Society.* (Report of the National Committee of Inquiry into Higher Education chaired by Sir Ron Dearing). London: HMSO.

National Research Council. (2001). *Knowing what students know: The science and design of educational assessment.* URL: http://www.aahe.org/special reports/part2.htm.

Nelson, C. (1989). Skewered on the unicorn's horn: The illusion of tragic tradeoff between content and critical thinking in the teaching of science. In L. Crow (Ed.). *Enhancing critical thinking in the sciences.* Washington, D.C.: Society of College Science Teachers.

Neufeld, V. R., Woodward, C.A., & MacLeod, S. M. (1989). The McMaster M.D. program: A case study of renewal in medical education. *Journal of Academic Medicine, 64,* 423-432.

Newble, D., & Clarke, R. M. (1986). The approaches to learning of students in a traditional and in an innovative problem-based medical school. *Journal of Medical Education, 20,* 267 – 273.

Newell, A. & Simon, H. (1972). *Human problem solving.* Englewood Cliffs, N.J.: Prentice-Hall.

Niemi, H. & Kemmis, S. (1999). Communicative evaluation. *Lifelong Learning In Europe, 4*(Suppl.1), 55 – 64.

Norman, G. R. (1988). Problem-solving skills, solving problems and problem-based learning. *Journal of Medical Education, 22,* 279 –286.

Norman, G. R. & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine, 6*(Suppl. 9), 557 – 565.

O'Neil, J. (1999). *The role of the learning advisor in action learning.* Unpublished doctoral dissertation. New York: Teachers College, Columbia University.

Palinscar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring devices. *Cognition and Instruction, 1,* 117 – 175.

Patel, V. L., & Dauphinee, W. D. (1984). Return to basic sciences after clinical experience in undergraduate medical training. *Journal of Medical Education, 18,* 244–248.

Patton, M.Q. (1990). *Qualitative evaluation methods.* 2nd ed. Thousand Oaks, CA: Sage.

Payne, J. (1883). *Lectures on the science and art of education.* Boston: Willard Small.

Perry, W. (1970). *Forms of intellectual and ethical development in the college years: A scheme.* New York, NY: Holt, Rinehart, and Winston.

Peters, A. S., Greenberger-Rosovsky, R., Crowder, C., Block, S. D., & Moore, G. T. (2000). Long-term outcomes of the new pathway program at Harvard Medical School. *Journal of Academic Medicine, 75,* 470-479.
URL: http:// www.academicmedicine.org/cgi/content/full/75/5/470

Popper, K.R. (1970). Normal science and its dangers. In I. Lakatos & A. Musgrave (Eds.), *Criticisms and the growth of knowledge.* Cambridge: Cambridge University Press.

Prawat, R. (1989, Spring). Promoting access to knowledge, strategies, and disposition in students: A research synthesis. *Review of Educational Research, 59*(Suppl.1), 1-41.

Prawat, R. S. (1993). The value of ideas: Problems versus possibilities in learning. *Educational Researcher, 22*(Suppl. 6), 5-16.

Regan-Smith, M., Obenshain, S., Woodward, C., Richards, B., Zeitz, H. & Small, P., Jr. (1994). Rote learning in medical school. *Journal of the American Medical Association, 17,* 1380-1381.

Resnick, L. B. (1989). *Knowing, learning, and instruction: Essays in honor of Robert Glaser.* Hillsdale, N.J.: Erlbaum.

Revans, R. (1982). *The origin and growth of action learning.* London: Chartwell Bratt.

Revans, R. (1983). Action learning: Its origins and nature. In M. Pedler (Ed.), *Action learning in practice.* Aldershot: Gower.

Ritzer, G. (1996). McUniversity in the postmodern consumer society. *Quality in Higher Education, 2*(Suppl. 3), 185-99.

Rogers, C. R. (1960). *On becoming a person.* London: Constable.

Ryan, G. L. (1997). Ensuring that students develop an adequate, and well-structured, knowledge base. In D. Boud & G. Feletti (Eds.), *The challenge of problem based learning* (2nd ed., pp. 125 – 136). London: Kogan Page, Ltd.

Ryan, G. L. (in press) *The development of problem solving and self directed learning ability in problem based learning.* Unpublished doctoral dissertation. Faculty of Education, The University of Sydney.

Sadlo, G. (1994). Development of an occupational therapy curriculum, part 2: The BSC at the London School of Occupational Therapy. *British Journal of Occupational Therapy, 57*(Suppl. 3), 79-83.

Salomon, G. & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist, 24,* 113-142.

Santos-Gomez, L., Kalishman, S., Rezler, A., Skipper, B., & Mennin, S. P. (1990). Residency performances of graduates from a problem-based and a conventional curriculum. *Journal of Medical Education 24,* 366-375.

Savery, J., & Duffy, T. (1994, August). Problem-based learning: An instructional model and its constructivist framework. *Educational Technology,* 1-16.

Savin-Baden, M. (2000). *Problem-based learning in higher education: Untold stories.* Buckingham: The Society for Research into Higher Education and Open University Press.

Scardamalia, M., Bereiter, C., Hewitt, J., & Webb, J. (1996). Constructive learning from texts in biology. In K. M. Fischer & M. Kirby (Eds.), *Relations and biology learning: The acquisition and use of knowledge structures in biology* (pp. 44-64). Berlin: Springer-Verlag.

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge-building communities. *The Journal of Learning Sciences, 3*(Suppl. 3), 265-283.

Scardamalia, M., Bereiter, C., & Lamon, M. (1994). The CSILE project: Trying to bring the classroom into world 3. In K. McGilley (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 201-228). Cambridge, MA: MIT Press.

Schmidt, H. G. (1983a). Intrinsieke motivatie en studieprestatie: Enkele verkennende onderzoeken. (Intrinsic motivation and achievement: Some exploratory investigations). *Pedagogische Studien, 60,* 185-195.

Schmidt, H. G. (1983b). Problem-based learning: Rationale and description. *Journal of Medical Education, 17,* 11-16.

Schmidt, H. G. (1984). Activatie van voorkennis en tekstverwerking. (Activation of prior knowledge and text processing). *Nederlands Tijdschrift voor de Psychologie, 39,* 335-47.

Schmidt, H. G. (1993). Foundations of problem-based learning: Some explanatory notes. *Journal of Medical Education, 27,* 422-432.

Schmidt, H., Dauphinee, W., & Patel, V. (1987). Comparing the effects of problem-based and conventional curricula in an international sample. *Journal of Medical Education, 62,* 305-15.

Schmidt, H. G., DeVolder, M. L., De Grave, W. S., Moust, J. H. C., & Patel, V. L. (1989). Explanatory models in the processing of science text: The role of prior knowledge activation through small-group discussion. *Journal of Educational Psychology, 81,* 610-19.

Schmidt, H. G., Machiels-Bongaerts, M., Hermans, H., Ten Cate T. J., Venekamp, R., & Boshuizen, H. P. (1996). The development of diagnostic competence: Comparison of a problem-based, an integrated, and a conventional curriculum. *Journal of Academic Medicine, 71,* 658-664.

Schmidt, H. G. & Moust, J. H. C. (2000). Factors affecting small-group tutorial learning: A review of research. In D. H. Evenson & C. E. Hmelo (Eds.), *Problem-based learning: A research perspective on learning interactions* (pp. 19 – 51). Mahwah, NJ: Erlbaum.

Schmidt, H.G., & van der Molen, H. T. (2001). Self-reported competency ratings of graduates of a problem-based medical curriculum. *Journal of Academic Medicine, 76,* 466-468. URL: http:// www.academicmedicine.org/cgi/content/full/76/5/466.

Schon, D. (1983). *The reflective practitioner.* New York: Basic Books.

Schon, D.A. (1987). *Educating the reflective practitioner: Towards a new design for teaching and learning in the professions.* San Francisco: Jossey-Bass.

Schumpter, J. (1934). *The theory of economic development.* Cambridge, MA: Harvard University Press.

Schwartz, P. (1997). Persevering with problem-based learning. In D. Boud & G. Feletti (Eds.). *The challenge of problem-based learning* (2nd ed., pp. 58-63). London: Kogan Page Ltd.

Schwartz, P., Fiddes, T. M., & Dempster, A.G. (1987). The case-based learning day: Introducing problem-based learning into a traditional medical curriculum. *Medical Teacher, 9,* 275-280.

Shin, J. H., Haynes, R. B., Johnston, M.E. (1993). Effect of problem-based, self-directed undergraduate education on lifelong learning. *Journal of the Canadian Medical Association, 6,* 969-76.

Simon, W. E. (1996, March). The dumbing down of higher education. *The Wall Street Journal,* pp. A18.

Simpson, M.A. (1972). *Medical education: A critical approach.* London: Butterworth.

Spaulding, W. B. (1969). The undergraduate medical curriculum (1969 model): McMaster University. *Journal of the Canadian Medical Association, 100,* 659-664.

Spaulding, W. B. (1991). *Revitalizing medical education. McMaster Medical School in the early years, 1965-1974.* Philadelphia: Decker.

Spiro, R. J., Vispoel, W. L., Schmitz, J. G., Samarapungavan, A., & Boerger, A. E. (1987). Knowledge acquisition for application: Cognitive flexibility and transfer in complex content domains. In B.C. Britton & S. Glynn (Eds.), *Executive control processes.* Hillsdale, NJ: Erlbaum.

Stake, R.E. (1995) *The art of case study research.* Thousands Oaks, CA: Sage.

Stasz, C., McArthur, D., Lewis, M., & Ramsey, K. (1990). *Teaching and learning generic skills for the workplace.* Berkeley: National Center for Research in Vocational Education, University of California.

Stata, R. (1994). Organizational learning – the key to management innovation. In W.L. French, C.H. Bell, & R.A. Zawacki (Eds.), *Organization development and transformation.* (4th ed.) Illinois: Irwin Publishing Company.

Stinson, J. E. & Milter, R. G. (1996, Winter). Problem-based learning in business education:Curriculum design and implementation issues. In Wilkerson, L. & Gijselaers, W. H., (Eds.), Bringing problem-based learning to higher education: Theory and practice. *New Directions for Teaching and Learning, 68,* 33 – 42. San Francisco: Jossey-Bass.

Swieringa, J., & Wierdsma, A. (1992). *Becoming a learning organization: Beyond the learning curve.* Wokingham: Addison-Wesley.

Tans, R.W., Schmidt, H.G., Schade-Hoogeveen, B.E.J., & Gijselaers, W.H. (1986). Sturing van het onderwijsleerproces door middle van problemen: Een veldexperiment (Directing the learning process by means of problems: A field experiment). *Tijdschrift voor Onderwijsresearch, 11,* 35-46.

Taylor, T., Gough, J., Bundrock, V., & Winter, R. (1998). A bleak outlook: Academic staff perceptions of changes in core activities in Australian higher education, 1991-1996. *Studies in Higher Education, 23*(Suppl. 3), 255 – 268.

Tennant, M. (1997). *Psychology and adult learning.* (2nd ed.) New York: Routledge.

Thoma, G. A. (1993, Spring). The Perry framework and tactics for teaching critical thinking in economics. *Journal of Economic Education,* 128 – 136.

Thomas, R. G. (1992). *Cognitive theory-based teaching and learning in vocational education.* Information Series No. 349. Columbus: ERIC Clearinghouse on Adult, Career, and Vocational Education.

Tosteson, D. C., Adelstein, S. J., & Carver, S. T. (Eds.) (1994). *New Pathways to medical education: Learning to learn at Harvard Medical School.* Cambridge, MA: Harvard University Press.

Tough, A. (1979). *The adult's learning projects.* (2nd ed.) Toronto: Ontario Institute for Studies in Education.

Tough, A. (1993). Self-planned learning and major personal change. In R. Edwards et al. (Eds.), *Adult learners, education and training: A reader.* London: Routledge and Open University Press.

Uno, G. (1999). *Handbook on teaching undergraduate science courses: A survival training manual.* Philadelphia: Saunders College Publishing.

Vermunt, J. D. H. M. (1989, September). *The interplay between internal and external external regulation of learning, and the design of process-oriented instruction.* Paper presented at the third conference of the European Association of Research on Learning and Instruction, Madrid.

Vernon, D.T.A., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Journal of Academic Medicine, 68,* 550-563.

Walton, H. J. and Mathews, M.B. (1989). Essentials of problem-based learning. *Journal of Medical Education, 23,* 542-58.

Walton, H. J. (1973). *Small group methods in medical teaching.* Medical Education Booklet. Dundee: Association for the Study of Medical Education.

Watson, G. H., & Groh, S. E. (2000). Faculty mentoring faculty. The institute for transforming undergraduate education. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 13 – 22). Virginia: Stylus Publishing.

Way, D. P., Hudson, A., & Biagai, B. (2000). Comparison of three parallel, basic science pathways in the same medical college. *Journal of Academic Medicine, 75,* S118-S120. URL: http:// www. academicmedicine.org/cgi/content/full/75/10/S118.

Weil, S. (1999). Recreating universities for 'beyond the stable state': From 'Dearingesque' systemic control to post-Dearing systemic learning and inquiry. *Journal of Systems Research and Behavioural Science, 16*(Suppl. 2), 171-90.

White, H. A. III (2001). A PBL course that uses research articles as problems. In B. J. Duch, S. E. Groh, & D. E. Allen (Eds.), *The power of problem-based learning* (pp. 131 – 140). Virginia: Stylus Publishing, LLC.

Whitehead, A. N. (1929). *The aims of education.* New York: MacMillan.

Wilkerson, L., & Gijselaers, W. (Eds.). (1996, Winter). Bringing problem-based learning to higher education: Theory and practice. *New Directions for Teaching and Learning, 68.* San Francisco: Jossey-Bass Inc.

Williams, S. M. (1993). Putting case based learning into context: Examples from legal, business, and medical education. *Journal of the Learning Sciences, 2,* 367 - 427.

Williams, G. & Fry, H. (1994). *Longer term prospects for British higher education. A report to the committee of vice-chancellors and principals.* London: Institute of Education.

Wingspread Conference. (1994). *Quality assurance in undergraduate education: What the public expects.* Denver, CO: Education Commission of the States.

Woodward, C. A. (2000) What can we learn from programme evaluation studies in medical education? In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning* (2nd ed., pp. 294 - 307). London: Kogan Page Ltd.

Woodward, C. A., Ferrier, B. M., Cohen, M., & Goldsmith, C. A. (1990). A comparison of the practice patterns of general practitioners and family physicians graduating from McMaster and other Ontario medical schools. *Teach Learn Medicine 2,* 79-88.

Woodward, C. A., Cohen, M., Ferrier, B. M., & Williams, A. P. (1994). *The relative importance of undergraduate and postgraduate education to the practice decisions and attitudes of young family physicians practicing in Ontario.* ACMC Medical Resources Conference, Vancouver, April 24 also Hamilton, Ont.: McMaster University Centre for Health Economics and Policy Analysis (CHEPA) Working Series paper.

www. pbli.org/pbl/pbl.htm

www.pbli.org/pbl/pbl4.htm

www.hagar.up.ac.za/catts/learner/lindavr/lindapg.1.htm

www.vanderblt.edu/lead/PBL/Class/Development/Guidelines.html

www.vanderbilt.edu/lead/PBL/Class/Development/Initial-Considerations.html

Yin, R.K. (1994). *Case study research: Design and methods.* Thousand Oaks, CA: Sage.

Dissertations

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