

***Implementing Problem-based Learning in Higher Education:
A Case Study of Challenges and Strategiesⁱ***

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Keywords: Problem-based learning, curriculum implementation, curriculum change, faculty development, organizational change

Abstract

This paper presents a case study of implementation of a problem-based curriculum in a Master of Management program at the College of Management, Mahidol University, Thailand. The goals of the paper include the following.

- 1) Definition of problem-based learning as a learning strategy;
- 2) Description of the challenges of implementing a learner-centered strategy in a Thai institution of higher education;
- 3) Identification of implementation obstacles and strategies;
- 4) Presentation of evidence of implementation successes, problems, and future challenges;
- 5) Discussion of implications for use of similar strategies in higher education institutions in Southeast Asia.

This paper employs a case study methodology to describe the implementation of problem-based curriculum over a one-year period. Data presented include three types. The first type is a narrative description by the authors who were responsible implementation of a new PBL curriculum. The second type consists of open-ended interviews with faculty teaching in the PBL curriculum. The third set is comprised of quantitative data drawn from student feedback on teacher performance in both problem-based and “traditional” classes taught in the college.

The paper shows that overall implementation of the curriculum has been successful when judged by the faculty and student responses. The results demonstrate that student-centered strategies such as PBL can be used successfully in higher education in an Asian nation known for its traditional instructional approach. The results also confirm that implementation of large-scale changes in teaching are not accomplished without encountering many obstacles both with respect to the role of teachers and students.

Because Wisdom Cannot be Told

“So he had grown rich at last, and thought to transmit to his only son all the cut-and-dried experience which he himself had purchased at the price of his lost illusions: a noble last illusion of age.” Balzac

This quotation from the French writer, Balzac, highlights the challenge that educators face daily the world over: how to transmit or transfer the knowledge handed down from one generation to the next. This challenge has taken on new importance over the past decade as globalization has raised the stakes in the economic, social, and cultural development of nations. This is especially true in the developing nations of Southeast Asia such as Thailand.

Until recently one of Asia’s tiger economies, Thailand’s economic growth ground to a halt in 1997. Among the causes of Thailand’s economic crisis was the inadequacy of its educational system (Bangkok Post, 1998a, 1998b; ONEC, 1998a). Thailand’s schools were never designed to produce the highly motivated, independent thinkers and learners demanded by an information-based economy (MOE, 1996; ONEC, 1997a, 1998a; UNESCO, 1998). Indeed, many have questioned whether Thai (and other Asian students) can learn effectively using “student-centered” learning approaches designed with such goals in mind.

Over the past decade, numerous planning documents published by Thai government agencies have eloquently articulated the need for a new and visionary set of educational priorities (Bunnag, 1997; Kaewdang, 2000; MOE, 1996, ONEC, 1997a, 1998a). Policymakers and educators alike have identified the urgent need for educational reforms that will foster economic competitiveness while preserving the national culture. For example, Professor Kriengsak Charoenwongsak of Thailand’s Institute of Future Studies for Development has noted:

If the trends [in enrolment and retention of primary and secondary school graduates] continued the number of secondary school graduates would double by 2002. . .

However, increasing the quality of Thai products also involves improving the quality of education. The current emphasis on rote learning does not help students assume positions in the workplace which stresses problem-solving and other analytical skills. (Bangkok Post, 1998b, p. 2)

These same inadequacies have been identified in Thailand’s system of higher education where there has been a traditional emphasis on memorization and the reproduction of knowledge. Educational goals such as problem-solving, critical thinking, creativity, independent learning, and the application of knowledge were not previously in the forefront of the nation’s higher education priorities. It, therefore, comes as no surprise that the predominant methods of teaching and learning in use – lecture and discussion – are not well equipped to develop these cognitive, attitudinal and skill capacities.

This paper describes the attempt of a graduate college of management in Thailand to implement a substantial strand of coursework grounded in problem-based learning (Barrows & Tamblyn, 1980; Bridges & Hallinger, 1993, 1995; Coles, 1985; Engel, 1991). Problem-based learning is a student-centered, constructivist learning method that was initially pioneered in medical education in the United States (e.g., Rush Medical School, Harvard University's School of Medicine), Canada (e.g., McMaster University), and the Netherlands (Maastricht University) during the 1980's (Barrows & Tamblyn, 1980; Bok, 1989; deVolder, & deGrave, 1989; Engel, 1991). In the 1990's the use of problem-based learning expanded into other fields including architecture, nursing, education, law, engineering, and management.

This approach to teaching and learning represents a major departure from the norm in most countries (Boud & Feletti, 1991; Margetson, 1991). In Asia the change to PBL is even more radical given the norms of the social culture (Walker, Bridges, & Chan, 1996). Thus, while there is a need to understand the conditions that support successful implementation of PBL in general, implementation in Asian cultures represents a particularly interesting case.

This paper will present a case study of the implementation of PBL at the College of Management, Mahidol University (CMMU). Specially, the paper will report:

- the context in which we implemented PBL at the College of Management, including the specific challenges imposed in our environment,
- the implementation process as it unfolded over the first five terms (one and a half years) including obstacles and management strategies,
- evidence concerning program success from the perspective of student course evaluations and feedback,
- future challenges that we perceive for implementation of PBL at CMMU as well as the implications of our experience for other educational institutions in Southeast Asia.

What is Problem-based Learning?

Before discussing the implementation of PBL at CMMU, it is necessary to define what we mean by problem-based learning. In our experience in training faculty in PBL, we have found that an important first step is to clarify misunderstandings about what PBL. In particular we will clarify how the goals and processes of PBL differ from the case method (Bridges & Hallinger, 1995; Christensen, 1995).

Goals and Defining Characteristics of Problem-based Learning

PBL was first formally introduced by faculty in leading medical schools that were dissatisfied with the quality of the professional preparation they were providing to students (Barrows & Tamblyn, 1980; Bok, 1989; deVolder & deGrave, 1989; Schmidt 1983; Schmidt, Dauphinee, & Patel, 1987). Knowledge application, problem-solving skills and attitudinal dimensions of effective medical practice were all areas that their own assessments identified as persisting weaknesses (Bok, 1989; Schmidt, 1983; Walton, 1989). Notably this self-critique was led by some of the top medical schools in several nations (e.g., Bok, 1989). PBL emerged as a response to these perceived weaknesses in the professional preparation of doctors.

Subsequently, the designers of PBL sought to develop an approach to learning and teaching that would address the following goals:

- Adapting to and participating in change,
- Dealing with complex, swampy problems and making reasoned decisions in unfamiliar situations,
- Reasoning critically and creatively,
- Adopting a more universal or holistic outlook,
- Practicing empathy, appreciating others' points of view,
- Collaborating productively in groups or teams,
- Identifying one's own strengths and weaknesses and undertaking appropriate remediation. (Engel, 1991, pp. 45-46)

The method that came to be known as problem-based learning emerged gradually over a 10-year period with numerous variants. However, at its heart, PBL has six defining characteristics:

1. The starting point for learning is a problem.
2. The problem is one that students are to apt face in the future workplace.
3. Subject matter is organized around problems rather than the disciplines.
4. Students assume a major responsibility for their own instruction and learning.
5. Most learning occurs within the context of small groups rather than lectures.
6. The solution to the focal problem has an implementation focus that goes beyond problem diagnosis and analysis. (Bridges & Hallinger, 1993, 1995)

As Barrows and Tamblyn (1980) note, in problem-based learning “the learning results from the process of working towards the understanding or resolution of a problem. The problem is encountered first in the learning process, rather than facts, models, conceptual frameworks, or other information. The problem serves as a stimulus and focus for problem-solving and learning.”

Thus, the role of the focal problem in PBL is quite different from the typical use of *problems* in cases. In PBL, focal problems are *not* presented to students for the purpose of giving them practice in applying previously learned information; rather they are used as the stimulus for *new* learning. This is an important characteristic that distinguishes problem-based learning from other problem-oriented approaches such as the case method (Bransford et al., 1986; Bridges & Hallinger, 1995; Brown & Campione, 1981; Brown et al., 1983; Christensen, 1987).

Moreover, in PBL learning how to solve problems occurs in the process of learning the subject matter of the discipline rather than as a discrete skill (Prawat, 1989). Development of skills in problem-solving as an individual and as a member of a team are therefore explicit goals of PBL (McGuire, 1980; Norman, 1988; Schmidt & deVolder, 1984)

In contrast to the case method, in problem-based learning the learning objectives and activities are based on the knowledge and skills needed to address problems encountered in the field, rather than on discrete competencies or disciplinary domains (Barrows & Tamblyn, 1980; Boud & Feletti, 1991; Coles, 1985). Knowledge derived

from disciplinary domains remains important, but it is organized quite differently. The focus of managerial education, for example, turns from the concerns of the disciplines as conceived by scholars (e.g., psychology, sociology, MIS) to major problems that managers face in the workplace (Bridges & Hallinger, 1995).

Another critical distinction between PBL and the case method lies in the explicit use of cooperative group learning in PBL (Bridges & Hallinger, 1995; Dolmans et al., 2002; Schmidt & deVolder, 1984; Norman, 1988; Slavin, 1989). The essence of managerial work is being able to accomplish results through people (Bridges, 1977). We contend that in the current environment of decentralized organizations, training experiences should emphasize cooperative problem-solving and teamwork as key areas for leadership development. PBL does this in a more systematic and explicit manner than does the case method.

In PBL the learning experience is structured so as to emphasize implementation as well as analysis and reflection (Bridges & Hallinger, 1992, 1995). The most common forms of the case method ask participants to analyze and describe what they would do if they faced a particular problematic situation. In problem-based learning students are asked to develop a plan for responding to the situation and, to the extent possible, execute the plan through different forms of role-play. Thus, learners confront as directly as possible the implementation of their solutions as well as some of the potential consequences of their actions.

Research on problem-based learning, primarily conducted in medical education, provide reasonable though not inconclusive support for the effects of this approach. Bridges and Hallinger (1993) reviewed this literature and concluded with the following observation:

Although medical educators present a rather persuasive rationale for using PBL to train a physician, do they provide any evidence that the approach is a sound one? Yes, compared with traditional programs in medical education, PBL programs generally yield equal or superior results. (p. 263)

Numerous other reviews conducted before and since have drawn similar conclusions about the effects of PBL on students (e.g., see Albanese, 2000; Albanese & Mitchell, 1993; Coles, 1985; Eisenstadt, Barry, & Glanz, 1990; Norman & Schmidt, 1992; Vernon & Blake, 1993; Walton & Matthews, 1989). While the differential effects of PBL on learning and problem-solving remain small, there is consensus that PBL produces amore enjoyable and motivational learning environment for students (Norman & Schmidt, 2000). That said, the debate over both the optimal conditions for use, the instructional process, as well as the appropriate modes of assessment of PBL continue (e.g., Albanese, 2000; Colliver, 2000a, 2000b; Newman, 2001; Norman, 2002; Norman & Schmidt, 2000; Tanenbaum, 1999).

Formulating an Implementation Strategy for PBL at CMMU

Before discussing the implementation of PBL at Mahidol University, we need to set the background. The College of Management at Mahidol University (CMMU) was started in 1997 as the Mahidol University's graduate college of management. It offers the Master of Management in a variety of management specializations, taught in English, to 750 students in its international program.

From its inception, CMMU was intended to be a center of innovation for the delivery of graduate management education in Thailand. CMMU was founded as a semi-independent unit of Mahidol University, a government university. CMMU was founded as a *hybrid* legal entity. CMMU is responsible on curriculum matters to Mahidol's University Council, but operates with its own Board of Trustees. We mention this because we believe that the College's capacity to innovate is derived, in part, from its semi-independent status.

The College's philosophy from the beginning has focused on offering personalized, student-centered learning in small classes. A key feature of CMMU's stated mission is *to develop knowledgeable students -- students who are able to evaluate and apply knowledge effectively in their work and in their lives*. As a graduate school of management, we believe that, if properly organized, curriculum and instructional approach should influence the knowledge and skills of our graduates (Bridges & Hallinger, 1995; Hallinger, In press; Mumford, Zaccaro, Connelly, & Marks, 2000).

The educational practices that derive from this mission are reflected in the physical facilities of the College as well as in the organization of teaching and learning. Classroom facilities are organized to foster student-to-student interaction and average class size is 26 students. All classrooms are equipped with movable tables and chairs, state-of-the-art multi-media projectors, teacher computer workstations connected to the Internet, and stereo sound systems. The combination of college philosophy, vision, small class size, and purpose-built classrooms was designed to create an ideal environment for instructional delivery of high quality graduate instruction.

Despite this seemingly receptive context for innovation in teaching and learning, a closer look beneath the surface revealed a different picture. A quality audit conducted in the third year of the College's operation found the following:

- Maintenance of the multi-media projectors and computer workstations in the classrooms was inadequate and operation highly unreliable. Consequently, instructors often chose to use overhead projectors rather than the "hi-tech" multi-media equipment.
- Moreover, when instructors did use the state-of-the-art teacher workstations, their usage was generally limited to using the computer as an expensive overhead projector for showing PowerPoint slides. There was little use of the more sophisticated capabilities of the equipment such as for using multi-media, internet/intranet access, or video cases.
- Although every classroom was equipped with tables and chairs to allow easy re-configuration for team-based learning, most instructors kept the tables and chairs in traditional rows. The vast majority of in-class time remained in a traditional, teacher-directed instructional delivery mode.

- An analysis of the curriculum revealed that very little instructional time was intentionally allocated to student-centered learning.
- The only real student-centered learning was located in the thesis and Independent study coursework that comprised the required capstone of the College's curriculum. These research-directed projects were the *traditional* options offered to students in most Thai Master degree programs. However, our faculty observed that these options did not align well with our goal of fostering ability of students to apply their knowledge. Therefore, we did not view them as the only approaches or necessarily the best ones to achieve our vision of graduates who could apply their knowledge effectively and ethically in the workplace (Bridges & Hallinger, 1995).

When the management of the College deliberated on these observations, several conclusions were drawn:

- Curriculum and instructional practice in the College was not consistent with the College's stated vision.
- Despite its potential strengths, the College was not organizing to take advantage of them.
- The College's future success would be based upon its ability to demonstrate its capacity to "develop knowledge-able students for Thai society."

With this in mind, managers and faculty members deliberated upon the question of where to start in terms of instructional and curriculum development. Given the College's vision, we sought to identify instructional and curricular strategies that were suited to this goal. The senior author as well as one other faculty members had considerable experience in implementing problem-based learning elsewhere. Other faculty, though lacking formal training in PBL, were nonetheless philosophically inclined towards methods of active learning and intrigued by what they had hear about PBL. Therefore, we decided to explore the possibility of incorporating PBL into the College's curriculum.

The Implementation Context

Our faculty conceived of the implementation of PBL as a stimulus for long-term, College-wide change in curriculum and instruction. We did not view PBL as "the answer" to educational quality problems. Rather we conceived of PBL as a systematic student-centered learning method that was consistent with our philosophy. Our intention was to employ PBL in a select portion of the curriculum.

The debates over the role and optimal processes for management education that ensued among faculty members were no different than have occurred in other fields (e.g., Bok, 1989). Some instructors felt this approach would diminish the research focus of the College. Others argued for a more comprehensive approach to implementation of PBL. However, given the limited number of full-time faculty and the need to implement quickly, a plan emerged to add a PBL option to the current set of capstone project options of the College.

At that time, like most Master Degree programs in Thailand, CMMU required all students to conduct either an independent study project or a thesis prior to graduation. We continued to see the value of these research-based approaches to demonstrating and creating knowledge. However, we believed that PBL represented another viable option, especially since our explicit focus was, in the words of Professor Charles Gragg of the Harvard Business School (1941) “to prepare students for action.”

A curriculum development team formed and was charged with implementation of this project. The goal was to begin implementation within three months, in the up-coming June term 2001 as part of a six-credit, two-term course already approved but seldom used course entitled *Consultant Internship*.

While this time-line was ambitious, we believed it was achievable. Contextual factors that we took into consideration when formulating our implementation strategy included the following:

- Students would be entering their fourth term of study in their five-term program during June. Given our conception of the course as a “two-term project”, we felt it was important to start in June if we were going to begin a substantial trial implementation in the next year.
- There was strong interest and support among a key group of influential managers and faculty for implementation of PBL. Therefore, we were confident that we could depend upon a large enough group of staff to generate sufficient momentum for the June implementation.
- We already possessed two computer-based PBL simulations that focused on organizational change in Thai companies (see Hallinger, Crandall, & Ng Foo Seong, 2000, In press; Hallinger & Kantamara, 2001). These could be used in tandem as the first module during the June term. This meant that we could phase-in implementation of other new modules starting from August through December. That is, newly developed projects would be implemented sequentially over the course of two terms. Thus, design could take place concurrent with actual implementation. Moreover, the existing projects could serve to some degree as design models for other projects.
- The intellectual resources necessary for development of new projects and implementation were already present in the College in terms of faculty with extensive experience in using PBL in a graduate environment. Both the Executive Director and Director of Academic and Student Services had used PBL for many years. Moreover, as noted there was a core group of faculty who were both philosophically aligned with this approach and had previous experience with the case method (Christiansen, 1987) and cooperative learning (Slavin, 1989).

Taken together, these factors meant that our decision to implement a PBL track within our Capstone Project was taking place in a potentially fertile environment. We did not face many of the usual obstacles to implementation of PBL or other new teaching methods: faculty resistance, conflict with curriculum policies, lack of administrative support, inadequate resources, inappropriate teaching facilities, overly large classes (Fullan, 1991, 1993; Fullan & Pomfret, 1977; Hallinger & Bridges, 1995).

There were, however, several obstacles that we did anticipate. Lack of faculty knowledge and skill was one. This would be the first formal PBL curriculum

development for most of the instructors. The same applied to the lack of experience in using PBL in the classroom. Developing new skills in curriculum design and teaching would be a challenge, even for those instructors eager to try this out (Fullan & Pomfret, 1977; Wilkerson, & Hundert, 1991).

We were also aware that the implementation of PBL in the cultural context of Thailand would bring additional challenges. Prior research on the implementation of problem-based leadership development in Asia suggested a variety of problems related to instructor attitude and skill as well as student norms and behavior (Hallinger, Chantarapanya, Siriboonma, 1995; Walker, Bridges, & Chan, 1996).

Finally, the pace and scope of implementation would present additional challenges. We anticipated implementing several class sections of the new PBL curriculum in the first term, which was only a couple of months away. PBL would require a degree of interdependence in both curriculum design and instructional delivery among faculty members that was altogether new at the College.

CMMU's Implementation Strategy

Based upon these supporting and constraining factors, we decided on the following strategy for implementation. We set a goal to implement the PBL-oriented *Consulting Internship* course with as many students in our second-year cohort as desired to take it. The size of the group who would be ready to start this phase of study in June 2001 was about 300. Another 165 would be ready to enter the Capstone courses in the October term. This represented the number of students who would be choosing between the *IS*, *Thesis* and *Consulting Internship* (CI) options in the coming terms.

Faculty were recruited for design and instructional teams (one and the same) based upon their interest in the PBL methodology and our assessment of potentially viable “problem domains” for inclusion in the PBL course (i.e., high impact problems and/or problems that may have less significant impact but are encountered frequently in Thai organizations; see Bridges & Hallinger, 1995). At the outset of implementation all faculty members involved in PBL curriculum design came together for a two-hour workshop on PBL. At this workshop the instructor outlined what PBL was and shared the specifications for how to design a PBL project.

Subsequently the faculty group involved in the implementation effort (about 15 instructors) met once or twice a month to review progress and identify common problems. Design teams for specific projects met much more frequently.

Within problem-based learning, there are two major variants: problem-stimulated learning and student centered learning (Barrows & Tamblyn, 1980; Bridges & Hallinger, 1995). *Problem-stimulated* projects are more structured. They provide less freedom to students in the selection of learning objectives. *Problem-stimulated* projects also identify the core learning resources for the student (e.g., readings, videos, consultants).

We decided to implement the *problem-stimulated* mode of PBL. We were aware that changing teaching behaviors is difficult and would take time (Fullan & Pomfret, 1977; Engel, 1991; Hallinger & Bridges, 1995; Wilkerson, & Hundert, 1991). In the

short to medium term (i.e., the first one to three years), we believed that the use of *problem-stimulated* projects would represent an easier transition for both instructors and students.

After this decision we turned to the design of additional new PBL projects. Each project would be conceived as a problem that required knowledge resources from multiple disciplines. This multi-disciplinary feature of the problems and resources responded to the need for *Consulting Internship* to be relevant to students from all seven of CMMU's different Master of Management majors (e.g., entrepreneurship management, human resource management, e-commerce management).

Over the next year we designed and implemented five new PBL projects in addition to the existing project on organizational change. The focal problems for the projects would cover major management problems faced in Thai business today:

1. *Making Change Happen!* Two computer simulations on the topics of implementing new information technology in Thai organizations and developing a learning organization;
2. *Retail to e-tail*: changing the business model from retail to e-tail;
3. *Strategies for Success*: developing successful business strategies in an increasingly competitive business environment;
4. *D2I (Data to Intelligence)*: Managing and analyzing information in order to make intelligent decisions;
5. *Managing Across Cultures*: managing cross-cultural conflict in a multi-national (Japanese-Thai) organization;
6. *Projects and People*: Implementing a project while addressing the problems of interpersonal behavior in teams.

The projects ranged in length from 14 to 21 hours in total length (i.e., four to seven three-hour class sessions). During the first year of implementation, students completed five of the six projects in the two-term course sequence. After evaluating the results of the first year of implementation, we reduced the number of projects to four and standardized the length of each project to seven weeks.

Each project would be designed and delivered by a team of between two and five instructors. Each instructor team had an assigned team leader who was responsible for coordination of instructors, maintaining linkage with the Subject Leader of the *Consulting Internship*, as well as for organization of the project and delivery of instruction.

As noted PBL operates in a team-based learning environment. Students would study in teams of between three and six students, depending upon the nature of the project and its organization. Assessment would take account of a combination of individual and team performance on both performance-based and traditional knowledge-based assessments.

To the greatest extent possible, grading of the *Consulting Internship* option was designed to mirror the grading for IS and Thesis in the College. Students would have to complete and successfully pass all five of the projects in order to gain a Pass on the *Consulting Practice* course. Grading on the overall course would be on a High Pass, Pass, or Fail basis. A failure on any single project would require students to retake

that project and to pass it prior to receiving a Pass on the overall *Consulting Internship* course.

Assessment has turned out to be one of the most significant implementation challenges. The fact that this option would be the equivalent to a 6-credit Independent Study project meant that we would need to hold students to at least as high a standard for passage of each PBL project as students faced in the defense of their IS projects. The fact that students would be studying in teams further implied that we would need ways of reliably differentiating individual as well as team performance. Finally, since the PBL projects each resulted in the delivery of *products*, faculty would need to use new unfamiliar methods of performance-based assessment.

The reader should note that even with our foreknowledge of these issues at the outset, it was only *during* implementation that many of them were resolved. Moreover, the implementation effort eventually involved 20 different instructors during the first year alone, as some instructors dropped out along the way. This also meant that the common knowledge base concerning both PBL and the content of various projects among members of the design teams had to be periodically refreshed. These observations reinforce the true impact that the broad scope and rapid pace of implementation had on our effort.

Implementation of the PBL Curriculum

Concurrent with initiation of the design teams during April and May of 2000, it was necessary to inform students of the new option being offered in the June term. A series of “public information” presentations were scheduled at which we outlined the differences and similarities between the PBL option and the traditional choices (see sample in Appendix A). Student concerns revolved around three main areas:

- Clarification of what the problems and disciplines that the projects would focus upon, what they would have to do, and how they would be assessed.
- The relative amount of work compared with IS, which was also a six-credit option.
- Whether or not they would be able to choose the members of their teams.

The outcome of this phase was that 108 students (36%) of the potentially eligible students signed up for the *Consulting Internship* option in the June term. We opened five sections to accommodate them (average class size of 22). We planned to implement two seven-week projects during the June term: *Making Change Happen!* and *Retail to E-tail*. In this section of the paper we will present the results of the implementation effort as well as a descriptive narrative of the chronology.

Overall Results

The data reported here are taken from student course evaluations conducted at the conclusion of all courses in the College. They represent quantitative data taken from a 17-question student course evaluation survey as well as qualitative feedback taken from the same survey and “Talkback” sheets completed at the end of each PBL project. The quantitative survey uses a five point Likert scale in which a higher score reflects better performance. This approach to assessing the implementation of PBL has been used previously with success (Lyon & Hendry, 2002).

The analyses included here address the following questions:

1. Do students perceive the PBL projects as meeting a high standard of instruction?
2. Do students perceive differences in the approach to instruction in the PBL projects compared with traditional courses in the college?

The analyses compare student perceptions of the PBL projects with corresponding results taken from our *Core Courses* over the same four-term period of implementation. The rationale behind comparing the PBL instructor and course ratings to those of the Core Classes lies in our belief that the PBL classes should be emphasizing particular teaching and learning skills more than the Core Classes. The Core Courses are taken by all students in all specialization programs in our Master Degree. They include Principles of Management, Finance, MIS, Economics, and Marketing. All students who would be taking the PBL option would have also completed the Core Classes.

[Insert Figure One about here: Trend comparison of Overall PBL Mean v. Core Mean on instructor rating]

Do students perceive the PBL course as meeting a high standard of instruction?

To answer this question we refer to data displayed in Figure One. This figure compares the mean rating of the instructor in all sections of all PBL projects in each of the four terms with the mean of all sections of the Core Classes. The typical number of sections being compared in a given term would be approximately 20 sections of Core Courses against 15 sections of PBL course projects.

As the graph indicates, students have perceived the PBL courses as being delivered at a high level of overall quality.

- With the exception of the fourth term of implementation, the mean PBL instructor rating across all sections was as high or higher than that of the Core Course sections in the same term.
- Also, it is notable that the overall mean for the PBL course sections has stayed within a relatively narrow range (3.90 to 4.10) across the four terms.
- By way of further comparison, although it is not included in the graph, we would note that the overall mean score of CP was higher than the overall mean score on the instructor quality item of all non-CP courses in the College during each of the terms.

Within the general trend of course evaluation data in the College, a rating of 4.00 reflects excellence in instruction. Ratings that fall below 3.50 reflect courses or instructors in need of improvement. Given these findings, we would conclude that overall, the PBL course has been implemented at a high standard of quality.

We would, however, be remiss if we did not also examine the variability of results across the various PBL projects. Figure One also displays the mean score on the overall quality of instruction item, term-by-term for each of the PBL projects. It should be noted that in a term any given project would typically have multiple course

sections with a total of between two and four instructors (see further detail on the organization of the projects in the next section of the paper).

The data show greater variability in the results for the different PBL projects. This reflects differences in ability of the instructors to design and implement their projects. Despite the variability, we would note that the overall pattern is still generally positive (i.e., in the upper ranges of the rating scale). We will refer again to these data later in the paper when we describe the implementation process. The qualitative data reinforce this perception among the students that the PBL courses were generally implemented at a high level of quality.

Do students perceive differences in the approach to instruction in the PBL projects compared with traditional courses in the college?

The purpose of this question is to ascertain whether the intended goals of PBL as a student-centered learning method were being achieved. This question was again answered through a comparison of the PBL results with those from the *Core Courses*. For this analysis, however, we looked at the results on specific scale items that addressed teaching and learning characteristics consistent with the goals of PBL. These items included the following:

- Rate the ability of the instructor to make the course content practical.
- Rate the instructor's ability to actively involve students in learning.
- Rate how well tests and assignments assessed your understanding of topics.
- Rate the instructor's effectiveness in encouraging students to learn from each other.

All of these items used the same response set: (1) Poor; (2) Not Very Good; (3) Average; (4) Very Good; (5) Excellent. If the instructors in the PBL course sections were using PBL as intended, we would expect better results on these items than in the more traditionally taught Core Course sections. Figure Two compares the results on each of the projects term-by-term on the item "Actively involves students in their learning" with the results on the Core Courses. The results on the other related items were generally in the same direction.

[Insert Figure Two about here]

The results show in Figure Two suggest two general conclusions:

- Instructors in the PBL course sections seem to be achieving the goals of the PBL method at a relatively high level.
- Except in the most recent term, PBL course sections were rated consistently higher on these instructor behaviors and course characteristics than the Core Courses.

The drop-off in results for the PBL course mean on these items in the fourth term is interesting and in a sense counter-intuitive. One would expect the results to improve as time passed and instructors became more confident in the course content and teaching method. However, that is not what happened. We address possible

explanations for this in the discussion of the chronology of implementation in the fourth term.

Chronology of Implementation

During the process of implementation we have sought to face up to problems as they have occurred. Significant amounts of evaluation data were collected and reviewed during each term of implementation. Based upon our observations of the projects as well as student and faculty input, numerous changes have been made.

Instructors have been removed from teams based upon performance. Assessments methods have been revised multiple times. Modules have been taken off of active duty for further refinement. As noted earlier the structure of the two-term sequence consisting of five projects was changed for the second year to four seven-week modules. New modules on different topics replaced some of the original ones.

Moreover, these are only the obvious changes. Each team of instructors made countless changes to the projects in terms of the content, learning resources, instructional process and assessment techniques. Refinement of the projects has been continuous.

Implementation in the First Term

Implementation of the first project on organizational change went quite smoothly. This was, however, due largely to the fact that the project had been used by the instructors previously. This reduced the incidence of problems at the outset of classroom implementation since we were able to anticipate many of them in advance.

Moreover, the project only used two instructors, with each instructor handling his/her own sections. Each of the five class sections met three hours per week and covered identical content. This required a high level of coordination between the two faculty members. The need for coordination became even more salient during the assessment phase, as we shall discuss below.

At the end of the first seven-week project period during the June term, assessments were concluded. Assessments included several products and performance:

- the results obtained on each of the two simulations of organizational change played during the project,
- a four-page personal case about organizational change written by individual students,
- two “strategy analysis” papers (average length of each 15 pages) in which by each three student team analyzed its results on each of the two simulations,
- a 90 minute final written exam,
- Individuals played each simulation once to obtain a final assessment of their ability to implement a change strategy.

Students were graded for the organizational change project on the basis of Hi-Pass, Pass, Low Pass or Fail. In addition to the faculty assessments of students, students were asked to assess the first project using two different instruments: the College’s *Instructor/Course Evaluation* form consisting of 17 closed end and four open-ended

questions, and a *Talk-back Sheet* specifically soliciting feedback on the module's construction.

In the eighth week, students shifted to their second project, *Retail to E-tail*, and a new set of instructors. This instructor team had five members with varying backgrounds in marketing, e-business, and web-site development. The instructors did take responsibility for specific sections, but rather taught the sections as teams, shifting from section to section.

In this project, students had to solve a problem of consulting to a jewelry company that wished to "go on-line." Their team products included presentation of a marketing strategy, a business plan, and a website designed to enable the company to move from traditional retail business to an e-tailing mode.

At the conclusion of the term, students had received grades for two projects. These records were kept by the Subject Leader. No overall course grade would be entered by the registrar until the student had successfully completed (i.e., passed) all five of the seven modules at the end of the second term.

As the results in Figures Two and Three indicated, there was a widely varying response from students to the two PBL modules. The ratings on the *Making Change Happen!* Project were very high across almost all items. The *Retail to E-tail* project provided a stark contrast. In fact student and instructor feedback revealed a range of problems that are quite typical of early implementation of an instructional change.

- Lack of clarity of instructor roles;
- Lack of clarity in student roles;
- Uncertainty about student *product* expectations;
- Lack of instructor skill in assessment.

These problems stemmed from a two main sources. First, despite the training and consultation provided, the instructors remained unclear about how best to organize the module's activities as well as how to actually teach in this style. Uncertainties about how best to organize and teach the module were compounded by instructor conflicts arising from the need for greater interdependency. Although the five instructors were organized to teach as a team, they were unable to work together effectively. People missed meetings and did not agree on how to implement the module. In the end the instructors did "turn" teaching rather than "team" teaching. This resulted in considerable confusion, a lack of accountability, and less desirable results.

The evaluation data (quantitative and qualitative) suggested that the core of the module was good, but that the instruction was not delivered to the desired standard. Based on this evaluation, the following changes were made to the module:

- Three of the five instructors dropped out of the teaching and one was added.
- The amount of content covered in the seven-week module was dropped (specifically the business plan was eliminated as a product).
- A new context was developed for the problem, changing from a jewelry company to a shoe factory.
- Assessment methods were changed to bring greater reliability and individual accountability.

Implementation in the Second Term

At the start of the second term, another group of 165 students was ready to enter the Capstone Phase of the program. Of the newly eligible students, 65% chose to enter the problem-based track, the opposite of the trend of the prior term. Moreover, some students who had chosen to do *Independent Study* during the June term switched over to *Consulting Internship* in October.

Therefore, in October, the initial cohort of students continued into their second term of study in *Consulting Internship* with three new PBL projects (*Projects and People*, *Managing Conflict Across Cultures*, *Strategies for Success*). Concurrently the second cohort of students started out with the first two modules. Thus, in the second term we were running nine class sections with about 275 students and 15 instructors. Managing implementation of the new PBL curriculum with that number of students (and faculty) at the desired standard of quality was a challenge.

Again, most of the problems were predictable. A number of the new instructors who started to teach in this term were not adequately prepared for their responsibilities. Again the issue of instructor interdependence emerged as an issue as some of our part-time instructors found it difficult to attend the meetings that were necessary in order to maintain consistency across multiple sections of the same project. This was especially critical when it came time to assess student performance. Indeed, performance assessment and feedback turned out to be key areas of weakness among our instructors. Despite the many problems that were encountered, as we noted earlier the overall data show a generally positive trend (see Figures One and Two).

At the conclusion of the October term, grades were calculated for the students who had successfully completed the five PBL modules based upon the assessments of the individual projects.

- Students had to achieve at least a Low Pass on all five projects in order to gain a Pass on *Consulting Internship*.
- Students who failed a project had to retake it before they could Pass CI. Approximately 10% of the students failed at least one of the projects the first time they took it.
- Students needed to achieve four High Passes and nothing lower than a Pass to gain a Distinction from Consulting Practice. 7.5% of the first 108 students achieved a Distinction on CI in the first year.

Implementation in the Third Term

In the February term, students who had begun the two-term sequence in October proceeded to the second set of PBL projects. Students who had to repeat selected projects were also included in these sections.

Our collective learning continued as well. During this term, we replaced one project, *Projects and People*, with another called *D2I (Data to Intelligence)*. This was due to the greater salience of the new topic within our overall curriculum rather than to the quality of *Projects and People*. There was another round of faculty turnover in the *Retail to e-tail* project as we continued to search for the right combination of instructor subject expertise. In this case we needed an instructor with more in-depth knowledge about internet marketing.

We also continued to fine-tune our assessments. Specific issues that continued to trouble us included:

- We felt that too much weight being given to group “products” in the assessment scheme. Although we also placed a high value on the “team learning” aspect of the project, we continued to search for the right combination of individual and group assessments that would represent fair and valid.
- Since this course represented a key “exit requirement” of the college, we wished to ensure that each student who passed had truly demonstrated an understanding of the project content. This concern surfaced in comparing the weighting allocated to assessments that were performance-based (i.e., focused on the ability to do the task) vs. assessments that revealed the students’ understanding of the content.
- A third issue concerned the assessment of student work across course sections. As the hectic pace of implementation slowed down somewhat, we finally had the time to look more closely at the grading across instructors teaching the same project. We found a surprising degree of variation from one instructor to another. This stimulated us to work more concertedly towards the development of assessment rubrics.

Implementation in the Fourth Term

By the fourth term instructor teams were mostly set, although there was still turnover in the *Retail to e-tail* project. We continued to adapt all of the projects based upon a continuing flow of student feedback and instructor experience.

During this term, the three major issues that arose concerned assessment procedures. First, we were still dissatisfied with the balance of individual v. group weighting of grades in two of the modules (*Retail to e-tail* and *Strategies for Success*). Although we had been working on this for several terms, implementation in practice continued to require further refinement.

The second issue concerned the degree to which assessment in the *Strategies for Success* project was based upon products that emphasized *doing* as opposed to products that revealed the students’ *thinking about what they had done*. This issue was most salient in this project because the *doing* was a team-based computer business simulation that emphasized competition. Some of the PBL faculty were concerned both that the competitive aspects of the simulation might be impeding learning and that the competitive results might not be the best indication of student learning or competence.

The third assessment issue concerned the reliability of performance-based assessments across instructors of the same project. Previously, both the scope and pace of implementation had relegated this important issue to the back burner. With greater stability among the instructors and less *design on the fly*, the instructor teams were able to spend more time checking the grading with colleagues teaching the same project. Indeed, it was only at this point that the important task of developing rubric (i.e., protocols) for the assessment of products was begun more systematically.

As noted earlier (see Figures One, Two and Three), there was a surprising drop-off in results on the student evaluations. A closer look reveals that this was due to lower evaluations on two of the four projects (*Making Change Happen!* and *Retail to e-tail*). Most of the change can in fact be attributed to continuing turnover in the instructors for *Retail to e-tail*. A new instructor came into this project and had uneven results across his sections.

In addition, more generally we may have experienced what Fullan (1991) has referred to as an *implementation dip*. This dip is frequently found in the second year of implementation of an innovation after the initial glow and enthusiasm has waned a bit. The load on the PBL instructors had been quite heavy over the first year and had no doubt strained our instructors' time and energy. The amount of assessment incorporated into each seven-week PBL project is at least equal to that of most 14-week courses in the College. Moreover, the attention given to assessment in terms of quality of assessment and feedback to students is also stressed in the PBL courses. Consequently, instructors were carrying a heavy load, which may have caught up to them in this term.

Conclusion

Faculty conflicts, curriculum development on-the-fly, achieving reliability across multiple assessments of student work, managing student grades, developing fair policies for problems unique to CI, constraints on faculty resources, and inability to predict student demand for the PBL track all made implementation a harrowing, but energizing experience. In this final section of the paper we reflect on some of the challenges faced in this large-scale implementation of PBL at CMMU.

Implementation in Action: Faculty Issues

It is no secret that there is a tradition of low faculty interdependence at most universities. At the time of initial implementation CMMU had taken this to an extreme. Over 80% of all courses in the College were taught by part-time instructors who came to the College only when it was time to teach. Faculty members were unaccustomed to working closely with together. Quite predictably, problems arose due to differences in academic perspective, personality differences, demands on time to develop the projects, ability to mesh schedules, and differing conceptions of PBL.

It should be noted that no faculty members were forced to participate in the project. Participation was entirely voluntary. As noted in our chronology, there was quite a bit of shuffling of team composition until faculty members figured out who was comfortable working with whom. Only two of the teams remained constant in terms of composition from the beginning. It took fully three terms before the sorting and self-selecting resulted in stable teams of faculty.

We also found that faculty needed considerable support in the area of student assessment. Especially during the first two terms, we had many complaints from students concerning assessment of their products. Through conversations with faculty, students as well as from formal feedback, we identified a number of problems related to assessment including:

- lack of feedback (i.e., only giving a simple grade) from instructors on student products;
- poorly framed feedback (i.e., feedback that does not stimulate correct learning);
- lack of reliable grading from instructors across sections of the same project module;
- poor balance between the contribution of group products and individual products in arriving at a student's grade for the project.

These problems stimulated us to make a number of changes in our methods of teaching and assessment during the term. Based upon our evolving experience, we came to the following conclusions with respect to the role instructors:

- *Instructor teams should be smaller rather than larger.* Given the size of our student population and the number of sections to be offered of a subject, instructor teams comprised of two to three persons seem to work best. Larger teams are harder to coordinate in terms of meeting times, and also in terms of coming to agreement on grading and other issues.
- *Each class section should have one instructor who is responsible for the students and assigning the final grade.* The use of teams works well in terms of design and overall delivery, but we found that it was necessary for each instructor to feel responsible for specific section(s) and for students to know who was accountable.
- *Instructors need training and monitoring in order to achieve a reliable standard of grading.* Training and advice included how to use and construct rubrics for assessing student performance, how to structure and weight assessments in order to ensure individual accountability in the context of team-based learning. Monitoring came primarily in the form of close checking of grades submitted in order to ensure agreement and thoroughness in assessment among a group of instructors.

In sum, with respect to the role of instructors, this was *not* “plug and play” system. It required (and continues to require) close monitoring and on-going support for the continued development of teaching skills. Instructors teaching in this portion of the curriculum work harder, in part because of the greater emphasis placed on reliability and thoroughness of assessment. Indeed, as we have implemented this course, each individual PBL project actually incorporates the equivalent of a full term's worth of assessment exercises for a typical graduate course.

This is quite a burden for the instructors, but one that they have accepted for now because of the pride that goes along with teaching in the CI program. The instructors recognize that this is something special and unique. Longer term, however, it is an issue that the College management will have to address.

Implementation in Action: Student Issues

Despite the usual warnings about Asian students wanting to be spoonfed, our students adapted surprisingly well to the PBL curriculum. It should be noted that many courses in the College do ask students to work on projects in teams. In addition many courses use cases and role-plays. So in a sense, the PBL Capstone Course represented a more

formal and explicit blending of instructional approaches already in use in bits and pieces.

As noted above, the first issue on students' minds concerned whether they could study in teams of their own choosing. Our instructors have taken different tacks on this issue with some insisting on assigning students to teams and others letting students form their own teams. Both approaches have tradeoffs and we continue to be eclectic on this matter.

Student feedback has been consistently positive on the practice-orientation of the CI projects. Students are able to see the direct connection between the content knowledge that they are learning and the problems of practice they are trying solve. This has proven to be highly motivational.

One issue that instructors face fairly frequently is student anxiety in the face of uncertainty. Although our problem-stimulated projects are fairly structured, from the students' point of view they are highly ambiguous. Moreover, completion of the products requires a much higher level of planning and collaboration skills than is typical of most classes. Consequently, the instructors have to provide ongoing assurance and guidance to the students as they struggle through the predictable challenges of solving difficult problems.

As suggested above, we conceive of the PBL modules as "projects." As such each project takes place within a specific, highly compressed time period. While this creates a certain amount of pressure we believe that this has several benefits as well:

- Students must practice skills in time management that they have learning in other courses (e.g., prioritizing, delegation).
- Under the pressure created by the time constraint, students experience the "emotional side" of group leadership and membership.
- Student experience and reflect upon the constraints and less than perfect conditions under which knowledge is put into use in organizations.

Implications for Other Asian Institutions of Higher Education

The findings from our evaluation study of PBL implementation are both encouraging and sobering. We are encouraged by the warm reception that our students have given to this student-centered approach to learning. Moreover, although this effort was undertaken and implemented in very short span of time, the results were quite positive from the start, even as compared with the Core Courses. While the effort at CMMU needs to build greater instructor consistency, there is little question that the students have found the new PBL sequence challenging and rewarding.

Indeed, the students now view the PBL sequence as the primary option of choice among the capstone project options. While some might assert that this is the result of students seeking an *escape from the rigors of conducting independent research*, we would disagree for several reasons.

First, many of our top students have gravitated towards the PBL option. They tell us the reason is not because they think it will be easier but because they perceive it to be more meaningful and relevant to their current and future work roles. The traditional

Independent Study project is useful for studying a single problem in depth, and potentially for contributing new knowledge. However, neither the format of a typical IS project, nor the work process undertaken in these research studies are well connected to the work tasks performed by professional managers (see Bridges, 1977; Bridges & Hallinger, 1995).

Second, it is interesting to note that quite a few of our IS students are now choosing to do one term of the PBL coursework as a free elective. What is particularly surprising about this is that the workload for the PBL projects goes well beyond that of typical elective choices. Indeed, there is a shared attitude among the PBL instructors that this option should act as a final screen for students before they can graduate. Accordingly, the workload is heavy and the standard high. Indeed the percentage of students who do not achieve a passing grade in this option is higher than the rate at which students receive “C” in any other course in the college. Therefore, we prefer to cast this as a positive choice by students for high quality instruction geared towards their professional work.

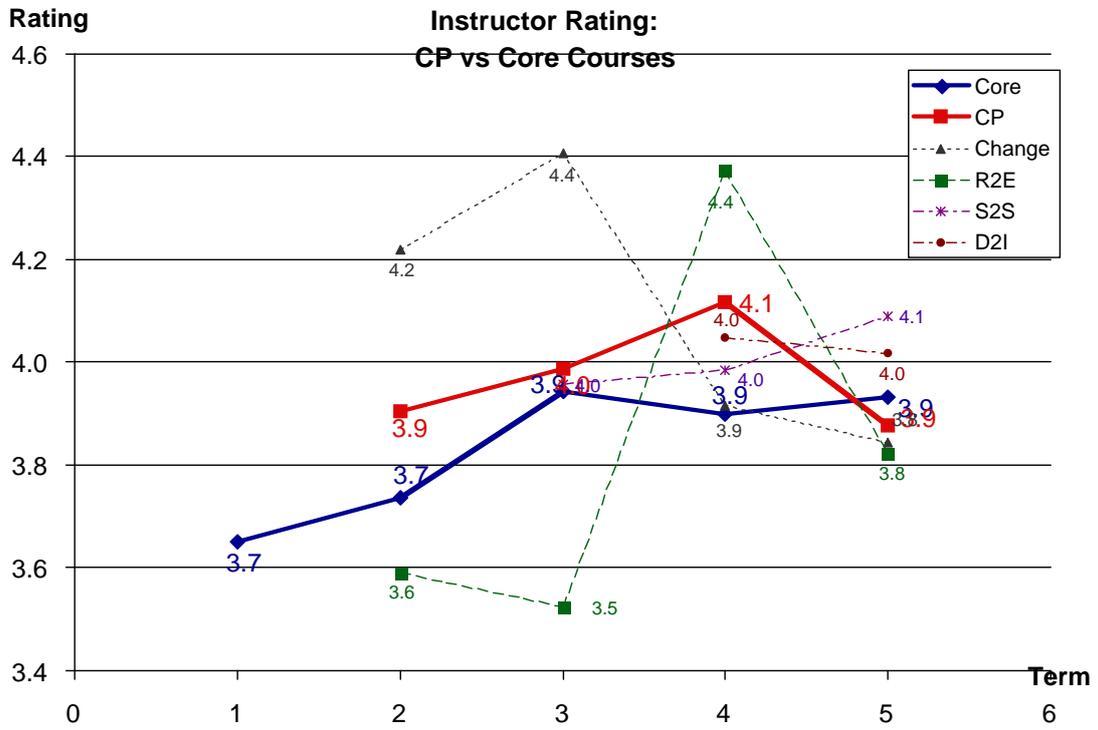
The more sobering implication of our effort lies in the resource-heavy nature of high quality PBL implementation. Factors that clearly contributed to our successful effort included:

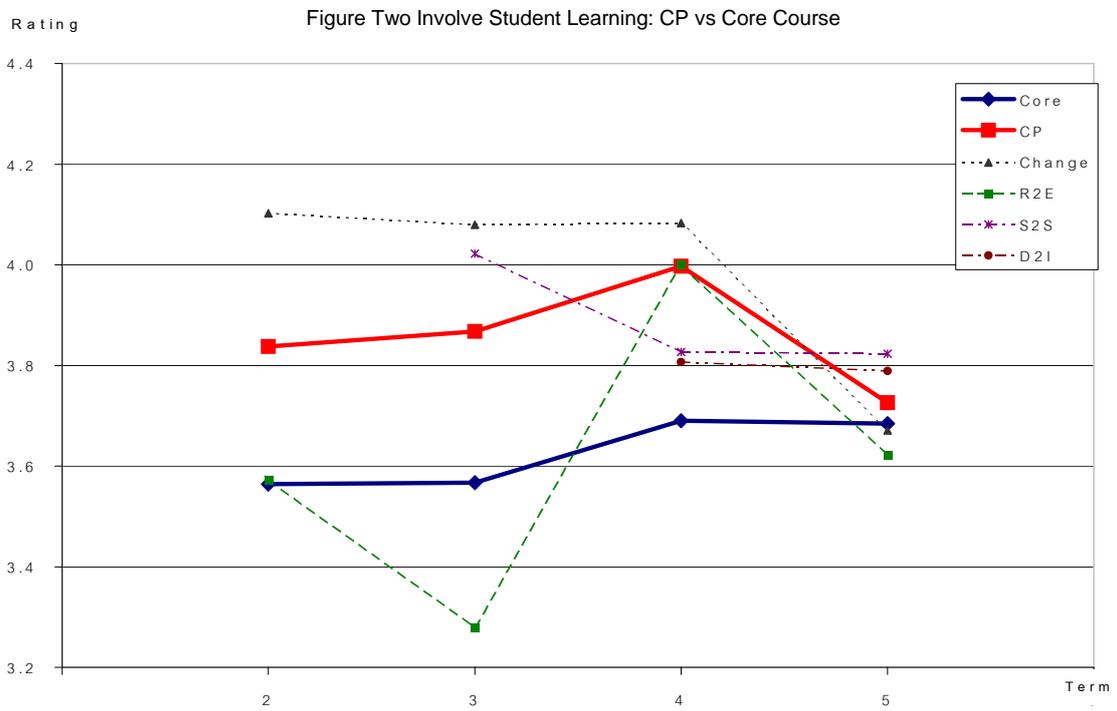
- Highly competent, strongly motivated faculty members eager to take on this challenge and to put in extra effort to achieve success;
- Relatively small class sizes that enabled the necessary instructor-student interaction (generally below 30 and none more than 36);
- Facilities that supported the team-based learning that is central to PBL;
- Financial resources to provide incentives for new project development;
- A college culture that valued and supported innovation;
- Internal staff resources deeply steeped in PBL;
- Support from the top of the organization for the implementation of learning methods that would achieve our goals of developing knowledgeable students.

Even with these supportive conditions at CMMU, it took an *immense* effort to implement the PBL courses at a high level of quality.

On a more positive note, we would close the following observation. At CMMU managers, faculty and students would almost unanimously affirm the usefulness of the PBL track in the College. Even given the higher workload for faculty and students, we feel that it has brought new life to our curriculum. Our recommendation to other institutions would be, “Don’t follow our example blindly.” Adapt the scope and pace of implementation of PBL at your institution based upon your own supportive and constraining conditions.

Figure One





References

- Albanese, M., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*, 68(1), 52-80.
- Albanese, M. (2000). Problem-based learning: Why curricula are likely to show little effect on knowledge and clinical skills. *Academic Medicine*, 34, 729-734.
- Bangkok Post*. (1998a, Nov. 3). Graft blamed for fall in world ranking: Kingdom slides from 29th to 39th place. *Bangkok Post*, p. 3.
- Bangkok Post*. (1998b, Nov. 25). Higher-value products and better education seen as vital. *Bangkok Post*, p. 2.
- Barrows, H., & Tamblyn, R. (1980). *Problem-based learning: An approach to medical education*. New York: Springer.
- Bok, D. (1989). Needed: A new way to train doctors. In H. Schmidt and others (eds.), *New directions in medical education*. New York: Springer Verlag, 17 - 38.
- Boud, D. & Feletti, G. (1991). *The challenge of problem-based learning*. New York: St. Martin's Press.
- Bransford, J., Franks, J., Vye, N., and Sherwood, R. (1989). New approaches to instruction: Because wisdom can't be told. In S. Vosniadou and A. Ortony (Eds.), *Similarity and analogical reasoning* (470-497). New York: Cambridge University Press.
- Bransford, J., Sherwood, R., Vye, N., & Rieser, J. (1986, October). Teaching thinking and problem-solving. *American Psychologist*, 41(10), 1078-1089.
- Bridges, E., with Hallinger, P. (1992). *Problem-based learning for administrators*. Eugene, OR: ERIC Clearinghouse for Educational Management.
- Bridges, E. & Hallinger, P. (1993). Problem-based Learning in medical and managerial education. In P. Hallinger, K. Leithwood & J. Murphy (eds.), *Cognitive perspectives on educational leadership*. New York: Teachers College Press.
- Bridges, E. & Hallinger, P. (1995). *Implementing problem-based learning in leadership education*. Eugene, OR: ERIC Clearinghouse for Educational Management.
- Good, T. & Brophy, J. (1991). *Looking in Classrooms*. New York: Harper & Row.
- Bridges, E. (1977). The nature of leadership. In L. Cunningham, W. Hack, & R. Nystrand, *Educational administration: The developing decades*. Berkeley, CA: McCutchan, 202-230.

- Brown, A., Bransford, J., Ferrara, R., & Campione, J. (1983). Learning, remembering and understanding. In J. Flavell & E. Markman (Eds.), *Carmichael's manual of child psychology, Vol. I.* (77-166). New York: Wiley.
- Brown, A., & Campione, J. (1981). Inducing flexible thinking: A problem of access. In M. Friedman, J. Das, & N. O'Connor (Eds.), *Intelligence and learning* (pp. 515-530). New York: Plenum.
- Bunnag, S. (1997, August 5). Poor academic performance of students blamed on rote system. *Bangkok Post*, p. 2.
- Christensen, C. (1987). *Teaching and the case method: Text, cases and readings*. Boston: Harvard Business School.
- Coles, C. (1985). Differences between conventional and problem-based curricula in their students' approaches to studying, *Medical Education*, 19, 308-309.
- Colliver, J. (2000a). The effectiveness of problem-based learning curricula: Research and Theory, *Academic Medicine*, 75, 259-266.
- Colliver, J. (2000b). Effectiveness of PBL curricula: Research and Theory, *Medical Education*, 34, 959-960.
- Copland, M. (2000). Problem-based learning and prospective principals' problem-framing ability, *Educational Administration Quarterly*, 36(4), 585-607.
- Copland, M.. (2003). Problem-based leadership development: Developing the cognitive and skill capacities of school leaders. In P. Hallinger (ed.), *Reshaping the landscape of school leadership development: A global perspective*. Netherlands: Swets & Zeitlinger.
- deVolder, M. & deGrave, W. (1989). Approaches to learning in a problem-based medical programme: A developmental study, *Medical Education*, 23, 262-264.
- Dolmans, D., Gijlsaers, W., Moust, J., de Grave, W., Wolfhagen, I., van der Vleuten, C. (2002). Trends in research on the tutor in problem-based learning: Conclusions and implications for educational practice and research. *Medical Teacher*, 24(2), 173-180.
- Drucker, P. (1995). *Managing in a time of great change*. New York: Talley House, Dutton.
- Eisenstadt, R., Barry, W., & Glanz, K. (1990). *Problem-based learning: Cognitive retention and cohort traits of randomly selected participants and decliners*. Paper presented at the Twenty-ninth Annual Conference of the Society of Research in Medical Education.
- Engel, C. (1991). Not just a method, but a way of learning. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning*, New York: St. Martin's Press, 23-33.

- Fullan, M. (1993). *Change forces*. London: Falmer Press.
- Fullan, M. (1991). *The new meaning of educational change*. New York: Teachers College Press.
- Fullan, M. & Pomfret, A. (1977). Research on curriculum and instruction implementation. *Review of Educational Research*, 47, 335-397.
- Godden, D. & Baddeley, A. (1975). Context dependent memory in two natural environments: On land and underwater. *British Journal of Psychology*, 66, 325-332.
- Gragg, C. (1941, October 19). Because wisdom can't be told. *Harvard Alumni Bulletin*. Reprinted by Harvard Business School, HBS Case #451-005.
- Hallinger, P. (In press). School leadership development: Global challenges and opportunities. In P. Hallinger (Ed.), *Reshaping the landscape of school leadership development: A global perspective*. Lisse, Netherlands: Swets & Zeitlinger.
- Hallinger, P., Chantarapanya, P., Sriboonma, U. (1995, July). *Implementing problem-based leadership development in Thailand*. Paper presented at the International Conference in Teacher Education, Chulalongkorn University, Bangkok Thailand..
- Hallinger, P., Crandall, D., Ng Foo Seong, D. (2000). Systems thinking/Systems changing: A Computer simulation for learning how to make schools smarter (141-162). In K. Leithwood and K.S. Louis (Eds.) *Intelligent learning systems*. New York: JAI Press.
- Hallinger, P., Crandall, D., & Ng Foo Seong, D. (In press). Making change happen: A simulation for learning to lead change. *The Learning Organization*.
- Hallinger, P. & Kantamara, P. (2001). Learning to lead global changes across cultures: Designing a computer-based simulation for Thai school leaders. *Journal of Educational Administration*, 39(3), 197-220.
- Hmelo, C. (1998). The cognitive consequences of problem-based learning in the early development of medical expertise. *Teaching and Learning Medicine*, 10, 92-100.
- Kaewdang, R. (2000). *Learning from monkeys*. Bangkok: Amarin Co.
- Lyon, P., & Hendry, G. (2002). The use of the course experience questionnaire as monitoring evaluation tool in a problem-based medical programme. *Assessment & Evaluation in Higher Education*, 27(4), 339-352.

- Margetson, D. (1991). Why is problem-based learning a challenge? In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning*. New York: St. Martin's Press, 42-50.
- McGuire, C. (1980). Assessment of problem-solving skills, *Medical Teacher*, 2(3) 118-122.
- MOE. (1996). *Education reform at the Ministry of Education Thailand*. Bangkok, Thailand: External Relations Division, Office of the Permanent Secretary, Ministry of Education.
- Mumford, M., Zaccaro, S., Connelly, M., & Marks, M. (2000). Leadership skills: Conclusions and future directions. *Leadership Quarterly*, 11(1), 155-170.
- Newman, M. (2001). How effective is problem-based learning? *Education for Health*, 14(2), 333-334.
- Norman, G. (1988). Problem-solving skills, solving problems and problem-based learning, *Medical Education*, 22, 279-286.
- Norman, G. (2002). Research in medical education: three decades of progress. *British Medical Journal*, 324, 1559-1562.
- Norman, G., & Schmidt, H. (2000). Effectiveness of problem-based learning curricula: Theory, practice, and paper darts. *Medical Education*, 34, 721-28.
- Norman, G., & Schmidt, H. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine*, 67, 557-565.
- ONEC. (1997a). *Education in Thailand 1997*. Bangkok, Thailand: Office of the National Education Commission.
- ONEC. (1997b). *Formal education statistics and indicators: Academic year 1988-1993*. Bangkok, Thailand: Office of National Education Commission.
- ONEC. (1998a). *International competitiveness, 1998*. Bangkok, Thailand: Office of the National Education Commission.
- ONEC. (1998b, Aug. 26). *Policy development: Basic education management 12 years*.
- Prawat, R. (1989). Promoting access to knowledge, strategies, and disposition in students: A research synthesis. *Review of Educational Research*, 59(1), 1-41.
- Schmidt, H. (1983). Problem-based learning: Rationale and description, *Medical Education*, 17, 11-16.
- Schmidt, H. & deVolder, M. (1984). *Tutorials in problem-Based learning*. Maastricht, Netherlands: Van Gorcum.

- 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, 305-315.
- Slavin, R. (1989). Cooperative learning and student achievement. In R. Slavin (Ed.), *School and Classroom Organization*, N.J.: Prentice-Hall, 129-156.
- Tanenbaum, S. (1999). Evidence and expertise: The challenge of the outcomes movement to medical professionalism. *Academic Medicine*, 74, 767-773.
- UNESCO. (1998, February, 16). *Asian education report*. Bangkok, Thailand: UNESCO.
- Vernon, D., & Blake, R. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine*, 68(7), 592-604.
- Walker, A., Bridges, E., & Chan, B. (1996). Wisdom gained, wisdom given: Instituting PBL in a Chinese culture. *Journal of Educational Administration*, 34(5), 12-31.
- Walton, H. & Matthews, M. (1989). *Essentials of problem-based learning*. Medical Education, 23, 542-558.
- Wilkerson, L. & Hundert, E. (1991). Becoming a problem-based tutor: Increasing self-awareness through faculty development. In D. Boud & G. Feletti (Eds.), *The challenge of problem-based learning*. New York: St. Martin's Press, 159-172.

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ⁱ The authors wish to acknowledge the assistance of Khun Usanee Phanchantraurai and her staff in the collection of the data included in this study, Racha Mahakuntha in the preparation of the data, and Patsagorn T. for preparation of the figures and tables.