CHAPTER 1: INTRODUCTION

Overview

This thesis describes a qualitative study that compares the processes and outcomes of two health science courses that were conducted under a Problem-Based Learning (PBL) educational framework at a university in Hong Kong. The purpose for undertaking the research was five fold. First, there is scant published literature about courses that use the PBL approach in its full philosophical and applied form. Second, the perceptions of students and academics engaged in full PBL courses have rarely been used to explore their experiences and outcomes. Third, there is no published literature that compares two full PBL courses. Fourth, the findings of the little published research about using PBL in any of its forms in Hong Kong Chinese culture is contradictory and inconclusive. Fifth, and finally, there is only little published substantive theory to inform practice, particularly in a Hong Kong Chinese cultural context.

This first chapter provides an overview of the research and the research design. It opens with a background to the study that: describes and defines PBL according to its characteristics; discusses the development and spread of PBL as an educational method in higher education; and provides rationale for using PBL in higher education particularly for professional education. In the following sections, the background to the research question is described and its significance highlighted. The research design and methods used are then described and justified, followed by a statement of any assumptions affecting the study. The chapter closes with a brief overview of the remaining chapters in the thesis.
Background to the Study

Problem-Based Learning

Problem-Based Learning is often promoted as an alternative and innovative approach to educating students in higher education (Boud & Feletti, 1999). Viewed more as a philosophy rather than a prescriptive methodology or a basic teaching method, PBL and its characteristic instructional process incorporates general education strategies aimed toward engaging students in active, student-centered education with both content and process oriented learning outcomes (Biley & Smith, 1999; Schmidt 1995; Walton & Matthews, 1989). The methods used in the instructional process differ markedly from traditional curriculum approaches that generally rely on didactic, teacher-centered, lecture-based, and content and exam driven methodologies (Boud & Feletti, 1999).

In PBL, new knowledge is assimilated as a result of engaging with, and learning in relation to, the problems presented at the outset of instruction. This is in direct contrast to conventional teaching strategies and methods of instruction usually found in higher education where disciplinary knowledge is expounded, factual elements are learned first, and then later applied to case studies and practice oriented situations (Margeston, 1988). At a fundamental level, “PBL is a way of constructing and teaching courses using problems as a stimulus and focus for student activity” (Boud & Feletti, 1999, p. 2).

The general model for “full” Problem-Based Learning is characterised by the use of problems or replications of problem situations drawn from real life as the starting point for the PBL tutorials and the learning process (Barrows, 1986; Boud & Feletti, 1999). A PBL environment emphasises an instructional process, which places much of the responsibility for learning on the students and requires them to work in small groups. Students do, however, also work closely with a facilitator, whose role is to guide students during their learning process. Instead of being an expert provider of information as a traditional lecturer, the facilitator ensures the PBL process is followed so that discipline content, cognitive and process skills are developed in the
context of solving a problem (Boud & Feletti, 1999, Engle, 1999). The whole process is aimed at achieving improved learning outcomes for students, particularly meta-cognitive skills associated with self-directed learning: that is, thinking, reasoning and decision making (Barrows, 1988).

**Problem-Based Learning Defined**

Defining PBL has long been an issue, and there is still little agreement because of the rise of many diversified and modified formats. Some of these formats are "erroneously assumed, and (sic) involve the addition of problem-solving activities to otherwise discipline-centred curricula" (Boud & Feletti, 1999, p. 2). Savin-Baden (2003) terms this approach as problem-solving learning and notes that these are frequently defined as PBL.

The original PBL methodologies for instruction were introduced at McMaster University in the 1960’s to educate medical students and formed the foundations for PBL. These courses have since been termed ‘pure’, ‘true’, ‘total’ or ‘full’ PBL (Boud & Feletti, 1999). Adaptations of the PBL format in some courses have arisen in response to the emergence of changed industrial and professional requirements for graduates (Boud & Feletti, 1999). This has led to a variation of nomenclature, which can be confusing. Tony Dickson, in his keynote speech at the 1st Asia-Pacific Conference on PBL in Hong Kong, noted that there are now “many churches within the religion of PBL” (personal communication, December 9, 1999).

The term ‘hybrid’ is used for courses that combine traditional lectures delivered to large groups and a PBL format used in smaller tutorial groups (Lai, Tang, & Taylor, 1997). These are often perceived as having commonalities with Barrows’ (1986) lecture-based case and case-based lecture varieties of PBL, described later in this chapter. For example, the Harvard model of PBL is a hybrid model, and “uses problem-based tutorials, lectures, conferences and clinical sessions” (Boud & Feletti, 1999, p. 3) as a framework for structuring content to be learned and taught. The Harvard hybrid model is common among medical faculties throughout Asia that are claiming to engage in PBL (Dickson, personal communication, December 9, 1999).
Margetson (1998) has warned that in many cases PBL has simply become a convenient peg for those claiming to be hybrid models to hang their methodology.

It is worth noting that PBL, with its supporting ideologies, has survived mostly in its original format. It has been sufficiently robust, providing the foundations for many evolutionary forms, integrating complementary methods, strategies and techniques to accommodate organisational, academic, economic or political demands and expectations (Boud & Feletti, 1999). As a result, PBL has spread beyond medical programs, and is now utilised by a range of discipline areas. It has been introduced at all levels of education and adapted to suit many contexts (Margetson, 1998). In particular, it has found a niche in the education of postgraduate and undergraduate students in an increasing number of countries. This has come about where revitalization and rejuvenation of content-overloaded, traditional courses and responsiveness to public demand has proved a necessity (Boud & Feletti, 1999).

Although Boud and Feletti (1999) claim there are “no universally agreed set of practices … found in problem-based courses to define them as such” (p. 2), there have been some more recent attempts develop a definition. Van Berkel and Schmidt (2000) built on previous works by Barrows (1983) and Norman and Schmidt (1992) to define PBL as:

an approach to professional education that stresses the use of real-life problems as a stimulus for learning. In PBL, student’s work in small tutorial groups on these problems [using a definitive process], and, in the course of discussing them, formulate goals for self-directed learning. The learning resulting from these activities is considered constructive and contextually meaningful (2000, p. 231).

According to Stokes (2001), full PBL courses have four distinct characteristics and she used these characteristics to define PBL. First, the problems are drawn from real life and practice situations. The problems are the starting point for all learning. Second, new knowledge is learned in the process of solving the problems. Third, the curriculum integrates knowledge from a range of cognate disciplines. Fourth, learning mostly occurs as a result of small group discussions. It is this definition by Stokes that will be adopted for this study as it focuses on full PBL. An elaboration of the structure and characteristics of a full PBL course as defined by Stokes follows.
Characteristics and Structure of Problem-Based Learning

Problem-Based Learning is characterised by a set of methodological procedures designed to assist students acquire specific learning outcomes. In order to achieve these outcomes, PBL encompasses a number of educational concepts. It is a process that integrates knowledge from multiple discipline areas, and it is the analysis of problems that provides the starting point for students identifying and progressively carrying out focused investigations (Biley & Smith, 1998). The PBL process supports broad-based knowledge acquisition using the concept of progressive inquiry and learning strategies (Engle, 1999).

The problem materials used as a stimulus to learning can be presented to the students in a variety of forms. These include replications of problem situations, problem scenarios, puzzles, vignettes, patient case materials or descriptions of problematic phenomena (Alavi, Cooke & Crowe, 1997). Because all problems or problem materials in PBL are drawn from real life situations, they provide students with opportunities to learn in association with likely work-place experiences (Alavi & Cooke, 1995). The format used in a full PBL approach follows the premise that the instructional process primarily serves to assist students to acquire new knowledge of the context of a future professional domain (Schmidt & Moust, 2000). It should be noted that PBL is not a simplistic approach to using isolated strategies and techniques to teach large groups of students; it is more complex and the methods used have potential to teach students knowledge and skills beyond the acquisition of discipline content alone (Margeson, 1998).

Incorporation of the essential elements of PBL defines the approach and gives the method or strategy for teaching and learning its signature characteristics (Boud & Feletti, 1999). PBL in its full form is designed to include two coexisting tasks. Both these tasks are essential to any PBL activity: the first concerns learning of content and the second applies to the processes involved in the methodological design (Vernon & Blake, 1993). For the first task, it is essential for students to be confronted with a problem to be analysed, while the second requires students as learners, “to identify, search out and learn the knowledge required to understand and
solve the problem” (Charlin, Mann, & Hansen, 1998, p. 326). Full PBL will have complete curricula built on this instructional arrangement.

**Taxonomy of Problem-based Learning**

Barrows (1986) believes different models of PBL are adopted because of expediency and consequently they may not achieve the outcomes desired from a full PBL course. Based on the varieties of commonly used models, he developed a taxonomy for different ‘species’ of PBL. Barrows purpose was to provide a means of assisting educators to recognize the range of limitations and expectations inherent in the different sets of education methodologies commonly regarded as PBL. There were six levels. In ascending order of student-centredness they are: lecture-based cases, case-based lectures, case method, modified case-based, problem-based and closed-loop problem-based. With lecture-based cases, large groups of students are presented with information followed by one or two cases to provide a link for relevant applicability of the information.

In case-based lectures, large groups of students are presented with vignettes or a case history prior to the lecture, which provides a framework for linking information as the lecture proceeds. The case method requires students to be provided with a complete case to study prior to formal instruction. It is more interactive, where a lecturer acts more as a tutor with a limited information-provider role. It employs both lecturer-centred and student-centred methods. Barrows (1986) notes that this method is common in law and business. Modified case-based is more frequent in medical schools and requires students to work in small groups where they are challenged by sequential management issues and patient management problems to engage in self-directed learning. With problem-based, students are presented with clinical patient cases in formats that allow free enquiry and generation of hypotheses. These are facilitator guided and result in activation of prior knowledge and assimilation of new knowledge that is problem-related. The final level, closed-loop problem-based, is an extension of problem-based and involves students to engage in self-directed study, evaluate what they have found and then revisit the problem in light of the new information they have found. This requires them to evaluate their prior knowledge and reasoning going beyond just acquisition of knowledge and discussing it.
Davis and Harden (1999) also developed a taxonomy of PBL designed to serve as a tool by which medical educators may conceptualize PBL, and gain a clearer picture of the differences of the problem formats and ideas about learning generated from studying the problems. Their taxonomy of PBL is based on a continuum of student learning. It ranges from what they term information-based learning for traditionally subject-oriented programs through to problem-based programs. The term problem-based applies where learning of subject matter is conceptualized in terms or principles derived from examples and illustrations from literature and work experience (Davis & Harden, 1999). With information-oriented learning, subject matter becomes ordered on the basis of principles stated first and then illustrated with examples. This is similar to Barrows (1986) lecture-based cases or case-based lectures, where content is mostly rote learnt and is abstract in nature. At the problem-based end of Davis and Harden’s (1999) continuum, students are provided with opportunities to discover the concepts and principles of the subject matter themselves. This is mainly through self-directed learning and the group processes of problem issue identification and discussion generated during the tutorial sessions. Resolution of the problem, review of the concepts and principles learned in relation to the problem are also part of the process (Schmidt, 1993). In addition, there is engagement in a process where consideration is given to applicability of the subject to generalized practice situations and feedback is provided to the students. This places the top end of Davis and Harden’s continuum of learning in PBL in line with Barrows closed loop, problem-based classification. Both these classifications will be termed full PBL for the purpose of this thesis.

**Rationale for Problem-Based Learning**

When PBL was first conceptualised and developed at McMaster University about 40 years ago (Boud & Feletti, 1999), it was in response to difficulties graduate medical students faced when placed in a clinical situation. All too often, they found themselves unable to apply much of the theoretical knowledge they had been taught using traditional methods and furthermore they had forgotten much of what they had learned to pass exams. In short, a lot of resources had been invested in their education, which was producing less than desirable outcomes (Woods, 1994).
Dolmans, Schmidt & Gijselaers (1995) highlight how PBL was accepted as a new way of educating undergraduate medical students for the profession by the association of American Medical Colleges in 1984, because it appealed as an attractive alternative to conventional educational approaches that encouraged ‘spoon feeding’ students. Didactic teacher-centred approaches, usually attributed to conventional approaches, relied on providing all the factual knowledge educators believed students should know. This did not sufficiently prepare students for the requirement to be life long learners. In the new PBL approach, students would be involved in active, critical and complex thinking processes and activities. The need to induce a culture where students became active, independent and efficient and effective in their self-directed learning and problem solving was essential to the production of students’ skilled behaviours conducive to maintaining ongoing lifelong learning (Boud & Feletti, 1999: Dolmans et al., 1995).

Engle (1999) claims there are two broad aims that underpin the use of PBL as a purposeful method of instructing students. The first is to “assist students toward achieving a specific set of objectives, that is to become capable in a set of [generalised] competences [sic] that will be important to them throughout their professional life” (Engle, 1999, p. 18). The second “is to use problem-based learning as the method of choice, because it is particularly suitable to support the conditions that influence effective adult learning” (p. 19). Engle believes that PBL needs to be conducted in the spirit in which it was originally intended, and conceptually formulated, for the knowledge attainment, skills development and behavioural outcomes to be achieved.

Underpinning the educational philosophy of PBL is an approach that “attempts to broaden the students’ ability for critical and analytical problem-solving by integrating formal theory, perhaps from a variety of disciplines, with real situations” (Biley & Smith, 1998, p. 358). The aim of adopting a PBL approach is therefore to ensure graduating students will have the skills necessary to keep abreast with the rapid changes characteristic in the contemporary workplaces for the duration of their working lives. The approach promotes active learning and relevance to practice in professional, clinical, and community contexts (Walton & Matthews, 1989).
Proliferation of PBL

On an increasing scale, PBL has been adopted in countries such as the United States (Distlehorst & Robbs, 1998), United Kingdom (Murray & Savin-Baden, 2000), The Netherlands (Schmidt, 1995), Sweden (Abrandt Dahlgren & Oberg, 2001), and Australia (Margetson, 1998; Alavi, 1995). Its adoption has not been confined to western countries; there are many instances where PBL is used in Asia (Stokes, 2001; Johnston 1999; Walker, Bridges & Chan, 1996) and to a lesser extent the Middle East (Bhattacharya, 1998; Mpfui, Das, Stewart, Dunn & Schmidt, 1998).

The interest in Asia has been generated by Government policies arising from changing economic circumstances. Aware that their students are industrious, results driven and that much of their learning was rote, producing graduates who are creative problem-solvers for knowledge-based economies became the focus of Governments throughout the region (Johnston, 1999). This was particularly the case for some of the former ‘economic tigers’ – Singapore, Hong Kong, Taiwan – following the Asian economic crises in the late 1990s. They have scant natural resources and all rely heavily on their nation’s manpower skills as their major resource.

In Singapore, for example, following the International Conference on Thinking in 1999, the Government announced a policy of placing a much greater emphasis on thinking in both school and higher education curricula, and provided the funds and resources to back their new policy (Johnston, 1999). This policy was enforced by Government directives and incorporates actions aimed at introducing centrally controlled curricula supported by slogan campaigns referring to Singapore as a ‘Thinking Nation’. Problem-Based Learning is one of the approaches adopted in varying degrees by some of their higher education institutions in response to the decree. For instance, the Faculties of Medicine and Dentistry at the National University of Singapore adopted hybrid models of PBL, while Temasek Polytechnic initiated an institution-wide change that included both full and hybrid PBL models. In all these cases, the switch to PBL was driven by a top-down approach (Johnston, 1999).
An indication of increase in interest is the attendance at annual Asia Pacific Conferences on PBL. The first conference in Hong Kong in 1999 attracted over 250 delegates from 25 countries, while the fourth PBL conference staged in Thailand in 2002 hosted over 600 delegates. This has continued with more recent conferences stimulating interest in Malaysia in 2004 and Japan in 2006. The next conference is scheduled for Beijing in 2008.

In Hong Kong, the change has been subtle and widespread. The Government funding agency for Higher Education, the University Grants Commission, has over the past decade provided considerable funds for initiatives that engender student-centred approaches and promote higher cognitive levels of learning. These initiatives are usually bottom up, emanating from groups of individuals or departments and are usually funded for a minimum of three years. One of these initiatives was establishing the Hong Kong Centre for Problem-Based Learning (HKCPBL) based at the University of Hong Kong to promote and support the practice of PBL throughout Hong Kong and the nearby region. Subsequently, all seven Hong Kong universities and the Hong Kong Institute of Education have introduced some form of instruction following a PBL model.

The Problem and Its Significance

The published work concerning PBL has been predominantly from western countries; Australia, Canada, Netherlands, United Kingdom and United States for example. Much of that work is descriptive, and addresses areas of interest to educators and practitioners throughout the discipline areas, rather than focusing on building a theory of PBL. There is little available research from Asia; a situation Stokes (2001) described as remarkable.

That lack of research is surprising as the recent rapid spread of PBL in a range of disciplines with its different approaches and formats throughout Asia provides fertile ground to conduct exploratory research. Walker, Bridges & Chan (1996) note that although PBL is widely accepted in western countries as an innovative approach to educating students for future work in professional contexts, there remains scope for further investigation of it as an instructional methodology, particularly in an Asian
context. They also note that the research informing PBL implementation in Asian countries such as Hong Kong has been extrapolated from western contexts (Walker et al., 1996). Furthermore, most of that has originated from medical discipline areas where it focused mainly on outcome measures only (Biley & Smith, 1998).

There is some research that questions the appropriateness of PBL as an educational approach in Hong Kong with regard to its acceptance as an instructional method (Walker et al., 1996; Tiwari, Chan, Sullivan, Dixon & Tang, 1999; Lai & Tang, 1999). In a comparative study, Walker et al. (1996) explored similarities and differences between their introduction of PBL into a Hong Kong education context, to reported experiences in western countries. They used PBL for a postgraduate, masters level course for educational administrators at the Chinese University in Hong Kong and found that tensions and barriers existed. These they attributed to embedded cultural and social system values giving rise to traditional beliefs about teaching and learning from both educator and student perspectives, which are in contrast to a PBL methodology.

Tang, Lai, Tang, Davies, Frankland, Oldfield, Walters, Leng, Tse, Taylor, Tiwari, Yim & Yuen (1997) claimed that direct importation of a PBL model to a Hong Kong context was not suitable. Instead, Tang et al. report how they had to use a highly modified form of PBL adapted from a hybrid model being used in a medical faculty in Hong Kong so it would be more acceptable to academics and students. In their model, which they termed Context-Based PBL, Tang et al. omitted many of the key elements of PBL and incorporated some traditional methods. The traditional methods they included were lecture-based information provision, instructor-led tutorials and exam-oriented activities (Tang & Biggs, 1999; Tang et al., 1997). They also incorporated some techniques from a PBL environment to encourage greater student involvement in the instructional process.

Contrary to a normal PBL approach, Tang et al. (1997) began the instructional process with lectures providing the necessary information for students to solve problems or cases, which were subsequently provided. However, these lectures also incorporated teacher-led and large-group discussions. In their Context-Based PBL environment, the discussions served to encourage students “to clarify concepts,
define problem-situations, give critiques to students’ work, and discuss answers of prepared questions” during the lectures and tutorial sessions (Tang et al., 1997, p. 584). There are disadvantages in the depth of learning in Context-Based PBL when it is compared to a full PBL model.

When problems or cases are introduced first as a trigger for learning in a full PBL environment, students need to engage in research and hypothesis generation, data analysis, clinical reasoning and decision-making activities to understand principles and concepts. That level of cognitive activity and engagement is significantly reduced or eliminated in a Context-Based PBL environment because students have already been supplied with most of the relevant information. In addition, a Context-Based PBL environment encourages learning of content for recall rather than for application in a clinical practice context. Students in a Context-Based PBL environment experience greater motivation than in traditional learning environments because of greater involvement with the case materials. However, the learning process remains passive and the instructional sequence teacher-defined (Barrows, 1986).

In direct contrast to the findings of Tang et al. (1997) and Walker et al. (1996), leaders of two different Health Science courses at a university in Hong Kong, where they implemented full PBL based on a western approach, gave very positive reports. Both Health Science courses have proven to be successful as they suited the students’ learning styles and were well accepted by the professional community (F. Smales, personal communication, August 8, 2002; M. Comfort, personal communication, October 30, 2002). Following research into the impact of a full PBL course in Hong Kong, Stokes (2001) also indicated that PBL could be directly transferred into a Chinese culture. She called for further research into the appropriateness and effectiveness of full PBL courses in an Asian context.

Although there is a growing collection of literature about methodology and outcomes of courses using PBL (Biley & Smith, 1998), much of this research is not focused or systematic (Boud & Feletti, 1999). Nevertheless, Boud & Feletti identified that:
there is mounting anecdotal evidence, from both schools in rapid transition and those changing more slowly, that students themselves are a valuable curriculum resource quite capable of promoting and hastening the development of PBL (1999, p. 8).

Given the conflicting research findings and opinions, this study will research the appropriateness and effectiveness of two different full PBL courses in a Hong Kong university. It will use students’ perceptions of their experiences of the PBL courses as the main source of data in a comparative study. It will also seek to inform substantive theory in an attempt to better inform PBL practitioners.

**Research Questions**

The essential question addressed by this research is: “What are the relationships, similarities and differences between two different full PBL courses in the Health Sciences that can be used to develop propositions about how to implement PBL in Hong Kong?” In order to answer this research question there were five primary questions that needed to be addressed. They were:

- What are the components integral to a successful full PBL system as identified by the literature?

- How do students and academic leaders in each Health Science course perceive student learning experiences in a full PBL environment?

- What are the similarities and differences between the two Health Science courses based on the perceptions of students and academic leaders?

- Are these findings consistent with the published literature?

- Is there enough evidence accumulated from students’ perceptions to generate substantive theory that will influence future practice?

**Significance of the Study**

The study is significant as it seeks to provide additional insights and understandings based on evidence gleaned from students’ perspectives and triangulated with course academic leaders about the use of full PBL as an instructional paradigm. These
additional insights and understandings will seek to clarify the contrasting findings between previous published studies into the use of PBL as an educational method in Hong Kong. It also seeks to clarify how students from a Chinese Hong Kong culture learn and the issues they encounter in a full PBL environment, which is derived in a very different cultural and social context.

The study also aims to develop propositions based on its findings about broad issues that need to be addressed when moving from traditional teaching and learning cultures to a full PBL environment. The results of this study can be used to inform future PBL practice in Hong Kong and possibly elsewhere. More specifically, the results should be able to allow academic curriculum leaders to make evidence-based decisions when adopting or improving PBL.

Research Design

Contextual elements affecting students’ experiences with PBL and outcomes from groups with different experiences with PBL provides opportunities for qualitative research focusing on student perspectives (Biley & Smith, 1999). Stokes (2001) supported these views after she conducted a study based on students’ perceptions of PBL in a Hong Kong context.

Method

Two primary but interrelated research tasks are central to this study: identifying the experiences of students as participants in full PBL programs, and developing credible assertions to inform substantive theory. The research procedures used to address those tasks employed qualitative methodologies. A qualitative approach was adopted for two fundamental reasons - a lack of existing robust research in the field, and the nature of the research question that is not conducive to an experimental approach. Most of the literature published over the last twenty years has been anecdotal with authors describing their experiences, the beneficial outcomes of PBL and the difficulties encountered when implementing PBL (Biley & Smith, 1998). It is difficult to find valid experimental studies on any aspect of PBL.
The qualitative approach followed a constructivist paradigm, detailed by Guba and Lincoln (1989), where the outcomes are "not 'facts' in some ultimate sense but are, instead, literally created through an interactive process that includes the evaluator ... as well as the many stakeholders" (p. 8). This method gives rise to "one or more constructions that are the realities of the case" (p. 8, emphases in original). The constructions evolve from a hermeneutic methodology which "involves a continuing dialectic of iteration – analysis – critique – reiteration – reanalysis, leading to the emergence of a joint (that is among all the inquirers and respondents ...) construction of a case" (p. 84).

During the initial phases of this study, due to the small body of existing research, an "emergent design" (Patton, 1990, p. 196) using open-ended methods, was followed. With this design the research methods are adapted to suit the unfolding circumstances and changing needs of the investigation. No hypotheses are being tested, rather it is a search for establishing hypotheses or assertions to be validated (Borg & Gall, 1989).

The techniques used in this study included: informal conversational interviews, open-ended interviews (Patton, 1990), focus groups (Krueger, 1988), member checks (Lincoln & Guba, 1985), and stimulus questionnaires with open questions (Fowler & Mangione, 1990). All of these techniques are methods typically used in qualitative research with an underpinning constructivist paradigm and ensure that any findings will be based on a wide range of data sources – a form of grounded theory (Glaser & Strauss, 1967). Grounded theory itself is a form of emergent design, as it also does not attempt to verify any existing theories.

Following this research methodology will enable substantive theory to be developed. Merriam and Simpson (1995) state that "substantive theory deals with phenomena limited to real world situations" (p. 113) and is more specific than formal theory, the other form of grounded theory. Ideally, substantive theory "provides the practitioner with a conceptual tool with which to guide practice" (p.113).
Procedure

At the beginning of the study an extensive literature search was conducted to locate studies about PBL generally and more specifically related to PBL in Hong Kong. While there is plenty of descriptive published information about PBL, little could be found that qualifies as substantive or robust research. Only three published studies that used students’ perceptions were located, however, none were directly related to the context of this study. Consequently, the initial steps involved investigative fieldwork gathering information to form a database for developing assertions. The later steps involved data analysis, supplemented checks, for refining and confirming the assertions.

Assumptions

This study was based on three primary assumptions. First, that PBL is used in its full form by the two courses involved with this study. Second, there are differences in PBL programs and these differences influence how students perceive their PBL experiences. Third, that some previous research findings, albeit from other forms of PBL, can be extrapolated to the wider areas where PBL is practiced, including this research project.

Structure of the Thesis

Chapter 2 reviews the literature purporting to identify elements of PBL and its processes, with particular attention given to the studies in a Hong Kong context. It also reviews some of the studies about research in PBL. Chapter 3 reports in detail the methods and procedures followed to collect and analyse the data used for this study. In Chapter 4, an analysis of the data from all the interviews is provided. It also contains a discussion about the findings in relation to the reviewed literature and develops assertions forming the basis for substantive theory. Chapter 5, the last chapter, provides a summary of the study, followed by a critical discussion of the research methods employed. Finally, the implications of this study are explored, and suggestions for further research are made.
CHAPTER 2: LITERATURE REVIEW

Overview

This chapter reports on the published literature about Problem-Based Learning (PBL) that is relevant to the stated purposes of this thesis. It looks at components which impact on the PBL Environment (academic leadership, problem design, facilitation, and assessment and evaluation) the PBL Process (the PBL tutorial and the tutorial group) and the outcomes of a PBL approach to education (participant learning and generic outcomes).

The Problem-Based Learning Environment

Academic Leadership

For academic leaders there are a number of issues that are critical to the success of a full PBL program and need to be taken into consideration. These include PBL curriculum development and its evaluation processes, induction of students into the PBL process, professional development of the staff involved, and provision of relevant high-quality resources. Resistance to change and existing cultural values embedded within the discipline, faculty or department culture further complicates management of a PBL program. The latter is especially the case within a Chinese Hong Kong context (Walker, Chan & Bridges, 1996). Given that PBL was originally formulated in a western context, and much of the research is based on western thinking, value systems and outcome expectations, those cultural concerns need to be addressed (Walker et al., 1996).

Hong Kong Chinese Culture

There are culturally bound issues that impact on implementing PBL in Hong Kong with its Confucian-heritage culture (Stokes, 2001; Watkins and Biggs, 1996).
Differing opinions and evidence exist about the effects of some of those cultural values and traditions. One group of researchers (Walker et al. 1996) found an inbuilt resistance to PBL while another (Stokes 2001) found elements of the culture actually lent support to it.

A study conducted by Walker et al. (1996) at a Hong Kong university alluded to problems when they tried to introduce PBL as a method of instruction for 52 participants in a module of a masters-level course for educational administrators. The problems related to tensions between the philosophy underpinning PBL and what that group of educational administrators perceived to be the dominant beliefs about student learning based on their traditional cultural values and expectations. On the other hand, Stokes (2001) argues that how undergraduate students from Confucian-heritage cultures and its value systems can be recognised for being able to adjust and adapt effectively to learning environments that support group cooperation, value effort, and reward striving to succeed in learning a lot of content knowledge. She bases this claim on her successful experiences at a different university in Hong Kong where these values were recognised and accommodated when adopting a full PBL approach at a whole degree course level.

Walker et al. (1996) attribute the resistance they encountered to differences of the underlying philosophies of PBL and traditional beliefs about how students should learn. The problems and tensions encountered “set the context for the initiative and pulled us beyond the normal considerations that have been described when introducing PBL in Western countries” (Walker et al., 1996, p.12). Even though efforts were made by the authors to reconcile tensions related to implementing a PBL methodology, some participants could not come to terms with the new ideologies, principles and concepts of student-centred learning. Walker et al. reported that there was a pervading perception of learning being an individual pursuit rather than a group effort; that wisdom is taught and not discovered and constructed by the learner; and that content should be presented first by a content expert as opposed to the problems being solved by naïve learners. In addition, Walker et al. found language differences and time constraints were also inhibiting factors in their PBL course. Importantly, they did report a degree of success in using a hybrid model of PBL, despite the constraints.
Walker et al. (1996) refer to the work of Hofstede (1980) in trying to explain the suitability of using PBL as an educational method in a Confucian-heritage culture. Hofstede looked at work related values and cross cultural management issues and classified them according to four cultural and social dimensions: collectivist behaviours; power distance behaviours; uncertainty avoidance; and gender attributes. Walker et al. used Hofstede’s dimensions as a framework for exploring explanations for the behaviour of participants in their innovative program. They form what Hofstede called a ‘cultural map’ whereby managers could predict the influence of culture on behaviour. Those dimensions are also useful background for this current study as they have the potential to be indicators for academic leaders about the possible success of using PBL in the Hong Kong culture.

The first dimension concerns collectivist behaviours. These were demonstrated by the participants in Walker et al.’s (1996) study and were attributed to low individualism, high collectivist culture found in Hong Kong Chinese contexts. In high collectivist cultures, ties between people are tight, relationships are highly structured and individual needs are subservient to the needs of the group. ... Harmony, face saving, filial piety and equality of reward distribution among peers [are deeply embedded in Chinese peoples value systems]. ... Status is defined traditionally by factors such as age, sex and family (Walker et al., 1996, p. 18).

The second dimension, power distance behaviour, refers to the hierarchical nature of power distribution within a culture. In high power distance societies, such as that found in the Chinese Hong Kong environment, inequality among members of a group generally is accepted and regarded as natural and legitimate (Walker et al., 1996). Behaviour among group members tends to follow a pattern that is suggestive of an unquestionable right of the lecturer to dominate and be a content expert in any field of education. The most senior person will also have the final say in any instructional or institutional policy making processes. At an institutional level, traditional power distance customs and behaviours will be adhered to and go unquestioned in order to maintain harmony and observe revered social customs. In a traditional teacher-centred environment, the lecturer or visiting expert will be highly regarded and his or her knowledge will be accepted without question. Any loss of the
power, as will occur in a student-centred curriculum with its diminished authoritative teaching role, may result in dissatisfaction or withdrawal from the scene.

The third dimension, uncertainty avoidance, is considered to be low in Chinese Hong Kong environments (Walker et al., 1996). When this dimension is low, the participants and lecturers, as well as group leaders, tend to display high levels of tolerance, thus remaining reserved and unthreatened when something becomes unclear. When uncertainty is high in strong uncertainty avoidance cultures people will try to minimise uncertainty “by imposing order and structure through rules and dogmas that breed coherence” (1996, p. 18).

The fourth, and last, dimension concerns how different societies view masculine and feminine values. In masculine societies, the attributes of competitiveness, assertiveness and materialism dominate while in a feminine society there is a tendency for men and women to nurture each other, maintain a modest opinion of each other regardless of the situation and display interpersonal consideration at all times. According to Walker et al. (1996), the cultural tendency on this dimension in Chinese Hong Kong is midway or equally balanced.

Taking into consideration these dimensions, there is potential for a PBL style of education to be accepted in Hong Kong. Small group work is an essential component in PBL and the collectivist nature of Hong Kong culture is well suited to this. However, being a strong power distance society will tend to create hierarchies within a group, which may undermine the benefits of collectivism. Their capacity to accept uncertainty may enable them to more readily adapt to deal with learning by solving problems. As a society that displays both masculine and feminine traits, mixed gender groups should be able to work in relative harmony.

Whitehall, Stokes, and MacKinnon (1997), following research into two full PBL programs in Hong Kong, found that conflicting cultural and social values have the potential to create tensions and confusion among students as they strive to adjust to any one system. They recommended that any change process needs to be carefully managed. In a later study, an evaluation of a new, full PBL program, Stokes (2001) concluded that it was “clear that the PBL approach can work well with Hong Kong
students” (p. 217). It seems then that when management of a PBL program addresses cultural nuances it can be successfully implemented.

Resistance to Change

Both students and academics will encounter problems with changing to a PBL methodology and, unless it is carefully managed, they will resist (Creedy & Hand, 1994). Students can feel stressed when they first embark on a PBL curriculum. The stress is a result of having to cope with study that is predominantly self-directed in nature. This is accentuated if the students have only experienced didactic, teacher-centred methods of instruction, and learned passively in an environment where information receiving and fact regurgitation was the norm (Walton & Matthews, 1989; Engle, 1999). In Hong Kong secondary schools, that norm applies (Lai, Tang, Arthur & Leung, 1999).

Andrews and Jones (1996) identified the difficulty students had in gauging the amount of information they needed to research and the depth they should go to appropriately investigate the learning issues. The research process could easily take more time than students had anticipated and was greater in comparison to that needed when studying in a traditional course. This resulted in engaging in surface learning only. Students also felt they could often miss important content and knowledge items that should be learned. Alavi and Cooke (1995) noted that students are also faced with new types of assessment for their contributions and learning, which can also cause initial uncertainty and confusion. All of these factors can lead to resistance to change.

Apart from the cultural issues in a Hong Kong context, academics can be quite uncomfortable with a new style of teaching. There is a perceived loss of authority as an expert in the field and having to withhold information in a tutorial session is not easy for them (Murray & Savin-Baden, 2000). Many traditional teachers believe the instructional process to be flawed. Starting with a problem instead of providing factual information first is difficult for them to accept. Some authors report that academic staff are more resistant to change than students (Barrows, 1988; Maudsley, 1999). Murray and Savin-Baden (2000), Little (1999) and Creedy and Hand (1994)
all recommend that academic leaders need to pay close attention to these matters and provide support by way of induction and training programs.

**Professional Development and Student Orientation**

Provision of programs for inducting both academic staff and students into the PBL process is essential (Creedy & Hand, 1994). This is particularly important in an Asian cultural context with their traditional social and value system (Stokes 2001; MacKinnon, 1999). Adjusting to a learning environment where challenging another’s opinion and questioning persons in authoritative positions will take time to be accepted by Hong Kong students. Development of strategies that enable challenging in a polite and non-confrontational manner, while still creating good interpersonal relationships and maintaining group harmony is paramount. It is worthwhile noting that the creation of conflict, displays of aggressive behaviour, interruption to interpersonal relationships or disharmony among group members “can cause lasting animosity in Chinese cultures” (Walker et al., 1996, p. 25). Establishing functional relationships and maintaining safe and trustworthy environments are essential when implementing PBL (Creedy & Hand, 1994). In Hong Kong (and elsewhere) there have been questions raised as to the suitability of PBL for students who come from highly structured, didactic, teacher-centered and exam-driven primary and secondary school environments (Watkins & Biggs, 2001). Consequently, carefully planned induction programs are highly recommended for students as a precursor to entering PBL programs as it results in students quickly adapting to the new learning environment (Stokes, 2001).

Both initial and continuing professional development activities become essential for academic staff as they need convincing in the first place, of the need for change, and then guidance and support for implementing it (Murray & Savin-Baden, 2000). There is a raft of new skills to be learned (Fletcher, 2002). As content experts they will be called upon to write problems in their area. They will need to collaborate with experts from other content areas to integrate subject matter to form a single curriculum, instead of working exclusively in their area. In addition, they need to learn a new style of teaching, where they are no longer the expert carrying a lot of status in a Chinese culture. In the new environment, they will need to be guides or
coaches with adept questioning skills. Furthermore, they will need to be accomplished in assessment of their students’ process skills performance (Boud & Feletti, 1999). Assessment methods need to be changed to suit a new student-centred learning environment where the process of learning is accentuated at the expense of rote learning for exams. Unless academics are comfortable with developing and maintaining an environment that supports learning – one in which the students feel safe to construct their own meaning of knowledge; discuss issues freely; question others; evaluate their own learning and its processes; and practice the skills of self-directed learning – then the success of a PBL program will be in jeopardy (Engle, 1999). All of these new learning and teaching skills are essential for the success of a PBL program and consequently professional development for staff is paramount (Murray & Savin-Baden 2000; Little 1999; Creedy & Hand 1994).

**Resources**

The provision of resources, whether human, material or time is a key feature in assisting students to learn and thus requires significant attention by curriculum designers (Stokes 2001; Ryan 1999; Ryan 1993; Albanese & Mitchell, 1993). The amount of information and the number of sources from which information can be gathered, for example from materials such as books, journals, reports, or from expert, staff members or peers, is wide and varied (Barrows, 1988; Boud & Feletti, 1999). It is common for students to show a lot of initiative when sourcing information and not just rely on the Internet and library (Stokes, 2001; Stokes, MacKinnon & Whitehill, 1997). For students, “what external information resource is needed and where and how it might best be found again requires deliberation and reflection” (Barrows, 1988, p. 2). Time becomes scarce when there is a lot of searching to be done to locate relevant items to research and study (Ryan, 1999; Ryan, 1993).

As mentioned earlier, one of the factors that students identify as being important to them is knowing just how much information they need to glean from resources when solving a problem. For students who are new to the PBL process some guidance from their facilitator will be necessary (Andrews & Jones, 1996). Some full PBL programs build a timeslot into the weekly timetable when students can request an expert to act as a resource person. This is not usually in the form of a traditional
lecture but rather primarily is designed in a form to allow the answering of specific questions put to them by students. In this way students have to think about the knowledge they require and not just depend on being ‘spoon-fed’ by the resource persons (Alavi, 1995).

Central to a full PBL program is the tutorial group, usually consisting of eight to ten students as an optimum size for effective learning (Engle, 1999, Barrows, 1988). As open discussion is required, it is usual for tutorial sessions to be held in rooms suited to small-group activities. In those institutions that are committed to PBL, the rooms may be equipped with electronic whiteboards for making notes, and/or Internet access. Students usually are free to bring their own resources to tutorials. In one university in the UK, where the researcher visited, students had requested and received the resources necessary to set up temporary cubicles in a large corridor so they could meet independently and work in groups. The University of Maastricht in the Netherlands was completely purpose built for a PBL environment and all its courses are based on PBL (Moust & Schmidt 1995).

Faculties and departments have to be re-organised into a flat structure as separate subjects disappear when integrated into problems (Stokes, 2001). Academic staff increasingly will work in teams across subject areas. Regular formal meetings and informal discussions become a feature of the academic PBL landscape resulting in more collaborative engagement than is the case for traditionally taught courses. Academics report that for them this is a positive feature of a PBL environment (Stokes, 2001).

Provision of sufficient, appropriate and accessible human and material resources, then, is an essential aspect of PBL, as not only does this action support consistency in learning but it also contributes to supporting the individual to achieve the aims of PBL curriculum as well as self-directed study (Engle, 1999). In a study conducted to investigate aspects of the tutorial process and the effects they had on students’ learning, Ryan (1999) found some of the students were only able to study at a surface level, that is, not sufficiently deep enough for thorough understanding of the concepts and issues to be learned. The reasons Ryan provided were that students had to cope with “excessive workload[s], lack of time to explore issues in adequate depth
and non-availability of resources” (p. 132). The amount of content expected to be covered and the ensuing time constraints were identified as affecting students’ ability to spend enough time on studying and learning important concepts and factual knowledge (Ryan, 1999; Albanese & Mitchell, 1993). This has implications for PBL curricula designers when planning their courses.

**Curriculum Design**

Given the large number of issues academic leaders need to address when implementing PBL, it is surprising that no direct reports or research about PBL curriculum design could be found in the literature. There are, however, a few references in works by Alavi (1995) and Stokes (2001) who were both instrumental in developing PBL approaches for degree courses in their respective health science related disciplines. Abrandt Dahlgren (2000) investigated the role of course objectives in three PBL programs and their impact on students learning.

Alavi (1995) refers to the importance of curriculum design as underpinning the success of a PBL program and outlines the elements involved in preparing to implement PBL. Time to prepare is an important factor. She relates that herself and two colleagues were given one semester to develop the PBL program for a nursing degree. Their curriculum was designed around what they termed learning packages, which were scenarios built around problems commonly confronting nurses in their daily practice. First, they developed a series of outcome objectives for the whole course and then broke these down into outcome objectives for each semester throughout the course. A conceptual matrix of requisite knowledge was used to guide the development of problems. In a conceptual matrix the main topics covering the content to be studied throughout the semester are listed vertically in a table. Problem titles are listed horizontally across the top of the table. Whenever a problem addresses a topic, the relevant matrix box is checked, allowing a reader to easily view how and where the content area is addressed. This provides a road map for the curriculum planners and users. According to Boud and Feletti (1999), in an effective curriculum:
there is a need for a clear conceptual map of the domain of learning, a curriculum structure, a means for students to progress through the material and a way of checking to see if both the students and the course are achieving what is intended (p. 16).

In addition, a facilitator guidebook was also written for each problem. The guide consisted of the problem statement or stimulus materials, the learning outcomes expressed in broad terms and the learning issues that students needed to address. It also contained some background content information and references about the problem for those facilitators for whom the topic was not their main area of expertise. Also included were assessment details and criteria for grading as well as all evaluation measures for maintaining the course. The learning materials and activities were sequenced so that the problem is always presented first and any related clinical skills required are learned in scheduled skills laboratory sessions. That way all new knowledge and skills are learned in the context of solving a problem.

It is also worth noting that Alavi (1995) stresses the importance of treating students as adults. She recommends that incoming students be treated as professionals from the moment they enter the course. This will support the notion that they are now expected to learn in an adult fashion taking responsibility for their own learning and being accountable for their actions. In doing so, they develop lifelong learning skills. Induction programs, she argues, should be provided for all students at the outset of the program and new staff provided with professional development about PBL.

Stokes (2001) describes developing a curriculum based on a ‘total’ PBL approach for the first three years of a four-year degree course in Hong Kong. She states that two concerns were uppermost in the minds of the curriculum development team when developing the new curriculum. First, they wanted to promote a deep approach to learning by students and second, engaging all staff in the process was a priority. In order to engage staff, they were included in all stages of writing the new curriculum: that is, staff wrote: “the outcome objectives, problems, predicted learning issues, and identified criteria for student performance and tutor performance” (Stokes 2001, p. 208). Professional development sessions were conducted for all staff and a student induction program developed. In a survey of staff involved in the program’s implementation, Stokes found that eleven of the thirteen staff overall were very
pleased with the change, while two remained doubtful of the value of PBL as a pedagogical approach. Stokes also warns that the amount of content in a PBL course is less than that of a traditional course, because more time is devoted to the process of learning. According to Albanese and Mitchell (1993) and Woods (1994), this can be as high as 20 percent. Given that a major intent of adopting a PBL program is learning how to learn, accumulating large amounts of content knowledge is no longer the main priority (Boud & Feletti, 1999).

Developing appropriate outcome objectives for a PBL program is an important consideration for academics developing PBL curricula. If the outcome objectives are appropriate, then they can influence learning processes. Furthermore, academics need to be aware that to be effective those objectives should be explicit. A study by Abramd Dahlgren (2000) examined the role of course outcome objectives and their relationship to students’ learning strategies in three different PBL courses (Bachelor of Physiotherapy, Master of Psychology and Master of Computing Engineering) at Linköpings Universitet, Sweden. The aim of providing students with overarching course outcome objectives was to provide support, structure, and guidance to the students for their self-directed studies.

In their study, Abramd Dahlgren (2000) interviewed 60, randomly selected students, 20 from each of three courses. The data were analysed qualitatively using an interpretive phenomenological approach (see, for example, Polit, Becket & Hengler, 2001; Merriam & Simpson, 1995). Results showed that generally students used course objectives in three main ways: as an integrated tool in the learning process, as an administrative schedule, or as a retroactive checklist (Abramd Dahlgren, 2000, p. 309, emphasis in original). However, Abramd Dahlgren also reports that some students were unaware of the role that objectives could play in guiding what they should study, although they vaguely remembered reading something about them in a booklet provided at the beginning of the first term. Some students in the Physiotherapy found course objectives to be of little use as they were “too abstract, difficult or unclear to function as a guide for their learning and, thus abandoned the course objectives” (Abramd Dahlgren, 2000, p. 318). On the other hand, students from Psychology used the course objectives in an integrated way, incorporating them to assist in guiding their studies and cross checking to ensure they had covered the course content. Students from Computing Engineering found the course objectives to
be detailed and directive, identifying the specific content items students were required to learn.

Overall, Abrandt Dahlgren (2000) found students mostly relied on three main options for guiding their learning: reliance on the tutor to keep them on track; tracking other students’ communications, including what they talked about or had read; and textbooks which provided overviews of what was incorporated within the topic area. It was these three sources that provided basic structure and organisation for studying relevant learning issues. In essence, course objectives were mainly regarded as relative to the planning and administration of their module units. Alternatively, the reading lists and other sources were of greater significance and were utilised as guides for learning by students. Abrandt Dahlgren stressed “the different strategies for using the objectives in the learning process in a way mirror the structure of the curricula in terms of how the objectives are formulated in the different programs” (2000, p. 322).

In conclusion, Abrandt Dahlgren (2000) stated that the relationships identified between course objectives and the learning process could not be justified in terms of PBL pedagogy and methods implied thorough use of a PBL curriculum alone. The ways students and educators use outcome objectives will differ in terms of the approach to learning discipline knowledge and professional practices. Furthermore, the values, beliefs, certain functions and methods of achieving relative outcomes within different discipline and curriculum design paradigms are often tacit … and the characteristics of an academic or professional culture are not always discernable to its members (Abrandt Dahlgren, 2000, p. 325).

Problem Design

Schmidt (1995) states that PBL is founded on the concept of problems; that is, “a collection of carefully constructed and engaging ‘problems’” which “usually consist of a description of a set of observable phenomena, situations, or events” (p.247). Problems in a full PBL approach should be of a complex and challenging nature, enabling students to go beyond just learning for practical or instrumental worth (Boud & Feletti, 1999). Margetson (1998) refers to problems of this type as
“reflexively problematic”, suitable for inducing the type and depth of learning processes and outcomes expected in a full PBL approach. Problems that are reflexively problematic in nature need to be contextually appropriate, goal oriented and have the capacity to provide a focus which combines all elements of a problem coherently, as found in practice contexts (Margetson, 1998). The nature of an adequately conceived and well-designed problem will challenge students to go beyond using “existing schemata and available routines” to become “more analytical, reflexive critical thinkers” (Boud & Feletti, 1999, p.9).

According to Ross (1999), the main aim of a PBL curriculum is oriented toward getting students to learn and use that knowledge. Problems are used for the purpose of getting students to identify, search out and research the knowledge that is considered necessary to answer the problem items, either individually or as a group. Knowledge is thus acquired as a result of work on the problems (Ross, 1999). In other words, the problem drives student learning (Schmidt, 1995).

Problems are constructed to elicit different levels and processes of learning. They may simply require students to grasp basic principles found in full descriptions of case scenarios that already contain much of the information needed to explain the phenomena outlined in the problem scenario (Margetson, 1998). This level of problem will encourage students to acquire knowledge through engaging in simple reasoning and uncomplicated problem solving exercises. In contrast, the design of problems promoting higher levels of learning, require students to think from the outset when they are presented with the problem. These problems are purposely developed with less structure and provide less explicit information (Margetson, 1998).

For instance, the construction of higher-level problems for medicine may provide information about symptoms a patient initially presents with in a clinic. In addition, some elements of the context in which this phenomena occurred will be included. In this situation, students are required to build on the little, but carefully constructed information provided. Using their prior knowledge, examples or associated knowledge from personal experiences, students are motivated to search deeper for meaning, explanations and resolutions to the unexplained and little understood
elements inherent in the problem scenario. This form of hypothetical deductive reasoning is often required in the professions (Margtson, 1998).

Barrows (1988) alleges that an holistic approach promotes students’ use of all relevant knowledge to solve, resolve or ameliorate the problem. Margtson (1998) explains that the opportunity for students to engage in the hypothetico-deductive reasoning processes, which replicates that occurring in professional practice is one of the foremost aims of curriculum designers in a full PBL environment, and is central to the PBL approach. A problem or problem sequence, therefore, should engender coherently all elements of a problematic situation replicating those commonly found in practice contexts.

Discovery of how these real-life problems are managed in working environments while simultaneously learning content knowledge is the goal of a PBL instructional approach and underpins problem design (Boud & Feletti, 1999). A good problem will be aligned with course knowledge, skills and attitude objectives. It will allow students to develop further and refine their conceptualisations of knowledge, while taking responsibility for their own learning. Solving well designed, real-life problems is a source of motivation for students in PBL courses (Margtson, 1998; Barrows, 1986). Students are understood to experience motivation from the challenge of not knowing different elements of the problems, and are intrinsically motivated to find out more about the problem items and topical information connected to the problem (Margtson, 1988; Schmidt, 1993; Barrows, 1986).

The research investigating the role of problems and the quality of their design is minimal (Schmidt & Moust, 2000). According to Schmidt and Moust (2000), problems that are well designed enable students to actively engage in the learning process at levels appropriate to their discipline knowledge development and acquisition. That is, the problem design takes into account their prior knowledge while challenging them to seek and incorporate appropriate new knowledge into construction of possible solutions to the problem.

Schmidt et al. (1995) and Gijselaers & Schmidt (1990) examined influences of some of the elements of a PBL approach on learning outcomes using student ratings and
summative test results. They reported, as did Schmidt & Moust (2000), that the role of problems and, in particular, the nature of the problems, are two elements often underestimated in terms of influence on learning outcomes for the students. Their findings indicate that the analysis of the problem contributed to understanding and to remembering relevant information, particularly in respect to unfurling prior knowledge and identifying gaps in subject knowledge. Schmidt and Moust (2000) concluded that the design of problems had a profound impact on student learning and achievements in both the cognitive and affective domains. They also note the impact is greater than had been previously assumed.

These findings support the views of Ross (1999), who postulated five distinct features critical to the success of a PBL curriculum. Three relate directly to the problem. They are: “importance of the person or persons who select, design or devise problems to be used; the purpose of any particular problem; and the form of the problems” (Ross, 1999, p. 30). The two remaining features are the availability of any resources required to solve the problem and ensuring processes students need to adhere to ensure intended outcomes are achieved.

Using real-life situations to form problems geared to the level of students’ capacity to understand is important. Andrews and Jones (1996) report on a case study conducted to identify some of the problems that might exist as a result of students’ participation in a PBL program. Students found the hypothetical situations represented in the problems, (for example, situations and phenomena found in management related situations) were difficult to handle and relatively unrealistic. In most instances students felt they were unlikely to encounter situations such as those included in the problems as the problem materials were pitched at a level that was beyond their scope of practice and not within their grasp.

In order to construct effective problems there are some other caveats that the literature suggests need to be observed. These include writing for clarity of the problem statement; ensuring a systematic solving strategy is possible; including qualities that ensure the group members are able to engage in the discussion processes; providing opportunities for learning goals to be formulated; and the
capacity to motivate students to engage in self-directed learning (Schmidt & Moust, 2000).

The form of the problem is important as it sets the scene for the level and type of thinking in which students will engage. In some instances provision of basic data will be necessary, particularly when students are new to a discipline. It is possible that students may not have encountered complex discipline specific data and factual knowledge prior to their entry into the program.

Use of available data is essential for hypothesis formulation, development of clinical reasoning and integration of content knowledge (Hmelo, Gotterer & Bransford, 1997). Resolution of problems can be done in two ways. First, there is data-driven reasoning, which experts often do. For example, the use of signs and symptoms to determine a person’s ailment “involves reasoning from the data to a hypothesis” (Hmelo et al., 1997, p. 390). Data-driven reasoning is considered “inappropriate for novices who have an insufficient knowledge base” to enable them to make informed decisions (Hmelo et al., 1997, p. 390). Students in their first years of PBL may not possess or have acquired enough basic knowledge to engage in complex problem solving or have acquired higher level cognitive skills to engage in reasoning for clinical contexts. Second, there is hypothesis-driven reasoning, which “involves using a hypothesis to explain data” (Hmelo et al., 1997, p. 390). Hypothesis-driven reasoning is more effective for students who are new to PBL. It is also more effective for experts when they are confronted with problems that are very complex or unfamiliar. As PBL is structured around students identifying their collective existing knowledge and determining the new knowledge to be learned, problem designers need to provide sufficient data for students to incorporate new concepts, ideas and mechanisms for thinking (Biley & Smith, 1999).

As students advance through their PBL course, problems will contain less information and be structured to elicit thinking expected in professional contexts. They will require students to engage in reasoning at a more complex level, once they have acquired adequate basic knowledge to support their learning (Hmelo et al., 1997). Good problems, for PBL in its full form, aim to engage students in this procedure, with its processes and outcomes in mind (Margetson, 1998). Margetson
believes that problems serve multiple purposes: developing an understanding between the problem elements encountered; their relationship to concepts surrounding the problem and the solutions; and the acquisition of related knowledge. It is not necessarily solving the problem or problems presented as an isolated activity.

Problems can be constructed in stages to reflect the developmental nature of unfolding scenarios encountered by professionals. Encouraging students to learn in staged procedural processes with the use of varied and increasingly complex approaches expresses the essence of learning the basic science knowledge in relation to clinical cases (Margertson, 1998). In this way, a student’s understanding, knowledge and skills can be developed in an integrated, progressive and cumulative manner (Engle, 1999).

In summary, the problem form is fluid with some overarching requirements. Whether it is an actual event, a descriptive statement about a situation, a set of questions, or any other relevant material to trigger learning, it has, if it is to encourage students to learn effectively, to have the capacity to enable students to define what concepts, mechanisms or processes need to be covered (Schmidt, 1993; Ross, 1999). As Ross (1999) notes, “a problem-oriented approach [including] using a (broader) problem to guide the selection” (p. 29) of the knowledge domain, generally is adequate. The problems should give directions to the area of knowledge to be covered and define the actual content to be covered. The PBL approach is considered worthy if the methods and strategies employed enable students to adapt, transform, and restructure their existing knowledge structures, constructs, and understanding of concepts in an efficient and effective manner (Margertson, 1998; Schmidt, 1993).

**Facilitation**

The role of the facilitator in PBL, also referred to as a ‘tutor’ by the Hong Kong students in this study and by authors such as Barrows (1988), Schmidt and Moust (2000) and Stokes (2001), is a complex and important one. It differs markedly from that of a lecturer or tutor working in a traditional learning environment with its subject-oriented curriculum and lecturer-centred, didactic pedagogies. Lecturers have
to abandon their former expert-providers-of-knowledge roles and take on roles as facilitators-of-learning. The distinction is often described as a ‘guide on the side’ compared to a ‘sage on the stage’ (Woods, 1994). This requires specialised skills (Barrows, 1988). “The role of the tutor is to facilitate students’ learning processes and to stimulate students to collaborate in an effective way” (Schmidt & Moust, 2000, p. 3).

There are reports indicating that the importance of facilitators in PBL has been underrated. Murray and Savin-Baden (2000) found when evaluating their own experiences in preparing staff for their roles as facilitators for PBL health science programs at the University of Dundee, Scotland, that there were more complexities than indicated in the literature at the time. After research designed to inform the development of a scale for PBL course evaluation, Schmidt et al. (1995) agreed when they stated that the impact of a facilitator’s role is more far reaching than had previously been publicised.

The ability, skill and attitude of a PBL facilitator, according to Murray and Savin-Baden (2000) can be a key factor in the success of PBL. In PBL tutorials during the discussion process, students and facilitators alike have distinct responsibilities to bring about the desired learning according to the aims the course. Students need to bring enough knowledge to support their statements during the discussions about the topical items and issues. At the same time, the facilitator then needs to use skilful questioning techniques to make students challenge and clarify their own and others’ ideas (Schmidt & Moust, 2000). Facilitators who have an ability to ask questions that promote different levels of student thinking are an important aspect of PBL and the PBL process (Schmidt, 1993). Barrows (1988) claims that the golden rule of facilitation is that no hypothesis or assertion made by a student should go unchallenged.

There has been some controversy about the content knowledge and facilitation skills required by an academic in a PBL program. There are claims that, to be successful, a facilitator must be a knowledge expert in the field so they are able to discern the veracity of students’ knowledge. Barrows (1988) believes it is not necessary and claims that a non-expert with support can successfully facilitate PBL tutorials.
However, he does believe that a content expert well trained in facilitations skills is the preferred option. Barrows (1998, p. 44) believes the worst situation for students is to have a facilitator “who is an expert in the field of study, but is a weak tutor”. Moust and Schmidt (1995), reporting on studies investigating these issues also concluded that it is more complex than first thought. Generally studies reported higher student levels of engagement and results when content-expert facilitators were involved, although this was not consistent. However, a clear trend was that when students’ prior knowledge level was high there was no difference between non-expert and expert facilitators. The recommendation, then, was to allocate content expert facilitators to the early years of a course as this is when students require more guidance and structuring of their learning even though knowledge is more important to students in later years.

Barrows (1988) outlines stages in successful facilitation of students new to PBL. Initially, the facilitator should be actively engaged in the discussion process using challenging questions. Students use this as a model and begin to naturally take on this role. The facilitator can then begin to withdraw and eventually reach a stage of intervening only when necessary. It is important that they keep the discussion flowing by guiding it and not allowing it to lapse. In support of Barrow’s strategy for effective facilitation, Moust and Schmidt (1995) found a tendency for students to contribute less during discussions if the facilitator contributed generously. This often occurs because of the facilitator’s interest and expertise of the content knowledge area being discussed (Schmidt & Moust, 2000). Students could, therefore, become more reliant on facilitator input and less reliant on engaging in self-directed study in that topic area (Schmidt & Moust, 2000). Walker et al. (1996) believe excessive facilitator contribution is a prevalent factor in hierarchical cultures, such as those found in Hong Kong, where facilitators are reluctant to forgo their position of authority.

Discussion among students in the group is the counterpoint for bringing about learning and understanding in PBL. The environment that facilitators create and nurture is also an important factor in conducting PBL sessions. Facilitators also need to be aware and respond at all times during the PBL tutorials to the group dynamics, interpersonal conflicts that ensue, the processes and procedures of the PBL process, and the educational program and group goals to succeed (Schmidt & Moust, 2000).
Research indicates students prefer facilitators who are approachable, helpful, and supply information at appropriate times (Murray & Savin-Baden, 2000).

For academic staff, creating learning in a safe environment where ideas and concepts can be openly challenged, and knowledge is deconstructed and reconstructed, is not easy. It requires preparation for both staff and students. Having a sound knowledge of the type of learning required in PBL, and the skills to be able to facilitate that learning often means significant changes have to be realised by the persons involved. They need to alter their pedagogical stances, ways of teaching, understanding of learning and personal preferences (Murray & Savin-Baden, 2000). The actions of the facilitator are highly significant in small group tutorial sessions (Gijseelaers & Schmidt, 1990) and can have a direct and influential effect on students’ perceptions of their learning, interest in the subject matter, success of their learning and enjoyment of their PBL experience. It is therefore important that facilitators are thoroughly prepared for their roles (Murray & Savin-Baden, 2000; Barrows & Tamblyn, 1980).

The quality of tutorial skills is a point of concern in institutions that use PBL as a method of instruction (Barrows, 1985). To ensure a quality product is offered, comprehensive preparation of staff needs to be initiated (Murray & Savin-Baden, 2000; Creedy and Hand, 1994). Provision of quality programs calls for provision of introductory and continuing professional development activities (Creedy and Hand, 1994). Ensuring staff involved in PBL programs are fully prepared, supported and provided with ongoing opportunities to develop their abilities and skills as facilitators is central to the success of any PBL initiative (Stokes, 2001). Learning to work as a facilitator (or tutor) and effectively facilitate learning in a PBL context is a key element in successful implementation and maintenance of PBL programs (Murray & Savin-Baden, 2000).

**Assessment and Evaluation**

Boud and Feletti (1999) identify two key issues that are problematic in PBL curricula, student assessment and course evaluation. They refer to inappropriate assessment methods that are not aligned to the learning processes and outcomes, and
evaluation strategies that are “implemented and acted upon far too late” (p. 5). Margetson (1995) points out that evaluation is central to PBL curricula. According to Margetson, evaluation should not just be an occasional activity but must serve to ensure there is achievement of the curriculum designers’ intentions. In summary, it “allows us to see that we are doing what we say we are doing” (p. 145). Evaluation should cover all aspects of a course: the problems used to stimulate learning; availability and suitability of resources to support learning; facilitation strategies; and measurement of student learning outcome. All aspects are used for reviewing of curricula and implementing on-going changes (Margetson, 1995). Engle (1999) supports this notion. He noted that it is essential that adequate resources, both human and material, are available to successfully support individual, self-directed study. According to Margetson (1995), learning that emulates from contextualized problem work “needs to be supported by relevant and responsive assessment, and evaluated as part of the learning process for both students and teachers” (p. 155).

Murray and Savin-Baden (2000) state that methods of assessment in content-driven traditional courses are not appropriate for process-oriented courses such as PBL. They believe that in traditional courses the standard forms of assessment drive students towards rote learning for memorisation of discipline knowledge. Murray and Savin-Baden warn that failure to adopt assessment methods that match the manner in which knowledge is learned in PBL will be counterproductive and act as a barrier to the process of meaningful learning. Murray and Savin-Baden (2000) cite Andersen and McMillan (1991) who stated that “process oriented curricula still often revert to traditional assessment strategies which tend to examine what students have learned, rather than whether students can apply and analyse what they have learned” (p. 111). Boud and Feletti (1999) also warn that summative assessment should be used sparingly and test application of knowledge rather than focus on recall as often happens in traditionally designed courses.

Alavi and Cooke (1995) maintain, from their experiences in successfully implementing a total PBL course for the whole of a bachelor degree in Nursing at Griffith University, Australia, that assessment is an integral part of a PBL curriculum. In their course assessment criteria on which students are graded were published at the outset of each semester. The assessment items were integrated into the curriculum to enhance the learning process. Alavi and Cooke also made frequent
use of formative assessment to provide feedback to students. Their strategy was to convince students that the new styles of learning, cooperation in groups, self-directed study, and collaboration and reflection are indeed valued. In other words, assessment became part of the learning process and it was used for more than just end products. They were careful to design assessment items to incorporate theoretical and practical elements as well as integrating knowledge from different disciplines. They highlight the importance of extensive feedback to students in the formative assessment process. Feedback comments need to be meaningful and regular to support the creation of an environment where learning is a developmental process (Alavi & Cooke, 1995).

Skills to be assessed - such as learning content knowledge, reasoning for clinical practice, engaging in study at a meta-cognitive level, either individually or cooperatively, plus demonstrating one’s ability to remember and apply appropriate knowledge in a competent way - are all elements of PBL (Engle, 1999). These skills are associated with systematic enquiry, literature searching, critical reading and the subsequent presentation of the findings, and as such are all “critical elements for students and student learning in PBL” (Murray and Savin-Baden, 2000, p. 120). Assessment of productivity and products are also key aims. Monitoring of students’ ability to utilise the knowledge they have learned in a clinical context as well as their ability to engage in clinical reasoning is recommended, irrespective of how difficult it might be to observe (Schmidt 1993). In summary, an holistic approach to assessment in PBL is seen as an appropriate way to integrate cognitive concepts with skills, and theory with practice elements which are important for application in professional practice contexts (Murray and Savin-Baden, 2000).

Student performance needs to be assessed for both the process of learning and knowledge learned. It should also match the learning process and be aligned to learning outcomes (Tang & Biggs 1999). Many methods have been used. Stokes (2001) reports assessing learning processes using tutor assessment, peer-assessment and self-assessment, submission of a reflective journal, and a component in the end-of-semester examination in which students had to reflect upon what they had learned during the examination. Assessment of content knowledge was by written assignments and an examination. Alavi (1995) recounts how students in her PBL course were required to develop learning contracts and draw up their own assessment
criteria in agreement with a facilitator. Feletti and Ryan (1994) describe a unique method designed to match the PBL learning process termed ‘triple jump’. A student is called without warning to a facilitator’s office and presented with a problem. The student is required to develop learning issues on the spot and then leave to research them, returning afterwards to discuss their solutions to the problem with the facilitator.

The process of ensuring that students are able to elaborate on the existing and new knowledge presented, raise insightful and critical questions, and analyse and pose alternative ideas as necessary, is essential to attaining the goals of learning promoted by a commitment to PBL (Schmidt & Moust, 2000). The opportunity for application of a feedback loop that enables students to identify things they may have missed, or not covered adequately, or do not understand properly, is essential for learning constructively (Schmidt & Moust, 2000).

The Problem-Based Learning Process

Margelston (1998) points out that in practice there are different conceptions concerning the approach to instruction resulting from the conceptualisation and construction of courses that serve to confuse the issue about what is the actual PBL process. In his article, What Counts as Problem-based Learning, Margelston (1988) highlights some of the issues that have arisen as a result of different institutions, discipline areas and groups adjusting their curricula design, content and procedures to suit their particular needs. When doing so they still label their variations of the original instructional method as PBL.

These differences in educational practices incorporated in the different forms of PBL have emerged in countries such as Australia, Europe and North America and impact on educational outcomes for students (Margelston, 1998). However, as Boud and Feletti (1999) point out, “it is rarely possible to translate a given approach from one context to another without considerable modification” (p. 11) to the original form of PBL as it was first introduced and reported by Barrows and Tamblyn (1980). Modification of PBL to make it compatible with the context and environment in which it is to be introduced or used may be expedient and suit institutional or
academic demands. However, such action will have implications for stakeholders (Margeson, 1998). Margeson claims PBL can be reduced to the point where it is merely a variation of traditional, teacher-centred approaches he terms “a convenient peg on which to hang knowledge acquisition of the ‘basic’ sciences” (p. 196). It is, therefore, not uncommon to find curricula, or parts of curricula, labeled PBL when they are not (Margeson, 1998).

Ross (1999) confirms Margeson’s view. Ross comments on the confusion over some curricula being labeled PBL, when they are in reality ‘normal’ or conventional, simply being problem-oriented or problem-solving focused. Ross (1999) defines curricula as problem-oriented when “problems are used as selection criteria for content (and method)” (p. 29). Problem-solving curricula are different and occur when “students are given specific training (or development experiences) for solving problems” (p. 29). The key point is that in a traditional approach, such as problem-solving curricula and often in a problem-oriented approach, “it is assumed that students have to have the knowledge required to approach a problem before they can start on a problem” (p.30). In the true form of PBL curricula, new knowledge “arises from work on the problem” (p. 30). Another distinction Ross makes lies in the level of detail and the scope of the problem in problem-oriented curricula compared to that found in PBL. In PBL, a problem can extend over one to five weeks and is more complex in nature. It can, therefore, be used at a sub-unit level.

Whether a course can be considered full or pure PBL depends on it being maintained in the form and spirit when it was originally designed. Form refers to the process of instruction occurring when “student work on the problem is explicitly used to get students themselves to identify, and search for, the knowledge they need to obtain in order to approach the problem” (Ross, 1999, p. 30). The spirit of PBL is that its process allows “information, concepts, reasoning, skills and attitudes … [to be] acquired in relation to each other, together complementing each other holistically in the growth of the student’s understanding” (Margeson, 1998, p. 197).

Schmidt (1993) provides an overview of the PBL process. He describes it as:
an approach to learning and instruction in which students tackle problems in small groups under the supervision of a tutor. In most of the cases, a problem consists of a description of a set of phenomena or events that can be perceived in reality. These phenomena have to be analysed or explained in terms of underlying principles, mechanisms or processes. The tools used in order to do that are discussion of the problem and studying relevant resources (p. 427).

The PBL Tutorial

The original model of PBL, as developed by Borrows and Tamblyn (1980), commonly involves two tutorial sessions with small groups of students. Barrows and Tamblyn (1980) and Barrows (1988) argue that the small group structure is very important as it ensures the major constructs underpinning the PBL process will be upheld. They maintain that because groups have no more than twelve persons, it is possible to ensure all group members participate actively in any group discussions. In this situation, students are better able to interact with each other and the facilitator (Barrows, 1988). Rather than creating “a working group” (Barrows, 1988, p. 8), as is common within larger groups, small group discussions in PBL tutorials can be easily guided and monitored for meaningful engagement and learning by all students. Those constructs, according to Barrows, enable achievement of outcomes inherent in a full PBL program.

Normally, a group elects one of its members to act as a chairperson for a tutorial to lead the group discussion. Another member acts as a scribe (or secretary) to make summary notes for the whole group. By rotating duties for the ongoing tutorials students get to experience a leadership role as well as working as a team in seeking solutions to problems. In addition, the lecturer assumes the role of facilitator, who ensures the PBL process is followed, facilitates the learning when required and, when essential, keeps the momentum of the learning process moving by acting as an occasional resource person.

The two tutorials, termed ‘T1’ for the first tutorial session, and ‘T2’ for the second tutorial session, are quite different (Engle 1999). According to Engle there are five stages in T1. At the beginning of T1, the group is presented with a problem that
has been designed to elicit the content knowledge of the discipline areas to be covered. The designers will have also considered the educational level of students and organised the problem to represent the context of a situation in which it would occur. In the next stage of T1, students in the group will examine the elements of the problem in detail. They clarify any terms about which they are unsure and identify what they already know about the problem. They then start to formulate their ideas regarding the problem using techniques such as brainstorming, exploratory discussions and hypothesizing with possible explanations. Following this, students begin to refine those initial ideas by critically reflecting on and discussing what has emerged out of their deliberations. At this point students start to formulate preliminary understandings of the “causes, mechanisms and solutions” (Engle, 1999, p. 20). In the final stages of the first tutorial session, the questions posed by the different members of the team are recorded. Engle contends that these questions emerge when the students do not have a clear understanding of the knowledge structures or concepts, or there are deficiencies in the group’s knowledge base. The gaps in students’ knowledge are termed learning issues (van den Hurk, Wolfhagen, Dolmans and van der Vleuten, 1999). Van den Hurk et al. (1999) found learning issues serve to guide students to study the necessary discipline content and learn cooperatively, playing an integral role in motivating and guiding students to understand the problem issues. The role learning issues play in student learning was found to be of particular significance when “the discussion in the tutorial group … [were] well structured and students listen to each other” (p. 215).

It is worth noting that the terms ‘learning issues’ and ‘learning objectives’ are commonly used synonymously resulting in misunderstanding among practitioners and students (Paul Fletcher, personal communication, December 2, 1999). Learning objectives are much broader in scope and nature than learning issues. Learning issues represent specific gaps in students’ existing knowledge and require further investigation or individual study by students (Barrows, 1988; Schmidt, 1993; van den Hurk et al., 1999).

Formulation of learning issues is a key element in T1. The facilitator plays an important role here making sure that the discussion has led to all the learning issues being identified, and may also act as a resource person by providing some additional information. At this stage, the learning issues will be allocated to group members,
either on an individual or sub-group basis, to be researched prior to T2, which is usually 2 to 3 days after T1.

This process is carefully structured to benefit learning as outlined in Schmidt’s (1993) six principles of cognition described later in the Outcomes of PBL section of this chapter. In the first stage of the first tutorial session Engle (1999) argues that the goal should be to incite student enthusiasm and to challenge them to engage in trying to solve the problem, which is common to all and important in their future professional practice. Because the context of the information presented is aligned with practice, it benefits the processing, storage and later recall from long-term memory (Schmidt, 1993; Engle, 1999).

During stage two of T1 is where students discuss the problem and logically analyse it by activating prior knowledge in context of the problem. Time is allowed for students to identify thoughtfully and convey succinctly what they do or do not know. This will require them to recall information and reflect on it in the light of a new context. In the third and fourth stages of the T1 process, students will freely engage in hypothetical-deductive reasoning (Schmidt, 1993). They put forward their ideas and refine them into hypotheses, which are discussed by the group until some consensus is reached. This process promotes elaboration of their existing knowledge and perhaps requires restructuring it in view of what others have to say. This progression in learning underpinned by principles of adult learning theory, assists students to comfortably and safely explore their individually determined learning requirements while working as a team member in their designated groups (Engle, 1999). The facilitator in this section of the tutorial needs to promote the safe environment allowing students are free to muddle their way through the process. However, the facilitator also needs to make sure learning is constructive and progressive as well as ensuring student thinking incorporates the primary elements of operating at a meta-cognitive level (Engle, 1999; Barrows, 1986).

After T1, students have time to research the information to a depth and breadth to suit the learning issues they have been allocated in context of the problem. They are free to use any reliable source, usually a library and the Internet. Sometimes the course designers provide a reference list. This is more frequent for students who are
neophytes in a PBL environment. When students return to T2 they are usually expected to supply copies of the resources they have sourced to the other group members. The process they follow in T2 reflects that used when trying to solve problems in professional practice contexts.

There is a lot of difference between T1 and T2. Whereas in T1 the discussion can meander and there is uncertainty, during T2 it is much more focused, with each student now expected to bring authoritative information to the discussion forum. During T2 students present what they have found as a result of their self-directed study and research efforts. It is in this forum where the main discussion of the problem and associated learning of new knowledge takes place, hopefully at a metacognitive level (Barrows, 1986, 1988; Barrows & Tamblyn, 1980). During the discussions students will reflect on what they have learned, explore other member’s information, challenge each other’s concepts and assumptions, and raise further questions they need to have answered. There is a progressive accumulation of knowledge as the group works together trying to solve the problem or resolve the problem situation (Engle, 1999). When the group has reached the end of its deliberations and the group members are satisfied with their conclusions, the tutor should, if necessary, fill in any small gaps that may be incomplete. If the tutor deems that more substantive information is required, then a T3 may be scheduled.

Evaluation of student learning is a very important element of the instructional process of PBL (Boud & Feletti, 1999; Engle, 1999). Students need time to review and reflect on their learning progress. For example, “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” (Engle, 1999, p. 22) are all questions that should be asked by the facilitator, and later, by the students themselves. In addition, the facilitator may provide additional formative feedback during both tutorials. The importance for students to be able to gauge their learning in comparison to other members of the group, and self-evaluate their progress and functionality as a group member, is not to be underestimated (Engle, 1999). “Active use of what has been learned, and feedback on how well new learning has been assimilated, helps embed new information in long-term memory” (Engle, 1999, p. 21).
Learning in T2 is achieved through active processing of new information in discussions with their peers. The processes involve critical thinking, questioning, logical reasoning and decision-making, all of which result in knowledge organisation, structuring and consolidation (Schmidt, 1993). Students learn independent research skills, and how to evaluate and process information from a range of sources. They develop effective communication techniques using appropriate cognitive, affective and, in some instances, psychomotor skills (Boud & Feletti, 1999; Engle, 1999). In the final stages of the PBL process, cumulative understandings of newly structured or newfound knowledge of concepts related to discipline content are reviewed. Reflecting upon the process, and revisiting the problem and associated information, may be carried out in order to elaborate further, or to study the subject matter in more depth (Barrows, 1986). If such a situation arises, students, often with the assistance of the facilitator, will repeat the necessary steps in the PBL process to arrive at the desired level of problem resolution or defined end point for the problem. It is through the processes of T1 and T2 that PBL aims to equip students with the knowledge they will remember, the skills they will need to apply and attitudes they should exhibit when they enter their chosen work fields (Engle, 1999).

The PBL Tutorial Group

Group Dynamics

The focal point of learning in PBL is the tutorial group. Barrows (1988) outlined the importance and function of small group learning and described four phases in its operation. During the first phase of about two weeks, members will be polite and agreeable towards each other. The second phase is short and characterized with friction erupting between some members for a number of reasons. These are mainly due to lack of contributions, domineering attitudes, or other interpersonal reasons. At this point, a facilitator needs to appropriately address these issues in order for the group to function effectively. By about the fourth week, in phase three, the group members will usually have begun to work well together and be quite productive. The final phase, usually the last week or two, involves farewells and often agreement to keep in touch. Barrows recommends keeping groups intact for at least ten weeks.
because this time is needed for them to work through all the processes involved in
teamwork, and to develop associated skills of cooperation, interpersonal
relationships, communication and leadership.

Tipping, Freeman and Rachlis (1995) report on a study they conducted at the
University of Toronto, Faculty of Medicine, about perceptions of 27 first-year
students and their PBL facilitators about small group dynamics when using PBL. The
students were assigned to three groups and data were collected over a period of four
weeks. A questionnaire was administered both at the beginning and end of the four
weeks. In addition, observations and videotapes of the tutorials were used to validate
the questionnaire data. The questionnaire had six categories of group dynamics:
Climate, Involvement, Interaction, Cohesion, Productivity and Leadership. They
found the data fitted into three main categories of observable behaviours: Climate
(emotional); Interaction (participation, power, listening) and Leadership
(effectiveness, style) as being important factors in small group dynamics. Little
mention was made of Involvement, Cohesion and Productivity. Based on these
results, Tipping et al. then provided training programs for PBL students and staff
aimed at improving group dynamics. They found that following training programs,
the factor of Climate decreased while that of Productivity increased. Their findings
would appear to have implications for academic leaders of PBL programs to provide
similar programs.

Schmidt, Dolmans, Gijseelaers and Des Marchais (1995) in a large scale evaluation
study of a PBL Health Sciences program at the University of Limberg, The
Netherlands, used a seven factor scale to illustrate how various components of a PBL
curriculum can be analysed. One of the factors focused on the tutorial group. It had
seven items: agreement on subject matter to be studied; contributions to discussions;
group discussion influence on learning; productive meetings; meetings stimulated
self-directed learning; compliance with agreements; and agreeability of the
atmosphere. Using those items as a guide, it is reasonable to conclude that the nature
and quality of discussion plays a major role, both directly and indirectly, as a factor
affecting group dynamics.
Discussion.

Small group discussions are described by Geerligs (1995) as “a cornerstone of problem-based learning” (p. 269). Group discussions, particularly when they are student-centered, provided students with opportunities to review items that have been put forward, and reflect upon and analyse complex concepts. The discussion process also allowed them to appreciate the diverse ideas and explanations and use them to generate theories (Burns, 1998). Schmidt and Moust (2000) agree. They emphasise that discussions serve the purpose of assisting the students to formulate tentative theories about mechanisms, processes and concepts emanating from the problem materials. Using discussions to develop explanations and make sense of the phenomena and events is not only a way of constructing theories, it generally is viewed as a highly desirable outcome of PBL. Other research indicates students’ engagement in a discussion group, whether active or passive, is all part of a significant learning process (Schmidt & Moust, 2000).

Geerligs (1995) reports an exploratory research study on participation in the discussion process using data collected from five tutorial groups over ten consecutive PBL sessions for first and second year students in a health studies course. Geerligs sought to establish whether during the discussion process, students remained task-focused, engaged in elaboration discourse associated with acquisition of relevant knowledge, and processed information at a meta-cognitive level. This applied to both active discussants and silent group members. One particular question Geerligs investigated is whether students’ verbal participation in a discussion group is a valid indicator of elaborations all participants make. Given that in PBL group discussions there is usually only one student talking at any time, the other members of the group remain silent, listening or engaging in thinking. A question remains regarding the nature of thinking the silent students are engaged in: is it content related or not, are students thinking about what they know (activating prior knowledge), what they have been discussing (reflecting), and how this informs their current understandings and concepts about the topics under review (elaborating).

Geerligs (1995) used a method termed random ‘thought sampling’ to establish categories and percentages of task-relevant and task-irrelevant categories of thought items. Thought sampling occurs when a random ring-tone is sounded. On hearing the
ring-tone, students’ make a quick note of what they were thinking about at that time. Six broad categories were established, three task-related and three off-task. The three items in the task-related were ‘content related thoughts’, ‘procedure-related thoughts’ and ‘metacognitive thoughts’. In the off-task category, there were ‘task-irrelevant thoughts’, ‘miscellaneous/ unclassified thoughts’; and ‘absence of thoughts’.

The findings of Geerligs’ study demonstrated that about three quarters of students’ learning procedures and processes were integrated, highly productive and task-focused, regardless of whether the students regarded they were silent participants or not. About half of these (55%) were subject matter or content focused. A small number (11%) had thoughts centred on procedural elements such as time and group work, while an even smaller number (8%) were engaged in aspects of meta-cognitive thinking. In the off-task category, 16 percent of students engaged in task-irrelevant thoughts, 6 percent in miscellaneous or unclassifiable thoughts and 4 percent registered absence of thoughts. Geerligs noted that the findings supported previous research which indicated discussion enables students to learn, regardless of any propensity students have to participate overtly (talkatively), or covertly (while remaining silent). It established that as:

major parts of students’ oral interactions are task-related and differences in verbal participations do not reflect differences in elaboration, we may expect that most thoughts students have during group sessions will be relevant to topics being studied (Geerligs, 1995, p. 270).

Problem-Based Learning Outcomes

Participant Learning

Schmidt (1993) and Norman and Schmidt (1992) outline some of the theoretical underpinnings of the method of instruction PBL follows, originating from the philosophies of rationalism and influenced by behaviourism (an American branch of empiricism). Rationalism is a branch of psychological theory that “presupposes that our knowledge of the world is primarily the product of our thinking activity” (Schmidt, 1993, p. 422). In this way, a process of deduction underpins learning, reasoning and cognitive activity, rather than knowledge being acquired by inductive
processes of careful observation and systematic description of reality as adhered to in an empirical scientific approach. Empiricism has also been a part of psychological theory and is associated with a belief that learning comes from a person experiencing the natural world and learning of knowledge comes from observation and practice of naturally occurring and measurable experiences. Proponents of rationalism such as Popper (1959) believe knowledge is a result of cognitive thinking, logic and reasoning. Noted theorists, such as Kant and Descartes, influenced the psychologist theoretical paradigms of rationalism and empiricism by gradually embedding ideologies that thinking and knowledge was also a construct of a person’s cognitive activity and not part of knowledge solely transferred form one person to another. These theoretical approaches formed the basis of Dewey’s (1929) writings concerning cognitive psychology. Dewey proposed the notion that cognitive activity formed the basis of a person’s learning and understanding of the surrounding world. Meaningful learning was not just a result of going through a mechanism whereby knowledge is “transferred” from one person to another. In this theoretical approach, as with constructive theory, Dewey’s ideology suggests knowledge must be actively learned through real-life experience and pursuit of intentional comprehension.

Learning is a function of an individual’s encountering challenging situations where consideration of both existing and new information is required. That individual actively thinks about the situation using data that is perceived to be relevant by forming and testing newly formulated concepts or hypotheses. These activities are the foundations of cognitive structuring. Cognitive structure, Schmidt (1993) states, “refers to knowledge [as data organised in a certain way and] stored in long-term memory” (p. 423). The subject matter studied must therefore be understood in a masterful way to learn and enable an individual to cognitively structure knowledge correctly. This process is now commonly referred to as constructivism and it provides the theoretical foundation for meaningful learning in a PBL environment.

Problems that are commonly encountered in real-life situations provide a basis for learning new information during the tutorials and self-study sessions. In the view of a rationalist theorist, these problems are well placed to initialize the instructional process and procedural aims attributed to this learning approach. “The emphasis on active construction of theories about the world by students and on testing their hypothesised consequences deductively through literature review and discussion”
(Schmidt, 1993, p. 423) is a key component of the underpinning theory supporting PBL and the PBL process as a comprehensive approach to educating students for professional practice.

Studying information in an integrated, holistic and meaningful manner enables the person trying to learn that information to integrate both existing and new information, as well as information not directly associated with narrow topical fields in a conceptual and coherent way (Schmidt, 1993; Engle, 1999). Problem-based Learning, in its full form, can theoretically support a learner to become a competent beginning practitioner through “understanding clinical problems and in bringing relevant knowledge to bear” (Margulison, 1998, p. 197). In this approach to education, “information, concepts, reasoning, skills and attitudes are acquired in relation to each other, together complementing each other holistically in the growth of the student’s understanding” (p. 197).

**Cognition**

Schmidt (1993, pp. 424-26) outlines six principles regarding cognitive learning that have direct implications for learning in a full PBL environment. These principles are: prior knowledge is the most important determinant of the new knowledge that can be processed; prior knowledge needs to be activated by contextual clues; the way knowledge is structured in memory affects its accessibility; storing and retrieving of knowledge can be enhanced if elaboration takes place during the process of learning it; accessing knowledge in long-term memory depends on contextual clues; being motivated to learn prolongs processing time and therefore improves achievement.

With regard to the first principal identified by Schmidt, a student’s prior knowledge of a topic or subject area is important in the process of learning, and a necessary factor for understanding, developing and elaborating on that and any subsequent information. Not only is having some prior knowledge about relevant subject matter important, but the character of that information made available, as well as the level and ability of the student, can also determine the breadth and depth of new information processed. The nature and extent of prior knowledge possessed by a student will therefore impact his or her ability and aptitude to learn. In addition, the
student’s preparedness to engage at a more complex level of thinking and reasoning will determine a student’s conceptual understanding at a meta-cognitive level. Levels of understanding, as well as the amounts, rates and quality of learning can therefore differ among the group members and has the potential to develop into situations where a gap in quality of learning is noticeable (Schmidt, 1993).

The second principle concerns how a student’s ability to recall knowledge already learned plays an important part in the process of understanding new information. Furthermore, the context in which the information is learned has direct and quantifiable effects on learning, as well as on recall of that information. Cues such as a title, key words or samples of relevant information, which are often subject and discipline specific, provide guides for enabling thought processes and recall mechanisms supporting the formation of new concepts, information processing and storage, and learning (Schmidt, 1993).

The third principle deals with how knowledge is structured in a person’s memory. It has direct implications for how this knowledge is interpreted and utilised in a workplace context. Workplace performance is directly related to how knowledge is structured from the way it was conceptually formed, and a person’s ability to recall multiple concepts and apply them. Performance is, therefore, directly linked to the concept of learning whereby “knowledge consists of propositions … [and] statement[s] that contain… two concepts and their interrelation … that are structured in semantic networks” (Schmidt, 1993, p. 424). According to Margetson (1998), “learning to be a competent practitioner is seen as a coherent whole from the beginning; clinical reasoning is integral with understanding clinical problems and in bringing relevant knowledge to bear” (p. 197). Thus the notion of a ‘growing web’ (Margetson, 1998) or “semantic network of propositions relating to each other in a web-like fashion” (Schmidt, 1993, p. 424) is plausible when conceptually organising data from different disciplinary contexts and structuring subject specific knowledge meaningfully. Accessing a memory with its available related cognitive structures enables people to “comprehend the world around them “ (Schmidt, 1993, p. 424).

The fourth principle concerns a process of elaboration. It occurs when new information is learned in association with, and in relation to, existing knowledge.
Elaboration is a complex thinking process and requires a person to revisit and perhaps restructure existing conceptual arrangements to accommodate the new knowledge. It is an integral part of enhancing a person’s way of storing and retrieving information from memory (Schmidt, 1993). Elaboration is, therefore, a key component of learning constructively, schematically and progressively for meaning that will be contextually appropriate. It comes when learning is dealt with actively, forming different conceptual propositions to explain the subject related information or phenomena. Establishment of a range of cognitive links or pathways and associations during the learning process, is described by Schmidt (1993) as a process that creates multiple retrieval paths and in turn “facilitates the retrieval of a concept from memory” (p. 426). Elaboration occurs frequently in a PBL environment when students are challenged and have to rephrase their statements for clarity or to reconsider their stance and offer an alternative explanation, for example.

The fifth principle involves activation and retrieval of knowledge from long-term memory. When it is necessary to retrieve and activate knowledge necessary for performance in a workplace context, it is affected by the environment or context in which the information was first learned (Schmidt, 1993). This contextual dependency of learning is relevant to a PBL approach to education, including what information is learned, how it is learned and whether it is learned in an acceptable or conceptually sound manner. Solving realistic problems and scenarios will enhance later performance as the type of learning enables the recall of prior knowledge and applying it in a context similar to that in which it was originally learned.

The sixth, and final principle focuses on the motivation of students to learn. In Bloom’s taxonomy it is termed the affective domain of learning (Anderson, Krathwhol, 2001). A student who is motivated to learn, Schmidt (1993) indicates, will put more time and effort into studying the subject matter than will a person who is not. They will therefore achieve more lasting, complex and retrievable knowledge reserves. Learning as a product of interaction between the learner’s existing knowledge and the challenge of potential resolution of well constructed problems that reflect real-life phenomena can be a driving force in the pursuit of knowledge acquisition for a student (Schmidt, 1993). Intrinsic motivation, the epitome of internal drive to know more, is an important aspect of learning in a PBL context where students take ownership of their learning processes and solve real-life
problems. Learning is best served when a person is motivated to learn (Barrows, 1986).

**Metacognition and Critical Thinking**

Both metacognition and critical thinking are terms often encountered in the literature about PBL when authors refer to high levels of cognition. For example, Barrows (1988) and Margetson (1998) use metacognition [sic] to describe thinking processes when learning in a PBL environment. Alavi (1995) refers to critical thinking when reporting findings about students’ perceptions of their learning experiences in a PBL course. However, generally agreed definitions that clarify both as discreet terms, are not evident in the literature.

Barrows (1988) discusses the process of cognition in a PBL context and uses the term metacognitive skills to describe the higher levels of thought involved. These include reflection and deliberation about problems leading to resolution through analytical thinking. These are the skills needed to address and resolve complex problems faced in real life and are sought after as a means of addressing the demands of a rapidly changing world (Race, 1998). According to Barrows (1988), the metacognitive process is similar to the learning processes utilized in PBL. Barrows stated that:

> Metacognition is this executive function in thinking, pondering, deliberating, or reflecting on the problem or situation; reviewing what is known and remembered about the kind of problem confronted; creating hypotheses; making decisions about what observations, questions or probes need to be made; questioning the meaning of new information obtained from inquiry; pondering about other sources of information; reflecting on and reviewing what has been learned, what it may mean and what needs to be done next (1988, p.3).

It should be noted that this definition is compatible with the six principles of cognitive learning outlined by Schmidt (1993).

Critical thinking is referred to in the PBL literature as an outcome of the PBL process and is often loosely used by PBL practitioners (Dickson, personal
communication, December 1999). According to Gordon (2000), there is little consensus about a definition of critical thinking and it is often used interchangeably with other terms associated with higher order thinking skills. In a review of the literature about critical thinking, Gordon claims that a broad definition by Ennis (1991) is widely used as a standard. Ennis defined critical thinking as a process involving “reasonable and reflective thinking that is focused upon deciding what to believe or do” (Ennis cited in Gordon, 2000, p. 341).

Other definitions of critical thinking have been proposed. Scheffer & Rubenfeld (2000) refer to the work of Paul, the founder of the Foundation for Critical Thinking. Paul defined critical thinking as “the art of thinking about your thinking while you are thinking in order to make your thinking better” (Paul cited in Scheffer & Reubenfield, 2000, p. 353). Scheffer and Rubenfield also report a definition adopted by the American Psychological Association. It is:

Critical thinking is a purposeful, self-regularly judgment, which results in interpretation, analysis, evaluation and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual consideration upon which judgment is based (2000, p. 353).

Given these definitions, there is clearly a lot of common ground between what people define as critical thinking and metacognition. Barrows (1988) definition is more overarching as it encompasses the PBL process and includes the elements of critical thinking. The term metacognition will, therefore, be used when reporting higher levels of cognitive activity in the context of this study. However, there will be specific references to critical thinking particularly as it is the term students will more likely to have been exposed.

**Affective**

There are many anecdotal reports consistently supporting the notion that a PBL environment raises students’ levels of motivation to learn (Barrows 1986; Engel 1999; Schmidt and Moust 2000). However, only little evidence has been collected to support this contention. Schmidt and Moust (2000) refer to a series of studies by De Volder, Schmidt. Moust and De Grave (1986) and De Volder, Schmidt, De Grave
and Moust (1989) where they found the influence of group discussions significantly raised intrinsic motivation about subject matter. They compared the extra work done by groups of students in using a problem-based approach and those presented with the subject in a traditional manner. They found that students experiencing the problem-based approach were motivated to borrow more reading materials from the library and to voluntarily attended lectures about the subject.

Dolmans and Schmidt (1994) mention a study by Blumberg and Michael (1992), which also revealed that PBL students actively sought out and borrowed more library resource materials than did their counterparts in conventional programs. Dolmans and Schmidt (1994) attribute higher levels of motivation by PBL students to use library facilities contributes to their capacity for active involvement in the discussions and processes during the PBL tutorials.

Alavi and Cooke (1995) report that when students were allowed freedom to develop their own criteria by which they were to be assessed in a PBL course increased levels of motivation were experienced. The students were very creative in developing the modes of assessment and became very engaged in the process. For example, some groups dramatised cases and solutions while others developed videos.

Johnston (1999) relates how students in a new PBL program showed higher levels of motivation than had been the case when the course was presented in a more traditional manner. He reports instances where students were motivated to go to unusual sources and put in much more effort to find solutions to problems. Informal feedback from the students indicated that ownership of the learning process was a prime, motivating factor. Johnston reported how one mature-age student commented that it was the first time in her three years at university she had been empowered with her own learning, which is similar findings reported by White, Amos and Kouzekanani (1999). They reported that one of the outcomes of their one-year PBL course for mature age students was that they valued being empowered with their own learning.

Schmidt and Moust (2000) mention that regular internal evaluations carried out in Maastricht University’s curricula (all PBL) indicate students regard PBL as highly
motivating. They also report that at a national level consumer studies in higher education show Maastricht courses are usually ranked highest in their category, and this is attributed to PBL being the mode of education. Schmidt and Moust note that active, constructive and successful discussion among PBL group members can be very motivating for students as their intrinsic interest in the topic under discussion can be activated. Intrinsic motivation is fuelled by students' participation in collaborative and cooperative environments where they collectively build knowledge structures as they strive to fill gaps in their knowledge bases and as they try to resolve the problem issues.

**Generic Skills**

Murray and Savin-Baden (2000) believe that the student centeredness of PBL is a key element in the process of ensuring desirable additional outcomes for students. The learning of subject content in a meaningful and integrated manner allows them to attain "the high level competencies, transferable skills and complexity skills" (p. 107) demanded by governments, industry and professional organisations, not only in the UK, but also in many western countries.

Schmidt (1983) commented that attempting to deal with overwhelming amounts of knowledge in medical and most other traditional curricula, subject matter is not integrated or organized for holistic learning, and instruction does not consider skills required to keep abreast with new knowledge once the graduate enters the workforce. He, and others, emphasized that in modern day contexts acquisition of transferable and lifelong learning skills exists as a primary consideration in higher education, and is particularly important when considering PBL (Schmidt & Moust, 2000; Biley & Smith 1999).

Engle (1999) believes adopting PBL ensures students have an opportunity to meet a set of objectives that address a set of competences having applicability to their professional life, regardless of which discipline group of practitioners with whom they are affiliated. Engle states; "adapt to, and participating in, change and self-directed learning are composite competences [sic]. Each set of competencies require the development of a number of component competences" (p. 18), communication
skills, information skills, the ability to cooperate with others, record keeping, and time and task management for example.

**Research on Outcomes**

There is scant published research on outcomes of a PBL program, which is surprising given that it has been practiced for about 40 years with an intent to improve student learning and make learning more applicable to practice.

White et al. (1999) conducted a study using an open-ended questionnaire to determine the outcomes for 24 students who had participated in a one-year PBL course. The outcomes they listed were critical thinking, learning how to learn, creativity in thinking, community focus, teamwork, research skills and personal growth. The most frequently reported outcome was critical thinking. The students were also asked to compare their PBL experiences with those in lecture-based courses. Students reported that PBL was more challenging and aligned to their prior experience and knowledge. They indicate PBL was based on reality and more related to their professional practice. White et al. also report findings of data collected from student focus groups when an evaluation of the same PBL course confirmed that students rated learning of teamwork the highest. White et al. then conducted a quantitative study, which confirmed the findings of the previous qualitative study. They point to the limitations of their study with its small cohort meaning that its findings cannot be generalized.

The PBL instructional methodology has not been without its critics. Following a meta-analysis of the published English language literature about the effectiveness of PBL over the previous 20 years, Albanese and Mitchell (1993) concluded that some problem-based students, on testing, were found to be less able to score as well on basic science examination papers as their counterparts from traditional courses. In terms of cognitive processing ability, they also concluded that PBL students were also found to engage in backward rather than forward reasoning strategies as would be found in practice contexts when problem solving were carried out by experts in the field (Albanese & Mitchell, 1993).
The findings of more recent research contrasts somewhat to that of Albanese and Mitchell. It suggests PBL students’ attendance, attitudes, and clinical performance were better “even allowing for different definitions, curricula context and costs, and study design in the evidence base” (Maudsley, 1999, p.657). According to Maudsley, the satisfaction derived by students in PBL courses is reported as positive and reports of students’ preference for adult learning strategies that characterize PBL override previous concerns raised by researchers such as Albanese and Mitchell (1993) and Vernon and Blake (1993). Furthermore, Moust and Schmidt (2000) report that research shows PBL students remember what they have learned for a much longer period of time than do students from a traditional course. Moust and Schmidt also point out that Albanese and Mitchell’s finding about recall of content was based on one example using multiple-choice items, not a form of assessment with which PBL students are familiar.

The “lack of a universally agreed upon ‘gold standard’ to serve as a definitive outcome measure” (Albanese & Mitchell, 1993, p. 56) remains problematic in PBL. It presents researchers, educators and administrators with a dilemma as to how to effectively evaluate outcomes related to criteria attributed to the educational approach.

**Summary**

The literature review helped set the background for this study. It revealed much of the published work, while mostly descriptive in nature, does generally show consistency amongst the experiences of those practicing PBL. There are no precedents for this study and authors express quite differing views and findings about PBL being introduced into Hong Kong higher education courses. There are, however, sufficient details about all the facets of implementing a PBL curriculum. In the next chapter, the research method adopted for this study is described and justified and the procedures that were followed are outlined in full.
CHAPTER 3: METHODOLOGY

Overview

In this chapter the rationale for the research design is provided and its methods of application are described. Details of the site and participants involved in the study are provided. The steps followed in collecting data from interviews and the process of analyzing it are then given. Comments about the effectiveness of the design based on the researcher’s experiences are also included.

Research Design

Context

There are differing points of view and little published research about the philosophical and psychological constructs that underpin PBL as an educational method. Suggestions have been made that it is possible to discern the holistic concept of PBL as having characteristics identifying it as an approach with its own theory (Biley & Smith, 1999). These suggestions are tentative only, still in the early stages of development and requiring further robust research (Biley & Smith, 1998a; Gijseelaers & Schmidt, 1990). Elsewhere, PBL has been described as having no definitive theory serving to inform the practice (Boud & Feletti, 1999). It is, however, generally agreed that the original instructional method of PBL was structured in direct relationship to the philosophical and theoretical constructs that inform it as a whole (Boud & Feletti, 1999; Schmidt 1993).

Problem-based Learning is proving not to be static in practice. Boud and Feletti (1999) note that while its “original ideas were sufficiently robust” (p. 4), the underlying principles and theoretical notions originally informing the design and rationales for adopting and implementing different forms of PBL are likely to have diversified and changed. They also note that new theories of learning and knowledge
construction may have emerged, requiring ongoing investigation of emerging theory or theoretical propositions. In Hong Kong, for example, where this study was conducted, different cultural, social and political constructs serve to inform curricula design and implementation, as well as their maintenance strategies. In other words, PBL as a student-centred education concept was developed and refined in Western societies with their acceptance of a more liberal approach. It is now being adapted for use in an Eastern culture with its predominantly overlying Confucian education values of lecturer as the complete authority figure.

Given the relative lack of established theory of PBL, particularly in a different cultural context, it therefore becomes necessary to investigate it in practice. Students are the one group of stakeholders in any educational program that experience the whole instructional paradigm and are therefore well placed to express and inform educators, administrators and researchers of their experiences. Furthermore, developing a deeper understanding about how PBL impacts on these students can potentially enhance the learning outcomes possible from the use of different types, formats and structures of this unique instructional methodology.

**Paradigm**

Practitioners working in new and innovative educational fields are confronted by complex problems and unexplained phenomena. Unfortunately, there is often insufficient theoretical information to assist them by providing explanations or even tentative suggestions based on propositions as a guide. The problems are usually inherent in innovative curriculum design and its implementation. It is likely that the practitioners are content knowledge experts in their respective fields but are lacking in theoretical background (Merriam and Simpson, 1995). A situation such as this makes it very difficult for new, innovative courses to fully achieve their intended outcomes. Further development of theoretical constructs underpinning innovative education courses to better inform practice is therefore necessary. In this study, it is for full PBL in a Chinese Hong Kong cultural context. Merriam and Simpson (1995) believe the process of building theory generally requires a qualitative research approach.
Tentative propositions built on emergent categories, themes and common properties situated in data collected from the two PBL programs may give rise to development of further theoretical constructs. A qualitative design using a grounded theory approach was chosen for this study because it is suited to applied fields of practice, including adult education contexts. It enables a deeper understanding of why participants in this study think and behave the way they do (Merriam & Simpson, 1995). The researcher, as the primary instrument in data collection and analyses, is able to get close to the data and "understand ... the experiences of those involved" (Merriam & Simpson, 1995, p. 97). It also enables the researcher to dig deep into informants' experiences and discover how their perceptions are constructed. Being a participant in the research process enables the researcher to have the flexibility to intervene when appropriate in the data collection process and therefore can broaden the scope of the investigation. It is acknowledged, however, that this approach is subject to researcher bias influencing what data is collected and how it is analysed.

The purpose of the research question demands an investigative approach. Discovery of similarities, differences and relationships between the two PBL curricula to see if they produce different outcomes is the central feature of this research project. Creswell (1994) notes the research question guides the research process. Research conducted using this approach fits the methods associated with qualitative research. In addition, Creswell claims that using a qualitative approach serves to provide the necessary freedom a researcher needs to explore the field of study in an unconstrained manner. As the data is collected directly from the students as major stakeholders in the PBL process, a grounded theory research methodology was selected for this study to enable tentative propositions to be developed and explored. No hypotheses have been formulated or tested.

Grounded theory, Merriam and Simpson (1995) explain, is best used when a qualitative research approach is chosen to investigate and explore phenomena, or problematic elements and issues, occurring in applied fields of practice. Use of research methods and techniques associated with a grounded theory approach are most appropriate when there is little developed theory in existence that serves to inform educators' practice or explain experiential elements. Merriam and Simpson also explain that grounded theory gives rise to substantive or formal theories. Substantive theory applies to real-world scenarios such as the particular educational
environments found in this study. Formal theory is more overarching and abstract, covering a number of substantive theories.

The capacity for researcher bias during the research process is higher due to the researcher’s position as the primary instrument for data collection and analysis (Merriam & Simpson, 1995). The researchers ability to influence what is collected and how the data is analysed and interpreted can be a weakness of the research design. With constant attention to maintaining trustworthiness by keeping interpretation as close to the original meaning as possible and ensuring consistency through bracketing and triangulation, the approach can be utilised to make constructive and informative contributions to the research itself (Merriam & Simpson, 1995).

*Grounded Theory Approach*

According to Polit, Beck & Hungler (2001), grounded theory is “an empirically based conceptualization for integrating and making sense of a process or phenomena” (p. 148). Qualitative, grounded theory methods utilise inductive research strategies where patterns, commonalities, and relationships among and between events or specific instances are critically examined (Polit et al., 2001). Grounded in reality, the data gathered is used to construct understandings of phenomena through synthesis of information structured so new concepts of what has taken place in an environment such as PBL can be contextualized and then purposively used to improve educational practice. A qualitative, grounded theory approach that involves use of an inductive research design has been selected to provide a framework for the investigatory procedures incorporated in this research project.

Creswell (1994) outlines an inductive process of data collection and analysis suited to a qualitative study. It includes steps whereby the researcher gathers information by fieldwork using interviews and, where appropriate, from participant observation strategies. In addition, data sources can also include documentary materials and previous research. The researcher then asks questions, which lay the foundations for formulating categories, and then looks for patterns or theories (Creswell, 1994), or tentative or suggestive propositions (Merriam & Simpson, 1995). When theoretical
categories are initially generated they should exhibit sufficient abstractness and sensitivity to reflect ongoing developments in the research leading to their further refinement (Merriam & Simpson, 1995). Central to the data analysis process is discovery of relationships between categories and among properties (Merriam & Simpson).

In grounded theory, incorporation of “multiple stages of data collection and the refinement and interrelationships of categories of information” (Creswell, 1994, p. 12 cites Straus & Corbin, 1990) is central to understanding the field in which the research takes place. Two primary characteristics of grounded theory research design are “the constant comparison of data with emerging categories, and the theoretical sampling of different groups to maximize the similarities and the differences of information” (Creswell, 1994, p. 12).

Techniques

Grounded theory techniques for collecting and analyzing data include interviews with participants, reviewing previous research, theoretical sampling and use of comparison groups along with constant comparative analysis and saturation. In this study, the researcher first used findings from the published literature, and the data collected from students and academic leaders to develop categories. These sources were consistently referred to in an iterative manner throughout the data analysis phase. When categories became consistent with frequent, similar responses, it was determined by the researcher that saturation had then occurred. Saturation means that no additional data can be found for further classification and category building (Merriam & Simpson, 1995). These techniques determined “what data to collect, how to handle the data and when to stop gathering data” (Merriam & Simpson, 1995, p. 115).

Initially, this study used a series of cross sectional, open-ended or unstructured interviews with students currently involved in the two PBL courses. An unstructured interview is defined as “an oral self-report in which the researcher asks questions without having a predetermined plan regarding the specific content or flow of information to be gathered” (Polit et al., 2001, p. 472). Open-ended questioning is a form of questioning used during the process of interviewing that “does not restrict
the respondents’ answers to pre-established alternatives” (Polit et al., 2001, p. 466). Polit et al. (2001, p. 314) argues that establishing an environment where “conflicting viewpoints can greatly strengthen a comprehensive description of a phenomenon” serves to determine the existence of any similarities and differences that exist between the two PBL courses during the analysis of data. This technique of open-ended interviews was used in all data collection phases of this project. Its analysis enabled development of “theory that emerges from, or is grounded in, the data” (Merriam & Simpson, 1995, p.112).

Theoretical sampling is an integrated and developmental process that occurs as the researcher collects, codes and analyses data while concurrently making decisions about the type and location of information to use in order to develop hypothetical propositions or theoretical suggestions (Merriam & Simpson, 1995). Theoretical sampling is “essentially controlled by the developing and emerging theory” (Minichiello et al., 2000, p. 161) and serves to extend, modify, develop and verify theory.

Snowball sampling, on the other hand, “relies on the researcher’s knowledge of a social situation … [and] involves using a group of informants with whom the researcher has made initial contact and asking them to put the researcher in touch with people in their networks. … so long as [the members of the population selected] … fit the criteria for the research project” (Minichiello et al., 2000, p. 161). The environment in which this research was carried out lent itself to the use of this form of non-probability theoretical sampling.

Merriam and Simpson point out how incorporation of data from a number of new and diverse sources, fits a grounded theory methodology. This was the case here where data are gleaned by interviewing different sets (groups) of students from different year groups in two PBL courses. Merriam and Simpson also point out how the discovery of grounded theory is facilitated through the use of comparison groups in the analysis phase. Comparing several groups “reveals quickly the similarities and differences that give rise to theoretical categories” (p. 115).
Triangulation was the main method used in this study to check for consistency and accuracy of the findings of the study. Triangulation was also used to add credibility to this study’s findings. Data triangulation involves using multiple data sources to “draw conclusions about what constitutes the truth” (Polit et al., 2001, p. 313) and therefore strengthens the research. The triangulation methods used were comparing data from interviews with pairs of students with that obtained from students in focus groups (Krueger, 1988). After a preliminary analysis, data collected from students was compared with the data from interviews with senior academic leaders. There was a form of triangulation built into the focus group discussions because they were structured to include member checks (Patton, 1990). As Polit et al. (2001) point out, “triangulation provides a basis for convergence on the truth” (p. 313). By incorporating multiple methods when collecting data about perspectives of participants, the researcher was better able to establish dependability of findings derived from this particular research project group.

Cohen, Manion and Morrison (2002) describe a focus group discussion as “a form of group interview … [where] reliance is on the interaction within the group, who [freely] discuss a topic supplied by the researcher” (p. 288). However, the process used was more “not in the sense of a backwards and forwards between interviewer and group” (Polit et al., 2001, p. 288) but representative of open-ended questioning where hanging sentences were sufficient to cue participants to speak on topical issues as they emerged from the interview discussion content. Open-ended questions allow “participants to respond to questions in their own words” (Polit et al., 2001, p. 267). Open-ended questions also “allow for richer and fuller information [provision] if the respondents are verbally expressive and cooperative” (p. 267). Hanging sentences, that is use of part of a preceding response or verbalized idea, also serve to stimulate focused responses from students, providing flexibility in scope for respondents’ replies and enrichment of subject under discussion (Minichiello, Aroni, Timewell & Alexander, 2000).

Member checks is a process of having volunteer participants who “provide feedback to study participants regarding preliminary findings and interpretations and securing the participants’ reactions” (Polit et al., 2001, p. 314). Focus groups with member checks were deliberately built into this study, and took place after data from the student interviews had been collected and a preliminary analysis conducted. In this
way, the reality experienced by the students could be more accurately represented. Applying a member check strategy served to give higher credibility by confirmation or disconfirmation of interpretations. It also helped to reduce potential bias and enabled early findings to be refined or progressively reinterpreted as the data analysis continued.

**Site and Participants**

This study was conducted at a university in Hong Kong. One faculty and one department of another faculty that offer different health science degrees and claiming to use full PBL as their educational approach had each agreed to participate in the study. Both degree programs led to a professional qualification, one taking four years and the other five years for completion. The final year of the five-year program was predominantly clinical in nature, so in effect PBL was mostly used for four years in both programs. They had similar student intakes of approximately 50 per annum. Cantonese is the students’ first language and the language of instruction is English.

A total of 44 informants participated in the study. Student participants for the interviews were selected on the basis of there being four from each year group per program and equal numbers of males and females where possible. Of the 32 participants in the initial student interviews, 12 were males and 20 were females. This proportion was representative of the overall student population gender distribution.

The two focus groups with six informants each consisted of equal numbers of three males and three females per group. There were two representatives from years two, three and four in each PBL course. Year one students did not participate in the focus group sessions as they were held at the beginning of a new academic year and those students had only just commenced their PBL courses. As newcomers to a PBL environment, these year one students were not considered to have had the experience or formed the insights necessary to provide reliable and representative insights and perceptions of their PBL experiences. One member of each focus group, one male and one female, had also been a participant in the previous interviews and served as a member check. Persons who act as member checks are chosen for their insights and
ability to validate, confirm or reinterpret data provided in earlier interviews by other members of the populations (student year groups) being investigated (Guba & Lincoln, 1989). Informants who act as member checks have participated in previous interview groups and therefore are qualified to validate and confirm what has or has not been identified and discussed beforehand (Polit et al. 2001).

Data were collected from students by interviews in April and by two focus groups in October. The two academic leaders were also interviewed in October, following the focus groups. Interviews and focus groups with students were conducted on-site in the same room and arranged by the respective course administrators (both are located in the same building complex). Interviews with the two academic leaders were conducted in their offices.

It should be noted that the data used for this study was collected as part of a larger study. The purpose of the larger study was to develop an instrument for investigating PBL environments. Before receiving the grant for its study, the HKCPBL obtained a clearance from the relevant social science ethics committee at the university in Hong Kong where this study was conducted. In addition, the Centre gained permission from the Dean and Head of the participating faculty and department, respectively, to approach informants for permission to collect data from them.

It also is important to note that the researcher for this study was employed by the HKCPBL as a research officer for the larger study, and was responsible for all logistical arrangements, liaising with designated contact persons in the faculty and department for administrative purposes, arranging and conducting the interviews and transcribing the audiotapes.

The Director of the HKCPBL, the Dean and the Head all gave the researcher their permission to use the data for this comparative study. (The Dean and Head will be referred to as HOD and HOS, respectively, for the remainder of this thesis). Students were fully informed of the purpose of the study and the uses to which the data would be put. Their consent was obtained in accordance with the university’s regulations. Completed consent forms remain the property of the university and are stored on-site. The consent included willingness to participate in the study, permission to use
the data for research purposes, and permission for the interview sessions to be audio
taped. An undertaking of anonymity and confidentiality was provided. The
researcher obtained verbal confirmation of this consent from students prior to each
interview session and from participants in the two focus groups. Verbal consent was
also obtained from both academic leaders prior to their interviews.

Procedures

Participant Selection

Sampling Procedures

Following initial discussions with the two senior academic leaders, it was decided to
interview, in pairs, four students from each year of the courses, one of whom would
be a student representative for each year. There were cultural reasons for these
decisions. First, it was believed that students were more likely to talk freely if one of
their peers was present. Second, being a student representative is considered a
prestigious position amongst their peers and so they should be given first
consideration as potential informants. Furthermore, four student participants from
each year group of both courses were seen as sufficient as “in most qualitative
research, the sample size tends to be small” (Minichiello et al, 2000, p. 169). In-
depth interviewing is time-intensive and involves extensive and complex interactive
involvement of both interviewee and interviewer. This requires the researcher to
constrain the amount of data to be gathered and used for analysis.

Student representatives were judged by the academic leaders to be knowledgeable in
a range of aspects concerning PBL, including their involvement with administrative
and evaluation processes of the course and awareness of student concerns about PBL
as an education method. This view is supported by Polit et al. (2001), when they
stated that student representatives should be regarded as reliable informants because
they are “knowledgeable, articulate, reflective, and willing to talk at length with the
researcher” (p. 246). The constructive contributions made to the study by this group
of student representatives supports the views of the academic leaders and Polit et al.
In Hong Kong, with its Chinese cultural context it is normal practice for the Head of Department or Faculty Dean to publicly endorse the research and then delegate authority to an administrator to invite the elected student representatives to participate first. The student representatives subsequently invited other students to participate. It is also socially acceptable among the student population for student representatives to act on senior academics’ behalf. Besides, it was convenient to use the existing administrative structure based on student representatives to organise participants for interviews. The two administrators also arranged the venue and advised participants of times for the interviews.

In the two PBL programs, there were a total of eight student representatives comprised of one male and one female representative from each year group. The respective administrators invited one of the two student representatives from each year area of the two programs, regardless of whether they were male or female, to participate. All who were invited agreed to participate. The sampling design for selecting the remaining participants used a snowball sampling strategy (Cohen, Manion & Morrison, 2000). Snowball sampling consists of a process whereby initial contact is made with informants who are considered best positioned to provide realistic, detailed, knowledgeable and reliable information about their environment. In this study, snowball sampling meant the student representatives identified three others from each of their year groups, who qualified for inclusion in the research project. The only caveat issued by the researcher was wherever possible the groups of two should consist of one female and one male. As it transpired, this was not always the case as the programs had a predominantly female cohort of students.

Selection of the informants for the two follow-up focus group discussions used the same sampling techniques. Those strategies had proven effective and efficient in both this study as well as for previous research conducted in the Faculty and the Department. It also ensured consistency in the approach and was considered suitable for the Chinese Hong Kong cultural context and university’s protocols. This time two Year 4 students, who had previously participated in the interviews as Year 3 student representatives, were each asked to invite five other students to participate in the focus groups. These two student representatives served as a member check for the focus groups (Patton, 1990). The ten extra students were not to have taken part in
the interviews, be spread over Years 2, 3 and 4, and the groups should be of equal numbers of males and females if possible.

The sample of informants selected for this study then was a non-probability or purposive sample where “the chances of members of the wider population being selected for the sample are unknown” (Cohen, Manion & Morrison, 2000, p. 99). Thus, not every member had an equal chance of being included and skewness or bias toward one point of view may occur. The non-probability sample used for this study, consisted of the most informative students and enabled the researcher to interview specific groups in greater depth. By using focus groups with new informants from each course (except one as a member check), the probability of the data being more representative of the population was strengthened. This method of sampling fits a qualitative research approach and provided the most convenient way of accessing persons who would be able to freely put themselves forward.

The researcher was able to utilise knowledge of the population through having access to faculty academic and administrative staff members during the selection and interview processes. Insiders have “a special knowledge of their own group” (Minichiello et al., 2000, p. 182), thus being advantaged by having additional insight into the elements under investigation. Alternatively, insiders can influence the type of questions asked and therefore create bias by discreetly influencing the nature of the data provided. The researcher was from a different cultural and ethnic group to the participants and therefore an outsider. As an outsider, the researcher was able to engage in the interview process with “unprejudiced knowledge about the group” (Zinn, 1979 cited by Minichiello et al., 2000, p. 182).

It was also essential for the researcher to bracket her knowledge. “Bracketing is described by Polit et al. (2001, p. 215) as “the process of identifying and holding in abeyance preconceived beliefs and opinions about the phenomenon under study”. When bracketing is used effectively, the researcher is able to shut out “the world and presuppositions to identify the data in pure form, uncontaminated by extraneous intrusions” (Patton, 1990, p. 408; Polit et al., 2001). Understanding requires the researcher to share essences of the informants’ experiences; essences being, “core meanings mutually understood through a phenomenon commonly experienced”
Bracketing of the researchers knowledge therefore contributed to the process of accurately describing, explicating and interpreting data collected during interviews with informants.

**Interviews**

All interviews were audio taped with the prior consent of all participants. The tapes were transcribed and later replayed as a check for the accuracy of the transcriptions. Some minor corrections of wording were made. Responses were coded for checking identity of the sources while preserving anonymity. This was an unusually long process as tapes had to be repeatedly played to clarify responses. Two unavoidable factors contributed to this. First, the students’ responses and comments were frequently unclear because of their limitations of English expression and soft speaking voices. Second, background noise on the tape sometimes masked responses because of building renovations. Unfortunately, no better venue was available.

Four students represented each year group of the two programs. For the interviews, they were further divided into groups of two and are identified as either group ‘A’ or group ‘B’ from each level of the two programs. The groups were interviewed according to availability of students, dependent upon their study commitments and faculty/department timetabling. Only one informant was unable to attend the initial student interviews, however, this student arranged for another student to participate in his place. Consequently, 100 per cent participation in all the interviews was achieved. The student who could not participate in the initial student interview volunteered to participate in the focus group interviews instead. All students were punctual and willingly participated in the discussions. This confirmed that the strategy suggested by the HOD and HOS about the students being interviewed in pairs was effective.

In order to maintain confidentiality and anonymity, coding was applied to responses so identities were protected, yet still able to be traced if required. Course origin represented by the letters ‘S’ and ‘D’, year level 1, 2, 3, or 4, interview group ‘A’ or ‘B’, and gender ‘m’ or ‘f’, were used as codes. Coding in the focus groups followed the same pattern except FG was added to identify informants as focus group
members. It was considered that this procedure would also allow for a richer description of data sources when analyzing and reporting this research.

In a Chinese cultural and ethical context, expressing evidence of learning can be difficult. During the interviews, there were opportunities for admission of a lack of learning or achievement and open expression of negative thoughts about an issue. Normally, these situations are generally avoided or brushed over. Hierarchical ordering occurs among students, particularly if one or more is seen to be older, more experienced or to be better socio-economically situated. These socio-cultural phenomena are magnified in a group setting and were found to be a limiting factor in being able to accurately determine some issues that emerged during the focus group discussions. All cultural mores, values and sensitive aspects were probed as deemed fit by the researcher, but respected and disengaged from as required. It should be noted that this phenomena was not as apparent in the initial student interviews where students were in pairs and from the same year groups.

**Students**

At the beginning of each interview, care was taken to immediately create a friendly atmosphere. The researcher introduced herself and briefly outlined the purpose of the study. In addition to the consent already obtained, verbal permission was sought to use the data for this study as a confirmation. All participants reaffirmed their consent. The informants were again informed of the purpose of the study and an undertaking of confidentiality and anonymity was given. Following that, an initial question “What do you regard as the most important aspects of PBL to you?” was put to each pair of students. Their responses were then followed by probing questions such as, “Could you tell me more about that?” “Why did you say that?” and “Could you please elaborate on that point?” This approach provided an immediate focus for the interviews and allowed for a settling period for the informants. Some informants were initially tentative so they were encouraged to speak by asking questions such as “Do you agree?” and “Could you add something to that?” Care was taken to only ask questions and not to pass judgment on any of the students’ responses or their discussions between themselves. The length of the student interviews ranged between 75 and 90 minutes. At times, due to a noisy background (renovations in the
whole building) and the difficulty in understanding some students’ English expression, questions were repeated.

Use of unstructured and open-ended interviewing techniques engendered some difficult situations where the expectation among the interviewees was for the interviewer to lead the questioning. They also tried eliciting information predetermined from research previously conducted and published by ‘famous’ academics.

**Focus Groups**

It was decided that the most convenient and efficient method of validating the data collected in the student interviews was to hold two focus group discussions with other students. The number of participants (six in each group) fell within the range of six to ten, considered by Krueger (1988) to be optimum for a focus group.

This approach provided a form of triangulation with the stimulus for discussion focused on the categories that the researcher previously developed from the student interview data. These two sessions are described as focus groups because they were “carefully planned discussions designed to obtain perceptions on a defined area of interest in a permissive, non threatening environment” (Krueger, 1988, p. 18). When an investigation is designed to find out how people regard an experience or event, focus groups are considered to be an appropriate environment (Krueger, 1988).

The two groups met separately on October 23, 2002 for a period of approximately 90 minutes each with the researcher as facilitator. Initially, prepared stimulus questions were put to the group and discussion among them was encouraged. Most questions were open-ended and dichotomous questions were avoided where possible (Patton, 1990). At the beginning of each session it was emphasised “there are no right or wrong answers, but rather differing points of view” (Krueger, 1988, p. 25). The intention was to provide an environment where participants were able to react to each other’s comments and stimulate responses and ideas that may not be forthcoming in a formal interview setting.
Initially the participants worked in year-group pairs and were given a list of some natural categories grounded in the student interview data to read and make notes as a stimulus for discussion. The group as a whole was then involved in a discussion to comment on the appropriateness of the categories and to make further comments. At this point some cultural nuances became evident among the group members. Interactions between the pairs of same year participants were relaxed and interactive, regardless of whether they knew each other or not. However, interactions between the pairs of students from the different year groups were punctuated by tones of culturally defined respect for those who were more senior to them. In addition, they would defer to the opinions of other participants, who might appear to have greater knowledge on the subject.

In order to overcome these cultural constraints, the researcher initially nominated the speaker to ensure all participants contributed their comments and elaborated on the points being discussed. This more structured way of commencing the focus group interviews enabled improved interaction between participants. Students quickly became more relaxed and freely expressed their thoughts and feelings. Even with this departure from usual practice during focus group sessions, it is important to note that “the participants’ rather than the researcher’s agenda … predominat[ed]” Polit et al. (2001, p. 288).

Overall, the size and manner in which the focus group interviews were conducted resulted in participants providing focused comments as well as giving considered thought to other’s ideas and views as they emerged. In addition, the homogeneous structure of the groups across Years 2 to 4 enabled representation of the reality of the student participants’ experiences to be freely expressed. Major insights, such as re-determining the hierarchical and domain placement of different categories, for example, took place as a consequence of the two focus groups.

The researcher found that conducting a focus group in a manner that ensured the discussion was focused and at the same time remaining open-ended as advocated by Cohen et al. (2002) proved difficult and thus may have slightly skewed the outcome. Occasionally, difficulties due to language differences were encountered. These were the informants’ use of idiosyncratic language such as phrasing structures and
occasional comments made in Cantonese between students to clarify their conceptual meanings and interpretations. Despite these caveats, information emerging from the focus groups assisted in progressively orienting the research data and coinciding analytical processes, while informing the development of truthful and representational themes and topics central to a grounded theory approach.

**Academic Leaders**

There were two sessions with the two academic leaders. At the first, informal discussions took place about the details for organising and conducting the interviews. A promise was given by the researcher to provide a progress report later in the study. The second interview was more formal. A set of prepared questions, based on the data collected from the students’ interviews was put to the leaders. At times extra questions were asked to clarify statements made by the academic leaders. Their responses proved useful to verify students’ comments and fill in some gaps about the two courses. The informal discussions lasted for approximately 45 minutes each and the formal interviews ran for about 90 minutes. Both leaders provided pertinent and extensive responses.

**Data Analysis**

**The Data**

It is important to note that the data used for this study were collected at a university in another country, Hong Kong, by the HKCPBL as part of a larger study. That larger study aimed at developing an instrument to be used for investigating PBL environments. Before receiving the grant for its study, the HKCPBL obtained a clearance from the relevant social science ethics committee at the university. In addition, the Centre gained permission from the HOD and HOS of the participating faculty and department, respectively, to access informants for data collection.

It is also important to note that the researcher was employed by the HKCPBL as a research officer for that study, and was responsible for all logistical arrangements, liaising with designated administrators in the faculty and department, arranging and conducting the interviews, and transcribing the audiotapes. The researcher remained
cognizant that she was part of the process and therefore maintained a critical presence. Care was taken to let informants express their views openly and freely without undue influence while the researcher remained an integral part of the data gathering process. Giving guidance, redirecting the discussion and providing stimulating comments were actions conducted judiciously.

**Consent**

The Director of the HKCPBL, the HOD and the HOS all gave permission to use the data for this comparative study. Students were fully informed of the purpose of the study and the uses to which the data would be put. Their consent was obtained by distribution of electronic consent forms in accordance with regulations of the university. See Appendix C for a facsimile of the electronic consent form sent first to student representatives and then forwarded to volunteer classmates identified by the student representatives. The researcher also obtained verbal confirmation of receipt of consent from the two contact administrative persons in the faculty and department. They also sent formal letter to the Director, HKCPBL confirming 100 percent participant consent. As mentioned previously, the researcher verbally reaffirmed consent prior to each interview session and the two focus groups sessions.

**Analytical Procedures**

**Background**

Creswell (1994) outlines how data analysis in grounded theory research is a fluid process involving simultaneous activities of field data collection, establishment of categories arising from data, and ongoing reorganization and rethinking of categories during the analysis process. The analysis process involves either coding or formatting information to produce meaningful and representational views consistent with interpretation of data. Simultaneous writing of descriptive and explanatory notes or memos also takes place throughout this analysis process.

Drawing from authors such as Tesch (1990), Bogdan & Biklen (1992) and Marshall & Rossman (1989), Creswell (1994) outlines the procedure for forming categories and coding when analyzing unstructured data collected from interviews using a
grounded theory approach. The raw files of interview transcriptions are subjected to “segmenting” of information, a process where categories are established. Codes are then used to track and organize data into categories, themes or patterns enabling the researcher to build a theoretical overview.

This project aimed to use the data collected to enable better understanding of the PBL phenomena and through further refinement serve to inform educators about improving practice. Accordingly, themes and patterns using schema suggested in published literature on PBL were used as a starting point for analysis. However, new categories emerged with their attendant themes and patterns. This process of de-contextualising information from existing literature and then reconstructing new or altered categories in line with the new data, enabled more refined and thorough conceptual and interpretational explanations and propositions to emerge.

**Procedure**

A preliminary analysis of data involved reading the transcriptions thoroughly and ideas about the data noted as suggested by Creswell (1994). Use of a mind-map produced an inductive, diagrammatic sketch of emerging data. It enabled the researcher to quickly establish a conceptual overview of the data in rough organisational patterns and subsequently develop a sense of possible categories as themes emerged. This process involved a lot of review by revisiting data and re-establishing categories. It also involved collapsing of separate categories in more abstract and overarching categories to cater for a more succinct overview. For example, after examining the data from three clear and informative interview transcriptions, discussion was a key theme that emerged. However, according to the literature, discussion is but one integral part of the overall PBL process. Others include the learning issues generated, interactions among participating members, and assessment and evaluation. Discussion then became a subcategory under a notional major category titled ‘The PBL Process’. Similarly, a subcategory titled ‘Facilitator as a Guide’ was placed into a major category of ‘Facilitation’.

As data were progressively analysed, notations about ideas were made and then any related subject matter was clustered on more mind-maps as it emerged. In this
manner, some major categories such as the "The PBL Process", the "Facilitation", the "Group Processes", and "Cognitive Activity" developed. These formed the initial overarching domain categories. These were then organized into sub-categories of thematic relationship hierarchies. For instance psychological, affective and psychomotor sub-categories fitted under Cognitive Activity. It should be noted that Creswell (1994) maintains an extensive amount of latitude is provided for when sorting of interview transcription data, notes and documentation is done. However, it is also important for a researcher to keep in mind that the categorization and respective coding of information lays the path for interpretation and discussion of data that emerges from the research as research project progresses. Appendix A shows the final overarching domains, the attendant sub-categories and the initial categories used to interpret and analyse data in this study. Appendix B shows the how thematic ideas were reduced to the final major category map.

Once the preliminary analysis was completed, the Qualitative Solutions and Research: Non-Numerical Unstructured Data * Indexing Searching and Theorizing (QSR NUD*IST 1998) computer software program was used. Version N4 of NUD*IST enabled progressive processing, coding, management and analytical theorizing of rich unstructured data collected from interviews (Richards, 1998). The QRS NUD*IST qualitative research tool provided flexibility when text searches, systematic indexing, data coding, pattern recognition, categorising, sub-categorising and data merging activities were required. QRS NUD*IST provided a comprehensive exploratory research tool that was suited to analyzing data emerging from a grounded theory research methods. Development of ideas, making memos, changing categories and sub-categories assisted research goals to be reached whilst continually comparing data samples fits the data analysis requirement for building tentative and suggestive propositions as theoretical constructs (Merriam & Simpson, 1995).

QRS NUD*IST provides the researcher with a tool which enables open and axial coding of data (Richards, 1998). Open coding refers to the range of functions and provision of opportunities to search, access and manipulate chunks of thematic data while asking questions and building understandings of the data. Coded categories and subcategory lists along with their groupings were also compiled in a linear fashion in an indexing tree format. The indexing tree format provided a means for
clustering information under a common category code according to how the researcher interpreted, categorised and analysed the research data (Richards, 1998). The common category codes contain data that have significant relationships, features and thematic similarities to the larger domain areas the data naturally falls into. Thematic data is held in specified units with common indexing codes at selected points within the organisational tree. Information held in nodal points can then be manipulated and integrated into different nodal points and progressively recoded as refinement of data continues. The index tree can be viewed at any time to give the researcher an overview of the data structure and category content, thus aiding in analyzing, sorting and interpreting large amounts of thematic data. With memos attached to any category or subcategory, information about clusters can also be viewed independently or as a part of the overarching network of ideas and category sections. They could also be viewed at nodal points in the hierarchically constructed index tree.

The program allowed effective and efficient manipulation of data for analysis. Data material belonging to each category or thematic grouping were brought together, reviewed, recoded, regrouped or decoded as required throughout the analysis process as outlined by Creswell (1994). The software enabled a constant comparative analysis to be employed. Using this method for identifying and analyzing data settings and their context proved an effective method.

The unit of analysis or segment (Creswell, 1994) was a student’s sentence, phrase or a word used to convey their thoughts on the topical items. This often proved difficult and time-consuming because of language limitations as students spoke in English, which is their second language. Some were not well practiced in using it for communication. Many words or expressions, “um”, “ah” and “yeah”, repeated words or groups of words, and short phrases were redundant and eliminated at the time of transcribing. Run-on sentences were chunked and structured into shorter sentences. In this process, care was taken to ensure the meaning or contextualising word usage was preserved.

Developing categories and subcategories enabled comparisons to be made between the two different full PBL programs on a course level basis. Furthermore, it enabled
identification of similarities and differences between different year levels in both courses. Those comparisons showed strengths and weaknesses of the full PBL programs. Using these outcomes, assertions were made about the programs, which in turn, represents a form of substantive theory that can be used to influence future practice.

Three reviews of samples of the analysis were completed by three acknowledged experts in PBL, including two who were Chinese, as a check on the validity of the analysis. The review involved: scrutiny of the raw data (interview transcripts); data reduction and analysis products (theoretical notes and analysis documentation), process notes (methodological notes and notes from focus group sessions); notations made by the researcher throughout the data collection and analysis process; the development phase of the coding; category formation and continuous comparative analysis process; and method of reporting results, as suggested by Polit et al., (2001). The reviewers’ feedback indicated the analysis process was sound, thus ensuring the nature and essence of the thematic categories are representative and correctly situated. The high degree of congruence of their feedback was important, especially because the researcher, as an interviewer and an analyst, was not Chinese. These reviews added rigour to the analysis and authenticity to the outcomes.

The process of identifying and illuminating categories by properties as they emerged from the data demonstrated how grounded theory was an appropriate choice by which to analyse the unstructured, open-ended interview data (Merriam & Simpson, 1995). The perspectives held by the subjects in both discipline areas and all year levels were able to be determined in relationship to their self-determined modes of perception, meaningfulness and understanding. Coding of data enabled its successful management when developing categories as outlined by Creswell (1994) and Merriam & Simpson (1995). This process formed the basis by which the raw data were able to be systematically processed as required by the researcher using a qualitative, grounded theory approach to analysing textual data (Creswell, 1994, pp. 145-155).
Reporting Findings

In reporting the research findings at the macro level, a realist approach as suggested by Creswell (1994) is used. In this approach, “a direct, matter-of-fact portrait without information about how the field-worker produced the portrait” (p. 159) serves to constrain the reporting of findings to fit within the parameters of the project boundaries. At the micro level, discussion of the narrative includes “use of long, short and text-embedded quotes” (p.160); scripting conversation; use of category names and concepts from the informants as well as the supporting literature; and “interview quotations with (author’s) interpretations” (p.160). In addition, other forms of related narrative elements are explained and included throughout the reported findings text.

Narrative outcomes are presented as quotations, or are condensed as reconstructed sentences, while maintaining accuracy. Two examples that typically demonstrate the alterations follow. The original transcription is provided first, followed by the changed version in italics.

At first, first – mmm, the discussions – yeah, - not smooth. Maybe – some, some - things have some problems, is pain- something like that. Yes, some difficulties - because group members are not familiar with the PBL’s and what they are doing - how to start, yeah. {Year 4, BD, Male}

At first discussion is not smooth [and difficult] because group members are not familiar with the PBL process and do not know how to start {Year 4, BD, Male}

They, they can tell you some things, some expectations and …and maybe think we cannot, can do these things. I should try more because - still got room to improve. It is so that every sessions, session we are doing the self-evaluations. I mean, we have anythings; like comments on (name supplied) the tutor, and whether or not we got, ideas, general ideas - some things like that. The evaluations, no, there is no space, mmm, some applications for us – we cannot – there is no, we cannot be doing all this. {BS, Year 3, Male}

The tutors can tell you their expectations and you still got room to improve. Every session we do self-evaluations. This includes anything like comments on the tutor, and
whether or not we’ve got the ‘general ideas’. The formal evaluations do not have the application [scope] to do all this. {BS, Year 3, Male}

This process aims to convey as concisely and clearly as possible the students’ perceptions and their concepts of their understandings of the different elements their PBL experiences The story is developed using the QRS NUD*IST methods of open and axial coding to link different category areas and sources. That is, selective coding was carried out to assist in explaining theoretical concepts from a diverse educational process, which is inherent in a complex system such as PBL with its integrated, multidisciplinary approach.

The process of identifying and illuminating categories and properties as they emerged from the data demonstrated how grounded theory was an appropriate choice by which to analyse the unstructured, open-ended interview materials (Merriam & Simpson, 1995). The perspectives held by the subjects in either discipline area or year level were able to be determined in relationship to students’ self-determined modes of perception, meaningfulness and understanding. Process, activity, strategy, relationship and social structure related coding processes were formulated as fitting and in line with processes outlined by Creswell (1994) and Merriam & Simpson (1995). This process formed the basis by which the raw data were able to be systematically processed as required of a researcher using qualitative, grounded theory approach to analyzing textual data (Creswell, 1994, pp. 145-155).

Summary

The research design for this project was developed in order to collect rich data from the student participants who were initially interviewed. Focus groups were used for confirming, refuting or redefining emerging domains or categories. The methods used to strengthen the reliability of the findings included triangulation using member checks and using data collected from interviews with the academic leaders of the two courses. In addition, sample reviews of the design and process of this study by three experts in PBL helped contribute to the credibility of methods used in this research. In the next chapter, the results of the research will be provided along with an analysis the findings.